

TUBERCULOUS EPIDIDYMITIS

A CLINICAL AND AETIOLOGICAL STUDY

by

WALTER M. BORTHWICK

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ACKNOWLEDGMENTS.

To Dr. John Watson, Superintendent of Robroyston Hospital and Sanatorium, Glasgow, the writer is grateful for the facilities offered to him in the examination of patients and for the use of the hospital case-records without which the investigation could not have been carried out.

The initial stimulus to probe the subject of genital tuberculosis in men, he owes to Dr. M. A. Foulis, Deputy Superintendent and Senior Resident Surgeon, Robroyston Hospital, whose interest in the subject equalled that of the writer's, thereby making the arguments and discussions which followed the more helpful and instructive. For reading and correcting the original copy of the investigation the writer is again indebted to Dr. Foulis and also for many of the radiological examinations.

Although most of the instrumental investigations were carried out by Mr. Arthur Jacobs, Urologist, Glasgow Royal Infirmary, for which the writer places on record his thanks, he is perhaps more grateful to Mr. Jacobs for the tuition in cystoscopy and ureteral catheterisation which was given to him in Robroyston Hospital and in the Glasgow Royal Infirmary, thereby enabling the writer to carry out many investigations himself.

The co-operation extended by Dr. Stuart Laidlaw, Senior Tuberculosis Officer and the Tuberculosis Officers, Glasgow Corporation Public Health Department, was invaluable to the writer in his attempt to review all the available patients. Recognition is also due to the former patients of Robroyston Hospital who attended for re-examination, some of whom underwent the discomfort of cystoscopy, but the writer would point out that, up to the present time, several patients have benefited to the extent of having had surgical treatment for an unsuspected renal tuberculosis which had extended beyond the renal cortex and medulla.

WALTER M. BORTHWICK.

Robroyston Hospital,

July, 1944.

CHAPTER 1 - INTRODUCTION

It would be indeed an ambitious hope to expect that anything wholly new could derive from an article whose genesis is the accumulated records of a hospital; but its justification is to be found in the very volume of the evidence sifted in an attempt to establish firmly what is known or suspected of tuberculous epididymitis.

In this thesis a careful survey has been made of the 402 hospital histories whose pages show evidence that tuberculous disease of the epididymis occurred at some time in the course of a patient's illness. Anything or any record which suggested that the epididymal condition could have been other than tuberculous has occasioned the discardment of such a record; and it is to the great credit of the dispensary tuberculosis officers of Glasgow that these rejected records are exceedingly few in number. Later will be given the criteria by which a lesion is judged to be tuberculous, but it is the writer's belief that each lesion referred to had the origin assigned to all. The period covered by the files goes as far back as 1921 and the most recent records discussed are those of patients who were admitted to Robroyston Sanatorium up to the end of the year 1941.

The writer's interest in the subject on the title page dates back to a little time after his joining the staff of Robroyston Sanatorium in 1936. As an Assistant Resident Medical Officer he had both surgical and medical lesions in his keeping, and on becoming Senior Resident Medical Officer in 1937 his further duties included some degree of supervision of his more junior colleagues and their wards. Throughout this earlier period he was still a novice in the treatment of tuberculosis, but a lasting impression of that period was the marked difference between the treatment of tuberculous epididymitis as practised by his senior colleagues, and his own teaching supplemented by post-graduate reading. Argument, discussion and observation of results culminated in his being convinced in some degree of the justification of the established practice at the hospital, and following a short paper read to the Tuberculosis Society of Scotland by a senior colleague it became obvious to the writer that nothing short of a mass survey of all the cases dealt with in the past could throw further light on the matter; in this conclusion his senior colleagues, both resident and visiting, heartily concurred. In 1940 the writer became Junior Resident Surgeon and his increased responsibilities and further duties resulted in a close liaison between himself and the Visiting Urologist, to whom he is indebted for the instrumental investigation of many

of the patients. It has already been suggested that the perusal of case records can but rarely lead to wholly convincing evidence. At best, findings derived from such sources can be but suggestive; and this viewpoint gains added weight when the period of time covered is a long one. In such a period many Resident Medical Officers have been responsible for the records and it is little to be wondered at that there has been great variation in the importance attached to tuberculous epididymitis. On the whole, where the lesion has been the cause of a patient's admission, the description and investigation have been adequate, but where a tuberculous epididymitis occurred as a complication of a more serious condition, the recorded notes have not always proved adequate for the purposes of this investigation. Most interesting, however, is the obviously growing interest in tuberculosis of the epididymis which has taken place throughout the years covered. Whereas in the earlier records scant attention was paid to the wider significance of the lesion, the later records show a growing recognition that tuberculous epididymitis is but an obvious lesion in a widely disseminated though frequently hidden tuberculous infection. To a great extent the writer has focussed his attention on these wider implications.

CHAPTER 2 - THE NORMAL GENITALIA

(a) EMBRYOLOGY.

A. General considerations.

B. The genital organs.

(1) The indifferent stage

(a) The gonads

(b) The primitive genital ducts.

(2) The stage of differentiation

(a) The testes

(b) The transformation of the mesonephric tubules and ducts.

(c) The transformation of the Müllerian ducts

(d) The ligaments of the internal genitalia.

(3) The descent of the testis.

C. The development of the scrotum, urethra, and prostate gland.

A. General Considerations.

In development, there is an intimate association between the urinary and reproductive systems. These two systems originate from mesoderm of the same region and though at first visible as a common urogenital fold, further growth soon brings about a sub-division into nephric and genital

ridges. Early in embryonic life, these systems are united through a joint use of the cloaca and later close relationship is maintained, especially in the male, where the urethra is utilised permanently as a common urinary and genital duct.

The history of each system is complicated as, some organs result from the association of structures originally separate and even remote, other parts appear only to disappear after a transitory existence while still other structures designed for one purpose appear to abandon their original destiny and turn to new uses. In consequence, the writer feels that in such an interwoven story, an explanation of certain facts is necessary to a complete understanding of the text.

The cloaca. The caudal end of the entodermal tube becomes the cloaca or common vent and it soon receives the allantoic, urinary and genital ducts. Even before these connections are complete the cloaca begins to subdivide into a dorsal rectum and a ventral urogenital sinus. At the end of the seventh week the cloacal membrane, which separates the cloaca from the outside, disappears and the division of the cloaca is concluded. Each of the new canals so formed acquires in that way its individual opening to the outside.

The development of the urinary organs. According to Arey,¹ vertebrates have made three distinct experiments in the production of kidneys. From the simplest type, that found in the lowest vertebrates, two improved organs have appeared successively in higher forms, and as might be expected, the embryo of the higher vertebrates indicates this progress by repeating the same kidney sequence during development. The earliest and simplest excretory organ was the pronephros, functional to-day, according to Arey,¹ only in such adult forms as Amphioxus and certain lampreys. The pronephros does serve as a provisional kidney in lower fishes and amphibians but is replaced by the mesonephros which remains as the permanent kidney in these animals. The embryo of reptiles, birds and mammals develops first a pronephros and then a mesonephros whereas the final kidney is a new organ, the metanephros.

The pronephros. The functional pronephros of lower vertebrates consists of paired pronephric tubules, arranged segmentally; one end of each tubule opens into the coelom and the other into a longitudinal collecting duct which drains into the cloaca.

In the human, the pronephros is vestigial and consists of seven pairs of rudimentary pronephric tubules which open into the coelom at their attached ends and distally into longitudinal collecting ducts. In that way, the primary

excretory ducts, named the pronephric ducts, are formed and these ducts serve as the ducts of the next set of kidneys, the mesonephroi.

The mesonephros. The mesonephros of Wolffian body is larger than the pronephros and contains more tubules which are larger and more complicated. It is called the "middle kidney" and it is situated in a more caudal position than the pronephros. The tubules of the mesonephroi drain into the pronephric duct which is retained as an excretory canal and is now known as the mesonephric (Wolffian) duct.

The mesonephros serves the embryo as a temporary excretory organ, and consists of a series of tubules each of which at one end opens into the mesonephric duct. These tubules arise just caudal to the pronephros and from the same source, the nephrotome region. When these tubules begin to expand there is not room for them in the dorsal body wall, which accordingly bulges ventrally into the coelom. Thus, on each side of the dorsal mesentery there is produced a longitudinal urogenital fold which attains its greatest relative length in a foetus of about 8 m.m. Soon after its formation this ridge divides into a lateral mesonephric fold and a medial genital fold.

The metanephros. The metanephros arises in a position caudal to the mesonephros and from it arises the permanent

kidney of amniotes. The ureter, pelvis, calyces and collecting tubules are outgrowths of the mesonephric duct.

B. The genital organs.

(1) The indifferent stage.

(a) The gonads. The early ovary and testis follow an identical course of development for a time and the two organs are structurally indistinguishable. At this stage the sex gland is designated by the term, gonad. The primitive genital gland makes its appearance in a ridge, described previously as the urogenital fold.

On the ventro-median surface of the urogenital fold, in 5 m.m. embryos, the peritoneal epithelium thickens and becomes many layered, so that during the 6th week there is a bulging into the coelom producing the longitudinal fold which is parallel and medial to the mesonephric fold. Earlier, certain large cells have appeared in the caudal end of the body called primordial germ cells. In an embryo of six weeks the gonad shows no sex differentiation and shows a superficial germinal epithelium and an inner epithelial mass. As the genital glands increase they become relatively shortened from the early elongated folds to more compact organs. They also shrink from the mesonephroi until the originally broad attachment is converted into a gonadal mesentery; in the male it will be known as the

mesorchium, in the female the mesovarium.

(b) The primitive genital ducts. All vertebrates develop both a male and a female system of ducts before sexuality is declared. After the sex is decided, the other sex ducts degenerate.

Both sexes develop more tardily, a pair of female ducts, Müllerian ducts, and in the human embryo of 10 m.m. the first indication of these ducts is the appearance of a groove in the thickened epithelium of each urogenital fold.

Embryos of six weeks and no longer than 12 m.m. are thus characterised by the possession of indifferent sex glands and both male and female genital ducts.

(2) The stage of differentiation.

(a) The testes. In the embryo of 13 m.m. or more, the genital glands begin to show two characters which mark them as testes; firstly the appearance of branched and anastomosing strands of cells, the testis cords, and secondly the occurrence between the covering epithelium and the more internal testis cords, of a loose layer of tissue which will become the tunica albuginea.

The radially arranged cords converge towards the mesorchium and here they organise the rete testis. The testis cords soon become marked off by connective-tissue sheaths from the intermediate mesenchyme. These sheaths

of the future testis tubules unite to form septula which converge into the mediastinum testis in one direction and extend to the encapsulating tunica albuginea in the other. The testis cords are composed chiefly of indifferent cells with a few larger germ cells and these solid cords gradually become converted into tubules but the process may not be complete even at birth. The distal portions of the testis tubules anastomose and comprise the tubuli contorti, while their proximal portions remain straight as the tubuli recti. The rete testis becomes a network of small tubules destined to unite with the efferent ductules.

(b) The transformation of the mesonephric tubules and ducts. In both male and female embryos of nine weeks there still remains some thirty mesonephric tubules. During the next week the total number is reduced, while none retains a continuous lumen. The tubules which have not been completely disorganised can be divided into cranial and caudal groups. The cranial group, eight to fifteen in number project against the rete testis and the cords of the rete develop in contact with these tubules and begin to unite with them in the foetus of three or more months.

In the male, the lumina of the rete tubules and the cranial mesonephric tubules become continuous by the end of the 6th month and the mesonephric tubules are transformed

into the efferent ductules of the epididymis; the latter coil and are known as the lobules of the epididymis. A few tubules of the cranial group comprise the cystic appendix of the epididymis. The caudal group of mesonephric tubules is vestigial but persists as the paradidymis and aberrant ductules. The efferent ductules are destined to convey spermatozoa from the testis tubules into the mesonephric duct; the latter accordingly undergoes certain regional specialisations which transform it into the chief genital duct. In completing these changes, the upper end of the mesonephric duct coils into the duct of the epididymis; the caudal portion remains straight, and, as the ductus deferens and terminal ejaculatory duct, extends from the epididymis to the urethra. Near its opening into the latter canal, the male duct dilates to form the ampulla, from the wall of which is evaginated the sacculated seminal vesicle in the foetus of thirteen weeks.

(c) The transformation of the Müllerian ducts.

In the male, degeneration of the Müllerian ducts begins at the third month and only the extreme cranial and caudal ends are spared. The cranial vestige is called the appendix testis, and the caudal segment persists as a tiny pouch on the dorsal wall of the urethra, called the prostatic utricle.

(d) The ligaments of the internal genitalia.

The primitive mesentery of the testis is the mesorchium, and it is represented in the adult by the fold between the epididymis and testis. The ligamentum testis develops in the lower end of the genital fold and extends from the caudal pole of the testis to the genital cord. A chorda gubernaculi develops within the inguinal fold, the latter bridging across to the adjacent body wall to fuse with the inguinal crest. The gubernaculum is continued by way of the ligamentum scroti to the scrotum. At the beginning of the 3rd month there thus exists a continuous ligament, the gubernaculum testis, extending from the caudal end of the testis to the scrotum.

(3) The descent of the testis.

The original position of the testis changes during development. At first it is a slender structure extending from the diaphragm. A faster elongation of the dorsal trunk in comparison with the slower growing gonad, produces a relative shift in a caudal direction, and, when this process of growth is complete, the caudal ends of the testes lie at the boundary between the abdomen and the pelvis.

In addition to the early false migration, the testis later leaves the abdominal cavity and descends into the scrotum. At the beginning of the third month, while the testis is fairly high in the abdomen, sac-like pockets appear which are the beginnings of the vaginal sacs and from the fourth to the end of the sixth month, the testes

lie near them, at the site of the future abdominal ring. Each processus vaginalis evaginates through the ventral abdominal wall, over the pubis through the canal and so into the scrotum. During the seventh to the ninth months, the testes also descend rapidly along the same path. The gubernaculum testis appears to play an important part, as, during the 7th month it ceases to grow and shortens by half, and this resultant shortening, both relative and actual, serves to draw the testis into the scrotum. After birth the gubernaculum atrophies almost completely.

Within a few weeks to a few months the narrow canal which connects the processus vaginalis with the abdominal cavity, becomes solid and the vaginal sacs now isolated, represent the tunica vaginalis of the testis.

C. The development of the scrotum, urethra, bladder and prostate.

The scrotum: Prior to the rupture of the urogenital membrane, the urogenital sinus extends forwards into the phallus and is continued to its apex as a sagittally placed epithelial plate named the urethral plate. The rupture of the urogenital membrane provides a common perineal orifice for both the genital and urinary tracts.

While these changes are in progress, two genital swellings, labio-scrotal folds, appear one on each side of the

phallus, and extend caudally, separated from the genital folds by distinct grooves. In the male, the genital swellings meet in front of the anus and unite to form the scrotum.

The urethra.

The male urethra is composed of two portions, one which lies above the opening of the genital ducts (Müllerian and Wolffian), and the other the urogenital sinus which lies below this point. The first named or true urethra is the lowermost narrow anterior portion of the divided cloacal cavity. In the male, this "true urethra" represents only that portion of the prostatic urethra to the verumontanum.

The urogenital sinus forms the larger part of the urethra in the male. It begins at the orifice of the Wolffian and Müllerian ducts and extends to the urogenital membrane.

The prostatic urethra is made up of the whole of the true urethra and part of the urogenital sinus. Through it the fused Müllerian ducts, the Wolffian ducts and numerous tubules of the posterior and lateral portions of the prostate, reach the urethra.

The Prostate.

This gland is first seen in a 55 m.m. embryo as knob-like solid epithelial sprouts from the anterior, lateral and posterior walls of the urethra. These tubules grow rapidly

in length, acquire a lumen and begin to branch. Lowsley² believes that the tubules are separable into five groups, middle, right and left lateral, posterior and anterior, which eventually become the corresponding lobes of the fully developed prostate. Johnson³ was unable to find such a division into groups, except the middle lobe which is formed by the posterior tubules lying behind the verumontanum. He found that the tubules of the anterior, posterior and lateral lobes, lie in close approximation with no suggestion of intervening septa.

The further development of the prostate consists in the further growth and branching of its glands, in the transformation of its epithelium into a secreting one and in the differentiation of its mesenchyme into connective tissue and muscular elements.

(b) ANATOMY.

The Testes.

The testes are suspended in the scrotum by the spermatic cords the left testis hanging somewhat lower than the right. The average dimensions of the testis are from 4 c.m. to 5 c.m. in length, 2.5 c.m. in breadth and 3 c.m. in the artero-posterior diameter, while the weight varies from 10 to 14 grm.

Each testis has an oval form compressed laterally and has an oblique position in the scrotum. The upper extremity is directed forwards and a little laterally and the lower extremity backwards and a little medially. The anterior border is convex and looks forwards and downwards; the posterior border is nearly straight and looks backwards and upwards.

The testis is invested by the visceral layer of the tunica vaginalis except at the posterior border which only receives a partial investment from that membrane. Lying upon the lateral part of the posterior border is the epididymis.

The Epididymes.

Each epididymis is a crescentic-shaped body situated on the lateral part of the posterior border of the testis and consists of three parts, the globus major or head, the body, and the globus minor or tail.

The globus major.

This is the upper extremity of the epididymis and overlaps the upper pole of the testis. It is enveloped by a serous covering except at its attachment to the testis. Situated in the groove between the globus major and the testis is a fairly constant structure, the appendix testis or hydatid of Morgagni, while attached to the globus major

is the paradidymis or organ of Giraldès.

The body:

The long axis of the body of the epididymis runs parallel to that of the testis, and is applied against but separated from it by an unfolding of the serous coverings of the organs which forms the intervening pocket called the digital fossa.

The globus minor:

This is the lower and smaller extremity of the epididymis and is attached to the testis by connective tissue and by the serous coverings of the organs. From the globus minor the vas deferens proceeds upwards in the loose tissue outside the sac.

The testis and epididymis are invested by three coverings: the tunica vaginalis, the tunica albuginea and the tunica vasculosa.

The tunica vaginalis:

The cavity in which the testis and epididymis are placed is lined by a membrane called the tunica vaginalis, consisting of two layers, the parietal and visceral layers. The former extends some distance above the two organs, so that the space which it lines is larger than the organs contained therein; the latter completely invests both the testis and epididymis except at the points of contact between the two,

namely (1) the posterior border of the testis where the spermatic cord is attached, and (2) the inner posterior aspect of the epididymis.

Tunica albuginea:

The tunica albuginea forms a fibrous covering for the testis. It is a dense bluish-white membrane composed of bundles of fibrous tissue. It is covered by the visceral layer of the tunica vaginalis except at the head and tail of the epididymis and along the posterior border of the testis where the vessels and nerves enter the gland. It is applied to the tunica vasculosa and, at the posterior border of the testis, is projected into the anterior of the gland, forming an incomplete vertical septum, called the mediastinum testis or body of Highmore.

Tunica vasculosa:

The tunica vasculosa is the vascular layer of the testis, consisting of a plexus of blood vessels held together by delicate areolar tissue. It lines the tunica albuginea and clothes the septula testis and therefore forms an investment to all the lobules of the testis.

The mediastinum testis extends from the upper to near the lower end of the gland. From its front and sides are given off numerous imperfect septa, septula testis, which radiate towards the surface of the testis, and are attached

to the deep aspect of the tunica albuginea. They incompletely divide the testis into a number of cone shaped lobules, lobuli testis. The mediastinum supports the vessels and ducts of the testis in their passage to and from the substance of the gland.

The number of lobules in a testis is variously estimated from 250 to 400 (Gray⁴). Each lobule consists of from one to three, or more, convoluted tubes, the tubuli seminiferi contorti. In the apices of the lobules the tubules become less convoluted, assume a nearly straight course, and unite at acute angles to form from twenty to thirty larger straight ducts, called tubuli seminiferi recti. These enter the fibrous tissue of the mediastinum and pass upwards and backwards, forming a close network of anastomosing tubes, named the rete testis. At the upper end of the mediastinum the vessels of the rete testis terminate in from twelve to twenty ducts, the vasa efferentia, ductuli efferentes, and these ducts carry the testicular secretion to the main duct of the epididymis, ductus epididymidis. The latter is represented by the body and the lower pole of the epididymis and it leaves the organ as the vas deferens.

Blood supply:-

The blood supply to the contents of the scrotum is threefold, namely (1) the spermatic artery, (2) artery to the vas deferens, and (3) the cremasteric artery.

(1) The spermatic artery arises from the abdominal aorta below the renal artery, at the level of the 12th dorsal vertebra. It crosses obliquely over the lower part of the ureter and lower part of the external iliac artery to reach the internal abdominal ring through which it passes with the spermatic cord to the testis. Before reaching the testis it gives branches to the epididymis, the largest one passing to the globus major.

(2) The artery to the vas deferens is a branch of the superior vesical artery from the internal iliac artery and it supplies blood to the body and tail of the epididymis.

(3) The cremasteric artery arises from the deep epigastric artery, itself a branch of the external iliac artery. It supplies the lower poles of the epididymis and testis.

The spermatic veins issue from the body of the testis at its posterior aspect, and arborise in the spermatic cord with the venous return from the epididymis to form the pampiniform plexus. This plexus ascends and in the inguinal canal two veins emerge from it and these follow the spermatic artery for some distance before uniting to form a terminal stem. The right terminal stem flows into the inferior vena cava and the left one enters the left renal vein.

Nerve supply:

The coverings of the testis and epididymis are richly

supplied by nerve filaments, the sources of these being, the ileo-inguinal and genito-crural branches of the lumbar plexus, the two superficial perineal branches of the internal pudic and the long pudendal branch of the small sciatic nerve.

The testis is apparently supplied only by the sympathetic fibres accompanying the spermatic artery.

It is thought that the nerve supply to the epididymis is from the plexus myospermaticus, a network provided with sympathetic ganglia in the muscular coat of the ducts.

Lymphatic drainage:-

The lymphatic drainage of the testis and epididymis is so intimately bound up with that of the vas deferens, seminal vesicles and kidney that a full description of it will be more appropriate at the end of the anatomical section.

The scrotum:

The scrotum is a cutaneous pouch containing the testes, epididymes and lower parts of the spermatic cords. Its integument is continuous above with that of the penis, behind with the perineum, and laterally with the thigh. The skin is thin, dark in colour, wrinkled, and possesses many sebaceous and sweat glands. In the subcutaneous tissue is the dartos muscle, connected with the fascia of the penis and below with the perineum. It has a median raphe and its fascia forms a septum in the midline, separating the two scrotal sacs; the left portion hangs lower than the right,

in correspondence with the greater length of the left spermatic cord.

The arteries supplying the scrotum are the superficial and deep external pudendal branches of the femoral artery and the cremasteric branch from the inferior epigastric artery. The veins follow the course of the corresponding arteries.

The vas deferens:

The vas deferens is the duct in the genital tract analogous to the ureter, conveying testicular secretion to the seminal vesicle from the epididymis. It is a continuation of the epididymis, beginning at the globus minor and terminating in the neck of the seminal vesicle. Twenty to twenty-four inches in length it follows a long winding course and its position alters with the movements of the bladder and the testis. From the epididymis it is quite tortuous but after one or two inches the tortuosity ceases and the duct is smooth until the ampulla. Anatomically several portions are recognised; (1) intravaginal, within the tunica vaginalis (2) scrotal, up to the external abdominal ring, (3) inguinal, between the external and internal abdominal rings, (4) pelvic, from internal ring to ampulla, and (5) ampulla. The last named portion is a dilated spindle-like enlargement, three to four inches long with its wall puckered and it enters the neck of the seminal vesicle obliquely at

which point the neck of the vesicle and ampulla are surrounded by a sphincter.

In structure, the vas deferens is a tube with a thick layer of unstriated muscle running in a longitudinal direction only. Its mucosa is arranged in longitudinal folds having an unciliated columnar epithelium.

The blood supply of the vas deferens is the artery to the vas deferens which is a branch of the superior vesical artery, itself a branch of the internal iliac artery.

The spermatic cord:

As the testis descends through the abdominal wall on its way into the scrotum, it pulls the vas deferens, vessels and nerves with it. These structures meet at the internal abdominal ring and there the spermatic cord begins. It ends at the posterior border of the testis, the left spermatic cord being a little longer than the right.

The spermatic cord traverses the inguinal canal and in so doing is covered by the different layers which form the abdominal wall. From within outwards these coverings are named, the infundibuliform (internal spermatic), cremasteric and intercrural (external spermatic) fasciae.

Besides the vas deferens the spermatic cord also contains the blood and nerve supply to the testis, the artery to the vas deferens, the cremasteric artery and the lymphatic vessels from the testis and epididymis.

The seminal vesicles:

The seminal vesicles are two lobulated membranous pouches into which the ampullae of the vasa deferentiae enter. The vesicles lie between the base of the bladder and rectum, above and behind the prostate. Their long axes run forward and downward to the median line to end in the ejaculatory ducts, which according to Eisendarth and Rolnick⁵ are continuations of the seminal vesicles. The ampulla of the vas deferens which enters the neck of the seminal vesicle runs for some distance alongside the seminal vesicle on the inner surface before entering it. Each vesicle is pyramidal in shape, with the upper end wider than the lower end and has a capacity of 4 to 5 cc's. as shown fluoroscopically. It contains a single coiled tube with irregular diverticula, the tube being 4 to 5" long when uncoiled.

The arteries supplying the seminal vesicles are derived from the middle and inferior vesical and the middle haemorrhoidal arteries. The veins accompany the arteries, while the nerve supply is from the pelvic plexuses.

The ejaculatory ducts:

The ejaculatory ducts, two in number, are the outlet ducts of the seminal vesicles. Each is three quarters of an inch long and runs forward and down between the middle and posterior lobes of the prostate and terminates in a

slit-like opening on each side of the utricle.

The prostate:

The prostate surrounds the urethra immediately below the neck of the bladder and is composed of a mixture of glandular and muscular tissue encased in a definite capsule. In addition to being penetrated in a curved manner by the prostatic urethra it is also traversed by the ejaculatory ducts from their point of origin to their terminations in the verumontanum. It has the form of a chestnut, its base being in intimate relation to the vesical neck. Its apex or distal portion is directed almost vertically downwards, and marks the point of division between the prostatic and membranous portions of the urethra and it rests against the superior layer of the urogenital diaphragm. The prostatic urethra penetrates the prostate from the middle of the base to a point just proximal to the apex, forming a curve with its concavity directed anteriorly. The result is that the greater portion of the prostate lies behind and lateral to the urethra.

Except over its base, apex and lower anterior surface, the prostate is enclosed by a fibrous capsule which is most dense where the prostate is in contact with the rectum. This portion of capsule is termed the recto-vesical septum or fascia of Denonvilliers which also covers the posterior surfaces of the ampullae of the spermatic ducts and the seminal

vesicles.

The arteries supplying the prostate are derived from the internal pudendal, inferior vesical, and middle haemorrhoidal arteries. Its veins form a plexus around the sides and base of the gland and end in the hypogastric veins.

The motor nerves of the prostate, according to Learmonth,⁶ originate in the first lumbar ganglia and course down the lateral roots of the pre-sacral nerve to terminate around the prostatic ducts and alveoli. It is thought that some sensory fibres are also carried in this nerve although the majority of the sensory nerve fibres originate in the anterior roots of the third and fourth sacrals and are carried by the pudic nerve to the prostate.

The lymphatic drainage of the male genital organs.

In a later chapter of this monograph, where the spread of tuberculosis in the male genitalia is discussed, it will be found necessary to refer to the lymphatic drainage of these organs. In consequence, it has been thought advisable that the lymphatic drainage of the scrotal contents, vas deferens, seminal vesicles and prostate should be given in considerable detail. The necessary information has been obtained from "Anatomie des Lymphatiques de L'Homme" by H. Rouvière.⁷

Lymphatic drainage of the testis.

The collecting vessels, four to eight in number, emerge

from the mediastinum testis and ascend in the spermatic cord with part of the lymphatic drainage of the epididymis to terminate in the aortic nodes.

Lymphatic drainage of the epididymis.

General:- The lymphatic drainage of the epididymis is towards the surface of the organ where union with the lymphatic system in the tunica albuginea takes place.

Regional:- These are best described under the appropriate regions which they drain, thus:-

Globus Major:- The lymphatic channels from this region accompany the branch of the epididymal artery supplying the area. These follow the spermatic artery along with the testicular lymphatics and terminate in the lateral aortic and pre-aortic lymph nodes.

Body:- From the body of the epididymis the drainage vessels accompany the epididymal artery and end in the lateral aortic and pre-aortic nodes.

Globus Minor:- In this region, three sets of drainage channels are recognised.

- (1) One set, which follows the branch of the epididymal artery supplying the globus minor, terminates as described above.
- (2) Those which accompany the artery to the vas deferens and continue with it up to the bladder, then pass outwards and upwards to terminate in the external iliac lymph nodes, situated in front of the bifurcation of the common iliac artery, and

- (3) Those which ascend with the cremasteric artery and end in the external iliac nodes.

Lymphatic drainage of vas deferens:

The lymphatic vessels accompanying and draining the vas deferens are numerous at both extremities and few in number in its middle part. These pass into the lymphatics which follow the artery to the vas deferens, and thence to the external and internal iliac lymph nodes.

Lymphatic drainage of seminal vesicles.

The main lymphatic channels, three or four in number, form a superficial lymphatic plexus, and follow the internal and external edges of the organ. They pass to a lymphatic node situated above and behind each seminal vesicle and then drain into the external and internal iliac chain of nodes.

Lymphatic drainage of the prostate.

The lymphatic capillaries arise from the glandular acini and unite to form a perilobular reticulum. From this reticulum several groups of channels are formed, one of which comes from the base and upper part of the posterior surface and drains into the external iliac glands. A second trunk from the lower part of the prostate ends in the internal iliac nodes while a third group of two or three trunks draining the posterior part of the prostate passes towards the sacrum, one trunk ending in the glands at the level of the second sacral vertebra and the others in the nodes over the

promontory of the sacrum. A fourth group passes down the front of the prostate to the perineum, along the internal pubic artery and this group ends in the hypogastric nodes near the origin of the internal pudic artery.

Lymphatic anastomoses.

(a) Testis and epididymis:- A collector trunk from the testis emerges posteriorly and passes towards the globus minor where it unites with the lymphatics of that region. Small communications are also present between the lymphatic vessels of the anterior end of the testis and those of the globus major of the epididymis.

(b) Epididymis, vas deferens, seminal vesicles and prostate:- The lymphatic channels of the vas deferens at its distal end anastomose with those of the epididymis and with those of the seminal vesicles and prostate at its proximal end.

(c) Testis, epididymis, kidney, kidney capsule and suprarenal gland:- Among the lymphatics of the testis and epididymis which go to the abdominal aortic glands, some go to the same elements which receive the collectors from the kidney, its capsule and the suprarenal gland. Before reaching the glands these collectors may join and all pass by common trunks into the lymphatic nodes of which they are tributaries. In view of the embryology of the testis and epididymis these facts are not surprising.

Main lymphatic nodes in relation to genital organs.

There are two series of nodes, one secondary to the other. The principal series of nodes on the left side lie in close relationship to the left side of the aorta. The main group is situated near the origin of the inferior mesenteric artery with the highest node immediately beneath the left renal artery and the lowest near the left common iliac artery.

On the right side the nodes lie in the groove between the aorta and the vena cava. As on the left side a node may be present as high as the origin of the right renal artery and there may be one close to the ureter as low as the brim of the true pelvis.

The secondary series of nodes lies on the outer side of the common iliac artery, close to the beginnings of the internal and external iliac arteries.

Lymphatic drainage of the scrotum.

The lymphatic vessels of the scrotum follow the course of the external pudendal vessels and end in the superficial inguinal and subinguinal lymph-glands.

(c) PHYSIOLOGY.

The Scrotum. The function of the scrotum has never been definitely elucidated, but most observers believe that it is thermo-regulatory. Moore⁸ insulated the scrotum of a

ram with a covering similar in shape and properties to a tea-cosy and, in a few weeks the testes became smaller and in eighty days the testes were aspermatic. Removal of the insulator was followed by recovery of spermatogenesis.

The supporters of the thermal theory state that in order to increase and multiply, the cells of the external excretory mechanism of the testes must be kept at a temperature two or three degrees lower than the rest of the body. In the scrotum and nowhere else in the body is this condition to be found.

The Testes. Two main functions are attributed to the testes, the first being an endocrine function and the second, spermatogenesis. The endocrine function with other secretions helps to produce secondary male characteristics. Spermatogenesis takes place in the seminiferous tubules, and the tubuli recti and rete testis are channels for the passage of the fully developed spermatozoa, which are non-motile in the testes.

The vasa efferentia are lined by ciliated epithelium which wafts the spermatozoa along to the head of the epididymis.

Belfield⁹ considers that the formation of spermatozoa by the testes is unnecessary to the normal life of the individual, as is proved by the human subjects of bilateral

retention of the testes. These men exhibit normal masculinity including sex power and desire, although their testes produce no spermatozoa. In his opinion many other observations show that the essential value of the testes is not spermatogenesis, but the transformation of overgrowth into energy. Belfield also states that, if the outlet of one of an animal's testes is closed by vasoligation, the other remaining open, several months later when both testes are removed, the interstitial cells of the occluded side will be found to be more numerous than those of the other.

The Epididymes. According to Eisendarth and Rolnick,⁵ the functions of the epididymes are three in number. Firstly they act as passageways for the spermatozoa from the testes and secondly the epithelium of the epididymes secretes a fluid which constitutes the bulk of the semen. This fluid activates the spermatozoa very little as is evidenced by the relatively slight increase of motility of the spermatozoa in their passage from the globus major to the globus minor.

The tail of each epididymis, having smooth muscle in its wall has powers of contraction and, when the spermatozoa have gone beyond the body of the epididymis to the tail, they cannot be forced back because of a valve-like arrangement between the body and the tail.

Eisendarth and Rolnick also ascribe an excretory function

to the epididymis while Belfield⁹ considers the epididymis to be the modified kidney of cold-blooded vertebrates and states that its convoluted tubules are still lined with ciliated cells like those of the frog's kidneys.

The Vasa Deferentia. The thick longitudinal muscle of each vas deferens contracts upon stimulation and the semen is carried along by secretory pressure and peristalsis, while the ampulla of each vas deferens contains a secretion which activates the spermatozoa to a marked degree.

According to Rolnick,¹⁰ the vas deferens, when stimulated, undergoes true peristalsis from the epididymis to the posterior urethra. During coitus, in his opinion, peristalsis undoubtedly occurs. The peristalsis of the vas deferens was first demonstrated by Fick¹¹ in 1856, and since then it has been confirmed by Waddell¹² and Macht.¹³ Lommel¹⁴ demonstrated that stimulation of the hypogastric nerves or irritation of the verumontanum produced active waves. As far as the present writer can determine from the literature, reverse peristalsis has never been demonstrated. Lommel showed, however, that when fluid was injected into the vas deferens and the vas deferens stimulated, the fluid progressed backwards by gradual stages towards the epididymis, following each peristaltic wave towards the posterior urethra. Lommel also noted that bacteria would not pass up the ejaculatory ducts from the posterior urethra

if the verumontanum were normal but when inflamed or congested, infection could spread from the posterior urethra through these ducts. Belfield¹⁵ demonstrated that urine may pass through a needle in a vasostomy wound when there is a patulous relaxed ejaculatory duct, and he had observed retrograde urination when a strong desire to micturate had been resisted.

The Seminal Vesicles. These organs act as reservoirs for the semen, and have the ability to contract and expel the fluid.

Barney¹⁶ states that the seminal vesicles have a secretion of their own and the work of Steinach and Walker has demonstrated that this secretion is almost a sine qua non of procreation. These two workers showed, according to Barney, that extirpation of the seminal vesicles in rats caused a marked decrease in fertility. Testut¹⁷ and de Bonis¹⁸ observed that after castration the corresponding seminal vesicle atrophied but cryptorchidism had no influence on the seminal vesicles.

Barney is of the opinion that when one seminal vesicle is diseased, the other is also involved and that during the early stages of infection, dilatation occurs owing to cessation of peristalsis or obstruction of the ejaculatory ducts or both. Later on, the infection is followed by a deposit

of scar tissue and these organs become lost to rectal examination. Barney also believes that a vesiculitis is usually accompanied by a prostatitis.

The Prostate. According to Eisendarth and Rolnick⁵ the prostatic secretion adds to the semen and it may activate and prolong the life of the spermatozoa. Thompson and Buchtel¹⁹ regard the function of the prostate as being purely sexual. Under sexual stimulation the prostate produces a milky fluid with an average pH of 7.24 and these writers do not regard this fluid as a motor stimulator for spermatozoa, as motile sperm are regularly to be found in spermatocele fluid. In their opinion the function of the prostate is to furnish a vehicle in which the spermatozoa are transported to the female genital tract and possibly protected by the fluid from injury by the vaginal secretion.

CHAPTER 3THE AETIOLOGY OF TUBERCULOUS EPIDIDYMITIS(a) GENERAL INCIDENCE.

The writer has used as material for this study, the case records of male patients admitted to Robroyston Sanatorium between the years 1921 and 1941 inclusive. During these twenty-one years, there were 5,476 males of all ages admitted to hospital suffering from tuberculosis in one or more of its forms. From that total, 402 case histories or 7.34% have been abstracted, which recorded the occurrence of involvement of the epididymis by tuberculosis, whether or not that was the cause of admission to hospital.

TABLE NO. 1/

TABLE NO. 1

Yearly percentage incidence of patients in Robroyston Sanatorium suffering from tuberculous epididymitis

Year.	Total No. of male Admissions.	Number of Epididymitis cases.	Percentage	Year	Total No. of male Admissions	Number of Epididymitis cases	Percentage
1921	367	1	0.27	1932	245	23	9.39
1922	376	6	1.60	1933	205	24	11.71
1923	408	10	2.45	1934	209	36	17.22
1924	365	10	2.74	1935	227	31	13.66
1925	263	4	1.50	1936	244	25	10.25
1926	362	9	2.49	1937	211	32	15.16
1927	279	13	4.66	1938	211	26	12.32
1928	247	18	7.29	1939	168	32	19.05
1929	237	16	6.75	1940	137	21	15.32
1930	222	18	8.11	1941	220	25	11.36
1931	273	22	8.06				

From Table Number 1 it can be seen that there is a marked difference in the percentage incidence of patients with tuberculous epididymitis admitted to Robroyston Sanatorium in the various years under review. The increasing incidence

becomes most marked after the year 1933 and from that time onwards, at least one in every ten males admitted to hospital had a tuberculous lesion of the epididymis.

At first sight it may be assumed, erroneously in the writer's opinion, that the disease under consideration has become much more frequent between the years 1921 and 1941. At least two causes, concerned with Robroyston Sanatorium, have been responsible to a marked degree for the apparent increase. The first is to be found by close examination of the earlier case-records of the hospital. In these records, the genitalia have received scant attention and it was sometimes with considerable difficulty that the investigator was able to extract those which recorded genital involvement. Swelling of the epididymis was reported in some case histories, without any further description or hint as to its origin, and these records were quite unsuitable for an investigation and therefore were not included in the total under review.

The second cause, and by far the more important, in the writer's opinion, was the appointment at the end of 1933 of a visiting urologist to Robroyston Sanatorium. This appointment was necessitated following the creation of a genito-urinary department and a special case-sheet was issued which called for a more complete examination of the whole genito-urinary system. Many of the admissions to

hospital from that date had been examined previously by the urologist, either in hospital or private practice and had been recommended for admission to Robroyston Sanatorium. In addition, the fact that such a department existed in the hospital attracted patients from districts outwith the Glasgow area and accounted in no little measure for the increase of cases with genital tuberculosis.

Because of these two influences on the percentage of patients suffering from genital tuberculosis, and especially the marked increase from the year 1933 to the year 1939, the mean figure of 7.34% may not, in the writer's opinion, be a true representation of the general incidence of this disease amongst patients suffering from tuberculosis, but rather the incidence in the patients admitted to Robroyston Sanatorium. From the year 1939, the number of patients admitted to hospital was greatly reduced owing to the outbreak of hostilities and a consequent reduction in the number of beds available for the treatment of tuberculosis.

The incidence of tuberculous epididymitis given by other investigators varies considerably. Menville and Priestley,²⁰ from the post-mortem statistics of patients dying from any cause, give a figure of 0.6% for the incidence of genital tuberculosis, while Bothe²¹ found that 5.13% of patients, from many thousands of autopsies on men who died

from a tuberculous condition, had a tuberculous genito-urinary lesion. Walker and Hawes²² quoted Reclus, who stated that he found disease of the testis and epididymis in 19 or 3.8% of 500 post-mortem examinations of men who died of pulmonary tuberculosis. Fowler and Godlee²³ from 531 autopsies found tuberculosis of the superficial genitalia in 1.7% while Cunningham²⁴ arrived at the figure of 0.8235% for the incidence of tuberculous epididymitis in 4250 autopsies. Schultz²⁵ gave his figure as 125 cases with genital and urogenital tuberculosis from 14,086 autopsies while in 666 post-mortem examinations examinations on men dying of tuberculosis, Greenberger, Greenberger and Alexander²⁶ found 67 patients with tuberculosis of the genitalis.

Miller and Lustock,²⁷ working in the Sanatorium of the Jewish Consumptive Relief Society, stated that the incidence of genital tuberculosis differs with the type of material available and that the average figure was 2.8% of all male tuberculous patients. Their own figure over eleven years between 1928 and 1939 was 61 cases of genital infection out of 1,316 male admissions or 4.7%. Negley²⁸ in his investigation found that out of 3,500 male admissions to Olive View Sanatorium the incidence of tuberculous epididymitis was 2.2%, while in 9,786 men admitted to a Los Angeles

general hospital urological clinique the incidence was 1.4%. Howard²⁹ examined 55,912 records of patients admitted to a London hospital and found that 158 had been diagnosed as having tuberculous epididymitis. Nine of these patients were under twelve years of age and he calculated the incidence in these over twelve years was 0.33% and under twelve 0.07%. Morson³⁰ investigated the records of another London hospital in 1932 and his findings were that 334 patients had tuberculosis out of a total of 8,616 and that six of the 334 men had disease of the genitalia. Barney and Colby³¹ gave as their opinion that the incidence of genital tuberculosis in tuberculous men is about 5% but that it is considerably less in children.

It must be obvious that the writer's incidence figure of 7.34% is the result of the study of a selected population and it is equally true that this selective factor must have become increasingly weighty in the years which followed the opening of the special genito-urinary department. Accordingly, the nearest approach to a true incidence figure must lie in the averages of the years prior to 1934 with the proviso already made that the inadequacy of the earlier records may be a material factor in reducing this figure. On this basis a figure of 4.52% is reached which corresponds closely to the figure reached by Barney and Colby and quoted in the preceding paragraph.

(b) AGE INCIDENCE OF TUBERCULOUS EPIDIDYMITIS

The youngest patient in the present series of 402 cases showing involvement of the epididymis by tuberculosis was eight months old, while the oldest was sixty-three years of age. Between these two age limits, it will be seen from the Table No. 2, that the incidence of the disease in this series remains at a low level up to 15 years, but rises sharply after that age, the peak being between 26 and 30 years. Thereafter, it remains high until the 41-45 age group from which time it falls rapidly until between 61 and 65 years only six cases occurred. These facts are presented in tabular formation below.

TABLE NUMBER 2

Age Group (in years)	Number of Cases	Per- centage	Age Group (in years)	Number of Cases	Per- centage
- 5	12	2.98	36 - 40	34	8.46
6 - 10	4	1.00	41 - 45	35	8.70
11 - 15	12	2.98	46 - 50	18	4.48
16 - 20	46	11.59	51 - 55	16	3.98
21 - 25	76	19.10	56 - 60	13	3.23
26 - 30	78	19.42	61 - 65	6	0.67
31 - 35	52	12.94			

The outstanding conclusion to be drawn from the above table, one that has been stressed by numerous writers on this subject, is that genital tuberculosis occurs most commonly during the years of maximal sexual activity. In the 402 cases under review, 252 or 62.69% occurred between the years of 16 and 35, while 206, 51.10% are present in the years between 21 and 35. These figures are very similar to those of other investigators of this condition. Ormond and Myers³² maintain that the incidence is greatest between the years 20 and 50 and in their series of 51 cases, only one case, that of a child of 16 months, occurred under the age of 20 years, while over the age of 60 years there were only two patients with tuberculous epididymitis. Hesse,³³ in his investigations found tuberculous epididymitis in two patients before the age of 10 years, one between 70 and 80 years and one after the age of 80. The bulk of his patients occurred between 20 and 60 years, 58.70% between 20 and 40 years and 24.3% within the age limits of 40 and 60. Barney³⁴ found in 120 cases an incidence of 45% between 25 and 35 years. Bailey³⁵ gives a figure of 75% for the incidence of cases between the ages of 20 and 40, a figure which is in excess of that given by most writers on this subject. Miller and Lustock²⁷ found the vast majority of their 61 cases occurred between 20 and 40 years with the

mean at 30 years of age. That genital tuberculosis can occur at any age is supported by Greenberger, Greenberger and Alexander,²⁶ whose series ranged from 2 to 67 years, while the cases of Robertson and Singer³⁶ occurred between the age limits of 18 and 58, with a maximum involvement between the second and fourth decades. The maximum number of cases was found by McCrea³⁷ to fall between 20 and 29 years of age and he concluded that genital tuberculosis was a disease of adolescence and middle age.

Among autopsies on a large number of patients Menville and Priestley²⁰ found 62 cases of male genital tuberculosis. The ages of these patients varied between 16 and 80 years but a majority of the patients was composed of young adults.

Several writers on this subject have confined their investigations into the incidence in children. Poissonier³⁸ found that the disease was uncommon in childhood but was more frequent in the infant than from the second year to puberty. Barney³⁹ collected eleven cases between the years 1872 and 1921 and found the ages were between nine months and 14 years. Schultz²⁵ had only two cases under 17 years of age and while Lowsley and Kirwin⁴⁰ found that the disease seldom occurred under 15 years of age, Campbell⁴¹ emphasized that no age was too young for tuberculous epididymitis. Dreschfield,⁴² and Howard,²⁹ quoting Giraldès both recorded

a case in the new-born while Everidge⁴³ found a relatively high incidence of genital disease in children's hospitals between 9 and 13 years. Howard had nine cases under 12 years of age, with the average age of 3 years 2 months. The oldest was 10 years and the youngest six and a half weeks.

An extensive review of the available literature on the subject of tuberculous epididymitis and its relationship to age incidence, shows that all the writers are in agreement, that the disease may occur at any age from infancy to old age, but that it is essentially a disease of the period of greatest sexual activity. Additional authorities on this subject are quoted below.

<u>Author</u>	<u>Age Limits in Years of Greatest Number of Cases of Tuberculous Epididymitis</u>
Thomson-Walker ⁴⁴	20 - 50
Martin ⁴⁵	20 - 30
Robinson ⁴⁶	25 - 45
Hunt ⁴⁷	20 - 40
Eisendarth and Rolnick ⁵	20 - 40
Herman ⁴⁸	15 - 45
Lowsley and Kirwin ⁴⁰	15 - 45
Schultz ²⁵	30 - 40
Carver ⁴⁹	During years of greatest sexual activity.

The largest series of cases found by the writer from a study of the available literature on the subject of tuberculous epididymitis, was that of Sjöstrand⁵⁰ who collected cases from several different sources and calculated the incidence for each age-group. Keyes⁵¹ carried out the same procedure with his series of 100 cases. For comparison, the writer presents in tabular formation, appended below, the details of the series of Sjöstrand and Keyes and his own series. The group of patients investigated by Kretschmer⁵² has been added but the age-group division is different.

Investigator	Number of Cases
Sjöstrand	509 (from various authors)
Keyes	100
Kretschner	94 (2 cases ages unstated)
Present Writer	402

Sjostrand's Series

Age Groups in years	15- 19	20- 24	25- 29	30- 34	35- 39	40- 44	45- 49	50- 54	55- 59	60- 64	65- 69	70- 74
No. of Cases	35	104	82	81	58	41	38	24	17	12	7	7
Percentage	7	20	16	16	11	8	7					

Keyes's Series

No. of Cases												
Percentage	8	14	25	16	10	9	9	0	3			

Present Series

Age Groups in years	16- 20	21- 25	26- 30	31- 35	36- 40	41- 45	46- 50	51- 55	56- 60	61- 65	66- 70	71- 75
No. of Cases	46	76	78	52	34	35	18	16	13	6	0	0
Percentage	11.59	19.10	19.42	12.94	8.46	8.70	4.48	3.98	3.23	0.67	0	0

Kretschner's Series

Age Groups in years	- 19	20 - 29	30 - 39	40 - 49	50 - 59	60 - 69
No. of Cases	4	28	37	9	11	3
Percentage	4.35	30.43	40.23	9.78	11.96	3.29

Summary of Above Tables

Investigator	Age Group	Percentage	Age Group	Percentage
Sjöstrand	15 - 39	70	20 - 39	63
Keyes	15 - 39	73	20 - 39	65
Kretschner			20 - 39	70.66
Present Writer	16 - 40	71	21 - 40	60

(c) EXTRA-GENITAL TUBERCULOUS LESIONS.

Young⁵³ states that the primary focus in cases of urogenital tuberculosis is often quite remote from the superficial lesion. In his experience he finds that the original source of infection often subsides and may be discovered only at post-mortem examination and then found to be fibrotic and inactive. He does not find it surprising that in all the investigations on the subject of genital tuberculosis, a large percentage of those showing a second tuberculous lesion elsewhere in the body is found, and that the genital lesion is taken as a spread of the tuberculous process from some other part of the body. The history or presence of lung tuberculosis is, in Young's opinion, strong presumptive evidence of genital tuberculosis in the presence of signs and symptoms referable to the genital tract.

Ormond and Myers³² discovered an extra-genital tuberculous lesion in 70% of 51 cases of tuberculous epididymitis and they accounted for the remaining 30% as being probably due to a spread of the disease from a dormant infection in a primary focus. The percentages given for the various forms of extra-genital lesions were as follows:-

Pulmonary alone	20%	Pulmonary and Urinary	8%
Urinary alone	20%	Pulmonary and Bone	6%
Bone alone	6%	Urinary and Bone	10%
Pulmonary, Urinary and Bone	2%	No other lesion found	30%

From these figures the present writer has calculated that in the series of cases investigated by Ormond and Myers, 36% of cases had pulmonary tuberculosis and 40% had renal tuberculosis.

White and Gains⁵⁴ state that the epididymal lesion is always secondary to a focus at some other part of the body, most often in their opinion the lung, a finding that is in agreement with the views of Greenberger, Greenberger and Alexander,²⁶ Eisendarth and Rolnick,⁵ and Harvey.⁵⁵ Other investigators, notably Walker,⁵⁶ Walker and Hawes,²² Robertson and Singer,³⁶ Wildbolz,⁵⁷ Gibson,⁵⁸ Thomson-Walker,⁴⁴ Webb-Johnson,⁵⁹ and Barney and Colby,³¹ qualify that view slightly and say that tuberculous epididymitis is frequently associated with tuberculous lesions elsewhere in the body. Herman⁴⁸ believes that tuberculosis elsewhere is probably essential in genital tuberculosis, while McCrea³⁷ states that the genital lesion is always secondary to some other lesion and that the other lesion is demonstrable in over 50% of cases.

From the following list, it can be seen that the percentage of extra-genital tuberculous lesions found by several investigators varies considerably but is always more than 50%.

<u>Investigator</u>	<u>No. of Cases of Epididymal Tuberculosis</u>	<u>Percentage with Extra-genital Lesions</u>
Keyes ⁵¹	100	100
Bumpus and Thompson ⁶⁰	300	54.8
Kretschmer ⁵²	94	79.8
Menville ⁶¹	65 (autopsies)	97.
Menville and Priestley ²⁰	62 (autopsies)	96.6
Carver ⁴⁹	77 (uro-genital tuberculosis)	88.3
Barney ³⁴	154	55.8

Colby,⁶² working in a sanatorium almost entirely devoted to the treatment of bone and joint tuberculosis, states that renal and genital lesions seem to complicate bone tuberculosis more frequently than is supposed and Fishberg⁶³ writes that operative treatment for genito-urinary tuberculosis may be instrumental in re-activating a dormant lesion in the lung which nearly all cases undoubtedly have. Miller and Lustock²⁷ accept the fact that genital tuberculosis is always secondary to some other lesion and in their series of 61 cases found that each case had at least one other tuberculous lesion. Hammond⁶⁴ gives his results for cases with early genital tuberculous lesions as, 4% having definite disease of bone or joint healed for many years, more than one per cent. under treatment at the same time, 4% with old pulmonary tuberculous lesions and in less

than 50% evidence of pulmonary tuberculosis. Osgood⁶⁵ states as a diagnostic feature, the fact that tuberculosis elsewhere in the body means genital tuberculosis in over 90% of cases with genital involvement. From clinical and post mortem findings Cunningham²⁴ believes that other tuberculous lesions are present in the great majority of genital cases.

In the present series of 402 men suffering from tuberculous epididymitis, at least one extra-genital tuberculous lesion was proved in 355 cases or 88.32%. The writer has worked out the various combinations of secondary tuberculous foci and these are shown, with the percentages, in Table No. 3.

TABLE NO. 3
LOCALISATION OF EXTRA-GENITAL TUBERCULOUS LESIONS IN 355 CASES

Extra Genital Tuberculous Lesions	No. of Cases	%	Extra Genital Tuberculous Lesions	No. of Cases	%
Renal	93	23.13	Pulmonary	121	30.10
Renal and Pulmonary	34	8.46	Pulmonary and Bone and Joint	34	8.46
Renal, Pulmonary, Bone and Joint	5	1.24	Glandular	2	.50
Renal and Bone and Joint	12	2.99	Pulmonary and Glandular	1	.25
Renal and Abdominal	2	.50	Pulmonary and Abdominal	1	.25
Bone and Joint	40	9.95	Pulmonary, abdominal, Bone and Joint	2	.50
Abdominal	7	1.74	Abdominal and Bone and Joint	1	.25
No other tuberculous	47	11.69			

In the 47 or 11.69% of cases with no obvious extra-genital lesion found on clinical examination, routine X-ray examination of the chest was not carried out and the urine was not tested biologically for the presence of organisms. Twenty-one patients had chronic scrotal fistulae with disease involving the testis and the vas deferens or seminal vesicles, 15 had involvement of the vas deferens with disease of the testis or seminal vesicles, while six were diagnosed by the appearances found at operation. The diagnoses in the remaining five men were doubtful at operation and the parts removed were submitted for histological examination with positive results for tuberculosis.

While the relevancy of the above details may not be obvious at first sight, the facts are presented at this stage simply to show that in the writer's opinion, all of these 47 cases suffered from genital tuberculosis. Further reference will be made to these facts in a later chapter.

(d) INJURY AS A FACTOR PREDISPOSING TO TUBERCULOUS EPIDIDYMITIS.

Tylinski⁶⁶ has shown in animals that injury has a distinct influence upon the localisation of the tubercle bacillus, and Illingworth,⁶⁷ writing on tuberculosis in man, considers that it may determine the localisation of organisms circulating in the blood-stream. Medico-legal questions

may arise as to the part played by injury in causing a lesion and in this connection the time relationship between the injury and the appearance of signs and symptoms is important. If a definite blow can be proved and the lesion appears soon afterwards, it is often taken as having had an influence on the localisation of the disease, but strains and lifting heavy weights are not usually considered aetiological factors in the production of genital tuberculosis.

The period of incubation may vary considerably and it has been suggested that the lesion develops more rapidly in patients with poor resistance. According to Girdlestone,⁶⁸ writing on injury and its relation to bone and joint tuberculosis, it would probably be fair to say that local injury can be excluded from causal relationship with the lesion, unless it occurred more than one month and less than six months, before the development of the first symptoms.

With regard to the type of injury, the writer feels that, firstly he must repeat what was written in the anatomical section concerning the relative positions of the epididymis and testis. Since the epididymis lies on the lateral part of the posterior border of the testis, some natural protection must be afforded to the epididymis from injury in front, and therefore he finds it difficult to understand why trauma, if it is an important aetiological

factor in the occurrence of genital tuberculosis, does not more often cause an orchitis instead of an epididymitis.

In a study of the available literature on genital tuberculosis, the writer is impressed by the complicating views which are held by a few writers concerning the relationship between injury and genital tuberculosis; most investigators do not mention the subject. Young⁵³ writes that injury to the testis was found in the history of very few of his cases and therefore could not be considered as an important aetiological factor. Out of 175 cases of tuberculous epididymitis he states that in only 6 records or 3.428%, was the association present, but he does not state any time intervals. On the other hand Thomson-Walker,⁴⁴ Horwitz⁶⁹ and Lowsley and Kirwin,⁴⁰ lay considerable stress on a history of injury as a precipitating factor, and Hammond⁶⁴ agrees with that, but modifies it slightly by stating that the injury is a predisposing factor if the genital symptoms and signs appear within one year. Among those who agree with Young, are Wallner,⁷⁰ Menville and Priestley,²⁰ investigating adults, and Howard²⁹ whose investigations were carried out among children. In one article Barney³⁴ merely mentions injury as a possible factor in the production of genital tuberculosis, but in a later article in association with Colby,³¹ lays more stress on it and in the latter article 18

out of 92 patients are quoted as having had a history of injury. Ormond and Myers³² do not state their views on this subject but write that 6 of their 35 patients with genital tuberculosis gave a history of previous injury. Keyes,⁵¹ in his article, states that 6 out of 100 patients whom he examined, alleged a history of trauma. Eisendarth and Rolnick⁵ attribute the onset of tuberculous epididymitis following injury, to a probable recrudescence of an old focus of disease, but Herman⁴⁸ feels that trauma lowers local resistance whether or not there was any previous local disease. Sjöstrand,⁵⁰ and Walker and Hawes,²² whose articles dealt mainly with acute tuberculous epididymitis, place considerable reliance on a history of trauma.

In the present series under review, the writer found that 18 patients, 4.48%, attributed their genital lesions to injury. Twelve of these men asserted that the local lesion occurred immediately or very soon after injury, the intervals between the two in these cases being less than one month. In the remaining 6 cases, the intervals between the onset of the genital lesion and trauma were one month in two cases, two, three and six months respectively in three cases, and one and a half years in the remaining case.

All the genital lesions on the first examination were found to consist of unilateral epididymitis but the remaining

epididymis became involved at a later date in eight men. Operative treatment was carried out on twelve of these men and, at operation the disease was found to be localised to the epididymis eight times. In three of the remaining four men, extensive disease of the epididymis was found with slight disease of the testis in the region of the hilum. Operation on the remaining case showed disease to be localised to the epididymis alone, but at a later date the other side became involved and a second operation showed the testis and epididymis to be extensively diseased.

The six men who had no operative treatment for genital tuberculosis, had unilateral epididymitis but in two cases disease was also present in the testis, these conditions being diagnosed on clinical examination alone.

The injuries which were thought by the patients to be responsible for the genital disease varied in type and below is shown a list of these as reported by the patient.

<u>Type of Injury</u>	<u>No. of Cases</u>
Blow (no details)	8
Strained himself while at work	2
Fell off a bicycle	1
Fall	1
Hit on testis by a vice	1
Baby's feet struck testis	1
Blow at football	1
Knock by a hammer	1
Injury (no details)	<u>2</u>
Total	<u>18</u>

A cursory study alone of the above table strongly suggests that injury in these patients probably played no considerable part in the production or localisation of the genital disease. It is common experience that a patient tends to think back from his present disease to a past injury and frequently too readily convinces himself of the association between the two. Similar injuries could no doubt be found in the case records of patients suffering from tuberculosis of bone or joint, where perhaps the question of injury is much more relevant.

(e) INFECTION. GONOCOCCAL EPIDIDYMITIS AS A FACTOR PRE-DISPOSING TO TUBERCULOUS EPIDIDYMITIS.

The possibility of gonococcal epididymitis being a pre-disposing factor to tuberculous epididymitis is mentioned by a few workers on genital tuberculosis. Usually the condition is classed with trauma as reducing resistance of the part, with a resulting locus minoris resistentiae. It would appear that these writers must also hold the view that the tubercle bacilli reach the epididymis via the blood stream, a viewpoint that is not universally accepted but one which will be more appropriately discussed later. Further, the question of why the prostate and the seminal vesicles are not more often attacked by the tubercle bacillus after gonorrhoea, has not been answered as far as the present

writer can discover from a study of the available literature.

Among those who regard the gonorrhoeal infection as a possible pre-disposing cause of the tuberculous lesion are Horwitz,⁶⁹ Donges,⁷¹ Herman,⁴⁸ Barney,³⁴ Barney and Colby,³¹ and McCrea.³⁷ In one series of 95 patients investigated by Barney,³⁴ 34 or 35% gave a history of previous gonococcal infection of the epididymis. Keyes⁵¹ includes gonococcal epididymitis as an exciting cause of tuberculous epididymitis and eleven of his one hundred patients with genital tuberculosis gave a history of gonorrhoea. Menville and Priestley²⁰ mention infection as a possible factor in the occurrence of tuberculous epididymitis but conclude that it is of slight, if any, significance, while Kretschner⁵² came to the conclusion that gonorrhoea played a less important role than was supposed. No evidence was found by Greenberger, Greenberger and Alexander²⁶ to support the view that in a tuberculous patient with a previous history of gonococcal epididymitis, tuberculous epididymitis was a likely occurrence.

The present writer was able to extract only ten case-records, 2.44% of the total, in which there was a history of previous infection of the epididymis by the gonococcus. The intervals between the onset of the two types of epididymitis in these cases was impossible to obtain in 7 and in

the three remaining patients the intervals were 2, 5 and 7 years respectively.

Thomson-Walker⁴⁴ dealing with this subject makes the statement, "many instances in which the onset is very acute and the diagnosis of preceding gonorrhoeal epididymitis is made, are probably instances of acute tuberculous epididymitis, the disease becoming chronic after some weeks."

CHAPTER 4THE DIAGNOSTIC STANDARDS OF TUBERCULOUS EPIDIDYMITIS

Most writers on the subject of genital tuberculosis are agreed that the diagnosis is a relatively easy one to make. According to Barney,³⁴ if on examination the epididymis shows induration, enlargement and nodularity, especially at the lower pole, the condition is very suspicious of tuberculosis. If, in addition, there is thickening of the vas deferens, or involvement of the prostate and seminal vesicles, the case is undoubtedly of tuberculous origin. In his opinion, chronicity and bilaterality tend to confirm the diagnosis while the presence of pus or tubercle bacilli in the urine removes all doubt. Young⁵³ stresses the fact that the condition may be acute in onset with marked pain and enlargement and may involve the globus minor or whole epididymis. After the acute symptoms have passed, a moderately hard, enlarged and nodular epididymis remains. Chronic induration, after gonorrhoea, according to Young, tends to decrease and finally results in a hard nodular painless epididymis which does not simulate a tuberculous process. Both these writers agree that active or healed scrotal fistulae point to a diagnosis of tuberculosis while the presence of a hydrocele is suggestive and positive confirmation

may be obtained by the finding of tubercle bacilli in the aspirated fluid. Young further believes that if any doubt exists, rectal examination may prove very helpful, as irregularity with enlargement of the prostate and seminal vesicles are characteristic of the disease. The induration is firmer than the usual vesiculitis and in his opinion may be hard enough to cause a suspicion of a neoplasm.

Stevens⁷² formulated several points helpful in the diagnosis of tuberculous epididymitis.

- (1) Double epididymitis slightly favours tuberculosis. Prior orchidectomy or epididymectomy with inflammation ensuing in the remaining epididymis almost invariably suggests tuberculosis.
- (2) Scrotal sinus of more than one month's duration is probably tuberculous.
- (3) Tuberculosis elsewhere in the body indicates that the genital lesion is tuberculous in over 90% of cases.
- (4) Involvement of the prostate and seminal vesicles for a period exceeding one month points to tuberculosis and after six months it is a marked factor in the diagnosis of tuberculosis.

Eisendarth and Rolnick⁵ make a diagnosis of tuberculous epididymitis on the following points.

- (1) Painless, firm and nodular enlargement of the entire epididymis.
- (2) Beading of the vas deferens.
- (3) Nodules in the prostate or seminal vesicles.

(4) Pynria

(5) History of renal tuberculosis

(6) Hydrocele.

They further believe that there is always at least one other extra-genital tuberculous lesion.

Thomson-Walker⁴⁴ stresses the insidious onset of tuberculous epididymitis with the absence of acute inflammation. Hard irregular and well-defined nodules of the epididymis with sinus formation are very suggestive of tuberculosis being the cause of the lesion while urinary tuberculosis or tuberculosis elsewhere in the body or a family history of tuberculosis make the diagnosis almost certain. Gibson⁵⁸ gives the most common symptom of this condition as swelling with or without pain and he believes that chronicity, bilaterality and sinus formation favour tuberculosis. Menville and Priestley²⁰ lay stress on a careful case-history and enumerate the common physical signs as described by Young and Barney. Robertson and Singer³⁶ consider scrotal fistulae as pathognomonic of tuberculosis and they maintain that 90% of cases with chronic enlargement of the epididymis suffer from tuberculosis. In their opinion the finding of typical caseous material at operation confirms the diagnosis. Among these writers who stressed the value of a rectal examination as an aid to the diagnosis of tuberculous

epididymitis are Robinson,⁴⁶ Gibson,⁵⁸ Rich,⁷³ Walker,⁵⁶ Keyes⁵¹ and Herman.⁴⁸

Sjöstrand⁵⁰ gives support to Young's view that tuberculosis must be considered as a possible cause, in a case of undiagnosed acute epididymitis. He gives the maximal age incidence for acute tuberculous epididymitis as between the years 20 and 30 and stresses the value of a rectal examination as an aid to diagnosis. Walker and Hawes²² consider that time alone may tell in patients suffering from acute epididymitis but a history of extra-genital tuberculous lesions, the absence of a urethral discharge and the presence of a hydrocele are more commonly associated with tuberculosis.

Wildbolz⁷⁴ considers that acute tuberculous epididymitis is more important than is generally realised as 25% of cases of tuberculous epididymitis have an acute onset. He finds the differential diagnosis between tuberculosis and gonorrhoea as the causative factor of the epididymitis in these cases, an easy one to make, as the tuberculous lesion only occurs in the presence of high allergy, which is only found if the patient has at the moment a virulent tuberculous infection in some other part of the body. Wildbolz maintains that the epididymal lesion due to the gonococcus will regress after a few days, whereas the lesion due to the tubercle bacillus becomes less acute but the infiltration does not

regress. In acute tuberculous epididymitis, Thomson-Walker⁴⁴ maintains that the pain and tenderness are less acute than in epididymitis produced by gonococcal infection. The tuberculous lesion in his opinion is usually associated with abscess formation and tuberculous lesions in the prostate and seminal vesicles; the urethral symptoms are slight, and discharge, if present, does not contain gonococci but may show tubercle bacilli on examination.

With a chronic epididymal lesion, syphilis is excluded in favour of a diagnosis of tuberculosis by Illingworth⁶⁷ because in the latter condition the testis feels normal and retains normal sensation. McLachlan⁷⁵ maintains that the onset of a tertiary syphilitic lesion of the epididymis is gradual and that the lesion is usually small. He finds, usually, that the globus major is the part affected and that it presents a nodular cartilaginous feeling. Gibson⁵⁸ agrees with McLachlan in that syphilis of the epididymis is confined to the globus major while tuberculosis starts in the globus minor. Thomas, Stebbins and Rigos⁷⁶ lay stress on a careful case-history and the Wassermann reaction for the exclusion of syphilis as a cause of epididymitis.

The consequences of mis-diagnosis between neoplasm and tuberculosis of the epididymis are serious and Bailey³⁵ quotes examples where several patients had been sent to

sanatoria because of a diagnosis of tuberculous epididymitis when the real diagnosis was primary carcinoma of the epididymis with secondary deposits in the lungs. Hinman⁷⁷ maintains that the differentiation of tuberculosis and neoplasm of the testis rarely presents any difficulties. He advises the Ascheim-Zondek test and an X-ray of the chest for metastases. A negative Mantoux reaction is very helpful in his opinion but a positive result is of no diagnostic value. Robertson and Gilbert⁷⁸ reviewed seven cases of co-existent cancer and tuberculosis of the testicle and found that in each the duration of the lesion was between four and six weeks and the ages of the patients between 28 and 53 years. They expressed the view that operation should always be carried out in doubtful cases and that the routine use of the Ascheim-Zondek test is very helpful in excluding cancer. Barney,³⁴ Gibson,⁵⁸ and Robertson and Singer³⁶ also advocate the Ascheim-Zondek test in cases where there is any suspicion of cancer.

Pyogenic infection of the epididymis is excluded by Barney³⁴ by a careful case-history. Robinson⁴⁶ finds that the differentiation between epididymitis due to the bacillus coli and epididymitis due to the tubercle bacillus difficult but he maintains that a careful case-history and a rectal examination clear up the diagnosis. Morson³⁰ advises an

examination of the urine for bacillus coli before excluding epididymitis due to that organism. McGavin⁷⁹ reviewed seven cases of non-tuberculous epididymitis all diagnosed by histological examination. For a diagnosis of tuberculosis he lays stress on the history and the local signs of disease. A non-tuberculous epididymitis, in his opinion is often less hard and craggy and if the cause is venous thrombosis of the pampiniform plexus, that condition may be palpated. He maintains that it is axiomatic that the diagnosis of tuberculous epididymitis involves a thorough examination of the lungs, urine and kidneys; if no other tuberculous lesion is found he is sceptical of the diagnosis being tuberculous epididymitis. Lesions of the prostate and seminal vesicles may occur with both types, he adds, but if gross and associated with urinary or urethral infection, the condition is more likely to be due to tuberculosis.

Thomas, Stebbins and Rigos⁷⁶ in the differential diagnosis between tuberculosis and simple epididymitis, exclude trauma and torsion of the testis by a careful case-history. Illingworth⁶⁷ excludes cysts of the epididymis as being smooth, tense and non-adherent.

Reference to the section headed Extra-genital Tuberculous Lesions, Chapter 3 (c) demonstrates that by the above standards all 402 patients may be regarded as unquestionably having suffered from tuberculous epididymitis.

CHAPTER 5 - THE LOCAL LESION(a) The incidence of double infection .

In the whole series, the writer found that the epididymitis was unilateral in 175 cases or 43.53% and bilateral in 227 or 56.47%. These counted as bilateral include 41 cases, 18.06%, which were admitted with unilateral disease, but which later developed disease on the second side while in hospital. Other workers on this subject have found varying results and these are presented below.

Workers	No. of cases of Epididymitis	Percentage Bilateral
Ormond and Myers ³²	51	47.06
Keyes ⁵¹	100	53.
Berger ⁸⁰	50	18
Barney ³⁴	150	40
Young ⁵³	175	58.28
Negley ²⁸ (Olive View Sanatorium)	83	35.
(Los Angeles Hospital)	121	23.
Robertson and Singer ³⁶	15	53.33
McCrea ³⁷	78	40
Kretschmer ⁵²	94	39.36
Cunningham ²⁴ (4250 autopsies)	35	43

Workers	Percentage of bilateral cases of epididymitis.
Spitzer ⁸¹	40-50 (when first seen)
Herman ⁴⁸	50 (at least)
White and Gains ⁵⁴	75
Thomas and Kinsella ⁸²	More than 60
Hunt ⁴⁷	63.6
Morson ³⁰	Large majority
Miller and Lustock ²⁷	Usually bilateral in the long run.
Walker and Hawes ²²	50
Campbell ^{83,84}	50

The average patient's history is unreliable with regard to an accurate time interval between the onsets of two definite symptoms. Very definite records existed of 63 patients concerning the onset of the disease of each epididymis, as an overwhelming majority developed the epididymal disease in hospital under medical supervision. Some of these men were admitted to hospital with unilateral epididymitis, the second epididymis becoming involved in hospital, but each man gave a very definite history of the onset of disease in the primarily involved epididymis. Consequently the writer has limited his investigation of the

TABLE NO. 4
Time of Onset of Second Epididymitis in 63 Patients

Time in Months.	1	2	3	4	5	6	7	8	9	10	11	12	15	18	21	24	30	36	72	96	108
No. of cases	2	11	5	4	7	8	2	2	1	1	1	3	1	2	2	3	1	4	1	1	1
Percentage.	17.	46	7.	6.	11.	12.	3.	3.	1.	1.	1.	4.	1.	3.	3.	4.	1.	6.	1.	1.	1.
	17	46	94	35	11	7	17	17	59	59	59	76	59	17	17	76	59	35	59	59	59
Percentage within 6 months 58.73																					
Percentage within one year 74.60																					
Percentage within two years 87.3																					

The results which the writer found in the present series, can be seen from Table No. 4. Thirty-seven or 58.73% of the total number of cases became bilateral within a period of six months while 47 or 74.6% showed recurrence on the other side within one year. In the remaining 17 cases the second epididymis became involved by tuberculosis at varying intervals, all except three being present within three years, these last becoming apparent at 6, 8 and 9 years respectively.

The above results lend support to the belief of Keyes,⁵¹ that if the second epididymis escapes infection for five years, it is pretty well out of danger. In a series of 8 cases of involvement of the second epididymis after operation on the first, Ormond and Myers³² found that all recurred within five years and 3 recurred within one year. Barney³⁴ reported that in his series the second epididymis became involved within a period of six months in 26.5% and within one year in 38.7% of cases. In the remaining 34.8% of cases the number of relapses dropped steadily after one year and he concluded that damage to the second side was an early event in most cases, but danger was not entirely eliminated until after the lapse of at least eight years. In the 94 cases of tuberculous epididymitis investigated by Kretschmer,⁵² 16% showed a spread of the disease to the

second side within a period of six months, while Bumpus and Thompson⁶⁰ gave a figure of 39% for recurrence within one year. Boguljuboff⁵³ quoted by Young, found that in 166 patients the second epididymis became involved by the disease in 137 or 82% within a period of fourteen months. Herman⁴⁸ makes the statement that at least 50% of cases of tuberculous epididymitis are bilateral and that 25 to 75% become bilateral within one year.

There appears to be general agreement and the writer's series confirms that the tuberculous affection of one epididymis is followed in a majority by the onset of the disease on the hitherto healthy side. The spread of the disease to the second side appears to be an early feature in most cases but may occur at any time up to a period of nine years. While these facts have been fully recognised in the average text-book of surgery, whether or not their proper value has been recognised will be discussed in a future chapter.

(b) Classification of tuberculous epididymitis.

General.

In this section the writer has attempted a classification of the various genital lesions in their age groups at which the epididymitis started. Most workers on this

subject do not classify the genital lesion apart from acute and chronic types. Miller and Lustock,²⁷ however, gave their own classification as catarrhal, ulcerative and fibroid. In the catarrhal type, according to these two workers there is a predominating evidence of tissue breakdown. The lesion is usually soft and fluctuating and the masses are, as a rule, comparatively large. There is no evidence of sinus formation although it may be imminent and the presence of a hydrocele, which they regard as an allergic effusion places a case in this group. The ulcerative type is one with sinuses draining while the fibroid type is characterised by the amount of fibrosis or calcification.

In the present series, the writer has not used the above classification of Miller and Lustock, as he is of the opinion that the catarrhal and ulcerative types merge without any obvious line of demarcation. There does not appear to him to be any difference in type between a lesion in which a sinus is imminent and one in which there is a sinus discharging, as both show a progressive lesion which differs greatly from the generally accepted acute form of epididymitis described by Sjöstrand,⁵⁰ Walker and Hawes,²² Young and Davis,⁵³ Barney³⁴ and others. In consequence, the writer has used the terms acute, subacute and chronic

as a classification of the various types of epididymitis. The acute type is well defined and is described in detail in a later chapter. Most writers on this subject accept the chronic or fibroid type of tuberculous epididymitis as that in which there is some enlargement of the epididymis characterised by a degree of fibrosis and a relative absence of symptoms, which may not be discovered until there is a complete routine medical examination because of some other tuberculous condition. For cases between these two groups, acute and chronic, the term subacute has been used. These cases all show a progressive lesion with a varying amount of caseation and, in many, subsequent sinus formation. Cases in this group include those in which the term fibro-caseous has been used to describe the condition found at operation. In later chapters the symptomatology of the various types of epididymitis will be discussed.

Reference to the section headed "Extra-genital tuberculous lesions" Chapter 3 (c) will show that, in the present series, in 88.32% of all the cases of epididymitis at least one other tuberculous lesion was present. As in the case of the genital lesion the writer has attempted to group the extra-genital tuberculous lesion or lesions according to their activity. Irrespective of the site of the associated lesion it has been classified as active or inactive, a third

group being added where no other tuberculous lesion was found. An active tuberculous lesion was taken as one in which the tuberculous process was spreading or causing general symptoms which necessitated hospital treatment. The inactive lesion was considered one which did not give rise to any symptoms, one which was localised and in many cases presented its causal tubercle bacilli enclosed in a capsule of fibrosis or calcification. The second type of lesion did not require any treatment in hospital.

Two tables have been made, one to show the actual numbers and percentage of each type of epididymitis in the various age groups. The second table shows the state of the associated tuberculous lesions of these cases at approximately the same time. The age group has been chosen as the one during which the epididymitis first made its appearance.

Reference to the tables marked 5 and 6 will show the numbers of cases in each group. The total number of cases used in this section is 384. The other 18 case records were considered unsuitable, owing to some patients having had a genital operation prior to admission to this hospital thereby making the records incomplete.

TABLE NO. 5/

TABLE NO. 5

Number of Cases of Epididymitis in each Age Group at time of Onset.
Age Groups expressed in Years.

Type of Epididymal Lesion	-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65
Acute				4	6	8	4	1	1	1			
Subacute	12	4	9	35	50	52	35	20	11	5	5	3	1
Chronic			2	7	14	12	9	13	23	12	11	9	5
Total No.	12	4	11	46	70	72	48	34	35	16	16	12	6

TABLE NO. 6
State of Extra-genital Tuberculous Lesion at same time.

State of other tuberculous lesion	6	3	8	37	50	59	40	28	25	14	12	9	4
Active							4	2	8	3	3	2	2
Inactive	6	1	3	5	12	7	4	4	2	1	1	1	1
No. other lesion	6	3	8	37	50	59	40	28	25	14	12	9	4

The acute form of tuberculous epididymitis will be dealt with in a future chapter and the percentage age incidence may be obtained there. The number of cases in the other two groups can be seen by reference to table number 5 with the percentage in each group in table number 5A. Altogether there are 359 cases in the subacute and chronic groups, 342 or 63% of the subacute variety and 117 or 30.47% of the chronic type.

A study of the number of cases of subacute epididymitis shows that all cases of epididymitis, 100%, occurring in the first two age groups up to 10 years were of this type. From the age of 10 years to 40 years, the number of cases remains high but except for a slight rise after the age group ending at 25 years, the trend shows a gradual decline and at 40 years the percentage is just under 60. After the age of 40 years there is a marked fall in the number of cases of the subacute variety and for the first time the number in this type is far below the number of chronic cases of epididymitis in the same age group. The fall is continued with each successive group until the last one where the number is as low as 16.67%.

The chronic variety on the other hand, does not appear until the third age group between 11 and 15 years and there it is only 18.18% of the total number in that group. Up to the age group ending at 35 years the number of chronic

cases appears to be fairly constant at just under 20% but afterwards there is a sharp increase uninterrupted until the last age group where 83.33% of all cases were of a chronic type.

It can be seen therefore, that genital tuberculosis developing before the age of 40 years, tends to be of a sub-acute variety, while cases occurring after 40 years usually follow a chronic course.

Consideration of table number 6 and table number 6A shows the state of the extra-genital tuberculous lesion if present. Apart from the first age group up to 5 years and the last group between 61 and 65 years, over 70% of the cases developing a genital lesion have active tuberculosis elsewhere in the body. The number of patients developing a genital lesion with other inactive tuberculous lesions remains low throughout all age groups but a slight rise is noticeable from the age of 40 years onwards. The percentage number of patients who develop tuberculous epididymitis where no other tuberculous lesion has been found remains low from the age of 15 years onwards, ranging from 11% between 16 and 20 years and 17% between 21 and 25 years, with a gradual fall to the last age group where no cases occur in this category. The apparently high percentage of cases in the first three age groups may be explained by the small number of cases in each group, causing a possible statistical error.

TABLE NO. 7

Subacute Epididymitis with state of Extra-genital Tuberculous lesion
(expressed in percentage)

Age Groups	-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65
Active	50.0	75.0	66.67	71.14	74.0	76.92	82.86	80.0	81.82	100.0	60.0	66.67	100.0
Inactive	-	-	-	8.57	8.0	11.54	5.71	10.0	9.09	-	20.0	33.33	-
No other lesion	50.0	25.0	33.33	14.29	18.0	11.54	11.43	10.0	9.09	-	20.0	-	-

TABLE NO. 7A

Chronic Epididymitis with state of Extra-genital Tuberculous Lesion.

Active			100.0	85.71	50.0	91.67	77.78	84.62	65.22	66.67	81.82	77.78	60.0
Inactive			-	14.28	28.58	-	22.22	-	30.43	25.0	18.18	11.11	40.0
No other lesion			-	-	21.43	8.33	-	15.38	4.34	8.33	-	11.11	-

TABLE NO. 7B

Acute Epididymitis with state of Extra-genital Tuberculous Lesion.

All acute genital lesions were found to have active tuberculous lesions elsewhere in the body.

Tables number 7 and 7A demonstrate the percentage number of cases of subacute and chronic epididymitis in each age group, with the state of the other tuberculous lesion, if present. The results found confirm the impression gained from tables number 5 and 6 that subacute and chronic tuberculous epididymitis in most cases, occur in patients with active tuberculosis elsewhere, and that the number of genital lesions developing in patients with inactive extra-genital tuberculosis is small. The acute form of tuberculous epididymitis is considered elsewhere but it can again be repeated that all patients with acute genital lesions were found to have active tuberculous lesions elsewhere in the body (Table 7B).

(1) Subacute and chronic epididymitis.

The well recognised fact that the average medical or surgical condition is rarely seen before it is already well established makes a description of the onset of such a condition a matter of considerable difficulty particularly in its time relationships. In tuberculosis, notably among its pulmonary forms, the writer has found from some years' experience, that disease may be advanced or at least well established before a patient decides to ask medical advice, the reason being in most cases, that the symptoms have not been sufficiently outstanding to have caused mental or physical

upset. In other cases the disease may have arisen and progressed so insidiously that the patient was unaware of the fact that all was not well within him; probably he had forgotten what it was like to feel really well.

Genital tuberculosis, on the other hand, as shall be seen later, may, at its onset have caused transient or slight upset, in its progress few if any symptoms, but the result of the diseased process on the patient differs greatly from that in the phthisical subject. It is beyond dispute that any visible or palpable abnormality of the genitalia may occasion considerable anxiety and often impels a man to attend for medical treatment earlier than he might otherwise have done. Howard,²⁹ writing on the subject of male genital tuberculosis, is of the opinion that the slightest swelling or abnormality of these important organs is generally sufficient to bring the patients to hospital, while Spitzer⁸¹ believes that patients will suffer many urinary symptoms without complaint but will promptly present themselves when any visible or palpable deformity of the genital organs appears.

The present writer feels that a detailed investigation of 402 case records, less some exceptions which will be described later, with personal contact with many of these patients, places him in the fortunate position of being able

to write with some authority on the start, the early signs, symptoms and course of tuberculous epididymitis. Against this is the fact that many of the patients were examined by the writer and his colleagues after admission to hospital, when a diagnosis of genital tuberculosis had been made at a prior date. In that way, often the real motive behind the patient's visit to a doctor may have been hidden from the writer, but in other cases, it was given spontaneously when complete confidence had been obtained.

In an attempt to offset such difficulties as have been mentioned, the writer proposes to examine the records in detail under two groups. In the first group are these patients who were admitted to hospital with the genital lesion already established, while the second one comprises those who developed epididymitis in hospital under medical supervision. To a certain extent, one group acts as a check to the other, although the information gained from each does not follow the same lines. Any case record, where there was any doubt as to the duration of the local illness, led to its being discarded and many patients were found who were unable to give a satisfactory account of their illness. Others were found who were unaware of the genital lesion and to these have been added a further few who were too young to give any assistance in tracing a history of their lesion. Additionally, all patients were excluded from

this section who had undergone an operation for genital tuberculosis prior to their admission to Robroyston Hospital.

Group 1 - Patients admitted with tuberculous epididymitis.

The records used in this section are these of patients admitted to hospital with an established tuberculous epididymitis, whether that or some other condition occasioned their admission. Each diseased epididymis, in all 373, is taken as a single entity and the writer attempts to correlate the signs of the disease locally with its duration in months.

The time interval of one month is used for the first two years, three monthly intervals for the third year, six monthly intervals for the fourth year, and thereafter yearly intervals up to the eighth year. These time intervals were chosen because it was found that patients were definite in their replies to questions regarding the duration of their illness, only up to a certain time limit and in this case it was found that, where disease had existed for more than two years, a certain vagueness became evident in their answers and consequently it was found impossible to place the duration into a single month.

TABLE NO. 8/

TABLE NO. 8

Cases admitted with epididymitis.

Time in months

Local Lesion	1	2	3	4	5	6	7	8	9	10	11	12	15	18	24	36	48	72	84	96	Total	
E																						
Major	5																					
Minor	28	5																				
Whole	25	25	15	3	6	2	1					2			4	3	2			2	128	
E+T		2	2	1	1	5				2												13
E+C	5	9	5	8	1	9	3					4		1	4		1					50
E+F	8	9	8	3		5	1					1			4	1			1			41
E+C+F		2	10	3	3	5	1		2			2	1			1						30
E+T+F	1	2	1		3	2		1	1	1	1	1										14
E+T+C	2	8	4		5	5	1					1		1	1					1		29
E+C+T+F	3	12	12	6	2	12	2		1	2		3	2	1	6	1	2	1				68

E = Epididymitis
 = Globus Major
 Minor = Globus Minor

T = Testis

C = Vas deferens

F = Fistula

In table Number 8 the investigator has listed the various lesions found with the duration of the illness as stated by the patient. The writer has used symbols to represent the organs affected as, in many cases, the tuberculous process had spread to the structures adjacent to the epididymis. The symbol E is used to represent the epididymis, T the testis, C the vas deferens, and F a scrotal fistula. By adding some or all of these symbols, all types of lesion met with are represented by a simple formula.

Disease confined to epididymis (E).

In the first group (E) where disease is confined to the epididymis, there are 128 cases or 34.32% of the total number. Fifty-eight of the 128 cases, 45.31%, are present in the first group ending at one month. Considering the 58 cases in greater detail, the writer finds that the whole epididymis was involved 25 times, 43.1%, the globus major alone 5 times, 8.62%, and the globus minor as the only part diseased 28 times, 48.28%.

The second month group is made up of 30 diseased epididymes, 25 of which, 83.33%, showed disease throughout the whole organ, while in the remaining 5 cases, only the globus minor was involved. No case was found in this group showing disease of the globus major without involvement of the body and globus minor of the epididymis. Fifteen cases

are seen in the third section where the duration of the illness was between two and three months and in all these cases, the whole epididymis was tuberculous. Thereafter the number of wholly tuberculous epididymes in each time interval can be seen by reference to table number 8 .

In the above record, where disease is confined to the epididymis, one outstanding feature is the large number occurring in the groups from the first to the seventh month, while from that time until two years there is a blank period, except for two instances occurring at one year. Thereafter it is seen that in several patients the epididymis had been diseased for two, three, four or eight years. It may be concluded that when the epididymis is the only part involved by a tuberculous process, in most cases the duration of the disease will be less than eight months but that tuberculous epididymitis may persist for a period of eight years without the tuberculous process spreading to the surrounding structures. In the present investigation, 115 or 89.84% of cases with epididymitis had a duration of eight months or less. Another point which merits attention, is the high incidence of patients in whom the disease was localised to the globus minor as compared to the incidence of disease of the globus major. No fewer than 33 out of 88 cases, 37.5%, in the first two monthly groups are seen in

which there was no disease apart from that in the globus minor, while the globus major alone was affected in only five instances or 5.68%. These findings agree with the statements made by Barney,³⁴ Young,⁸⁶ K. M. Walker,⁵⁶ George Walker,⁸⁷ Webb-Johnson,⁵⁹ Schoonover,⁸⁸ McCrea,³⁷ Gibson,⁵⁸ Robinson⁴⁶ and Lowlsey and Kirwin,⁴⁰ all of whom assert that invariably tuberculosis of the epididymis begins in the globus minor. Ormond and Myers³² state that when the disease spreads by the lymphatic system the globus minor is involved first but when there is a blood spread the globus major is affected first. That viewpoint receives support from Latham⁸⁹ who reported on epididymitis complicating septic meningitis where the globus major was the first part involved. Of the cases investigated by Latham, organisms were obtained from the blood in 70%. Rolnick⁹⁰ in his study of the mechanism of epididymitis asserts that disease which spreads by the lumen of the vas deferens is always held up at the tail of the epididymis and that disease of the body and globus major represents a spread by peritubular extension from the globus minor. Cooper⁹¹ found it impossible to inject chemicals along the vas deferens past the tail of the epididymis due, in his opinion, to some valvular arrangement between the tail and body of the epididymis.

Disease Involving Epididymis and Testis (E+T).

The second type of lesion under consideration is one in which the disease is present in the epididymis and testis. Few cases occur in the present series and out of the total number examined only 13 such instances, 3.49%, were found. In 11 or 84.62% of that number the disease had been present for less than seven months, the remaining two being of ten months' duration.

The noteworthy feature in this group is the absence of cases with the disease confined to the epididymis and testis in the later time intervals, showing that either, tuberculosis which involves these structures does not remain localised for any length of time or, that patients suffering from disease of these organs do not remain out of hospital for any length of time.

Disease Involving Epididymis and Vas Deferens (E+C).

Where the epididymis and the vas deferens are the structures involved by the tuberculous process, the writer finds 50 cases or 13.4% of the total number. The time limits in this group vary, but again, the great majority of cases occur in the early time intervals, as no fewer than 40 or 80% had a duration of less than eight months. The remaining ten patients had had their genital disease for varying intervals, four for one year, one for eighteen months,

four for two years and one for four years.

Disease of the Epididymis with a Scrotal Fistula (E+F)

Forty-one instances, 10.99%, of tuberculous epididymitis with fistula formation are present in this group. A notable feature in this section is the relatively high percentage of cases of short duration. More than half the number of patients had had the genital disease for a period of three months or less, as 25 cases or 60.98% are present in the first three time intervals ending at three months. Thereafter, the writer finds three cases of diseased epididymes with a scrotal fistula of four months, five of six months and one of seven months' duration. After the seventh month group there is an absence of cases up to two years, except for one occurring in the one year section. After four instances at two years, there are other two cases, in one of which the disease had been present for three years and in the other seven years.

The early formation of a fistula in association with tuberculous epididymitis was noted by Barney³⁴ who stated that 50% occurred within six months and 71% within one year.

Disease Involving Epididymis and Vas Deferens with a Scrotal Fistula (E+C+F)

The next type of case considered by the writer was one in which the tuberculous process involved the epididymis and

vas deferens with an associated scrotal sinus. In this section there are thirty cases, 24 or 80% having a duration of less than eight months and in only one person had the lesion been present for a period exceeding one year and three months, the duration in that case being three years.

Disease involving the Epididymis and Testis with a Scrotal Fistula (E+t+F).

The writer found the condition of tuberculous epididymo-orchitis with a scrotal fistula was present in 14 or 3.75% of patients. In each case the duration of the disease was not longer than one year, the lesions being fairly evenly distributed between the twelve month groups.

Disease involving the Epididymis, testis and Vas Deferens (E+T+C).

Disease of the epididymis, testis and vas deferens was found in twenty-nine instances, the duration in all, with four exceptions, being less than eight months. The four exceptions occurred at one year, one and a half years, two years and eight years respectively.

Disease involving the Epididymis, Testis and Vas Deferens, with a Scrotal Sinus, (E+T+C+F)

The last group and the largest one, apart from the cases of uncomplicated epididymitis, is made up of 68 instances, 18.5% of the total number. Again the age of the lesions in the majority of cases is under eight months, no fewer than

72.06% being in that category. Thereafter the duration of the lesions in the remaining patients extends from nine months to six years.

Summary and Conclusions from Table Number 8.

From the survey of table number 8 the investigator draws certain conclusions.

1. Men with a genital abnormality tend to seek medical advice at an early date. That opinion, based on experience, is supported by this study of cases admitted with an established genital lesion, as no fewer than 55.76% of all the cases under review were in hospital for treatment within three months and 79.89% within six months of the onset of the disease.

That view, as has already been mentioned, receives added support from the statements of Spitzer⁸¹ and Howard.²⁹

2. The results support the statements of Barney,³⁴ Young,⁸⁶ K. M. Walker,⁵⁶ George Walker,⁸⁷ Webb-Johnson,⁵⁹ Schoonover,⁸⁸ McCrea,³⁷ Gibson,⁵⁸ Robinson,⁴⁶ Lowsley and Kirwin,⁴⁰ Nitch,⁹² Bailey,³⁵ Herman,⁴⁸ Dillon⁹³ and Martin,⁴⁵ that tuberculous epididymitis usually starts in the globus minor.

In the above series, 33 out of 88 cases, 37.5% in the first two monthly groups showed disease localised to the globus minor.

3. Few instances are present and therefore the writer considers it to be rare, of tuberculous disease starting in the globus major. Only five instances or 5.68% were found in the same two groups in which the globus major was the only part involved.

4. It is uncommon for the tuberculous process to remain localised to the epididymis for a period of over seven months as there were only two instances between the groups of seven months and two years. If the disease does remain localised it may persist for many years as four cases of uncomplicated epididymitis had been present for two years, three for three years, two for four years and two for eight years.
5. If the testis becomes involved by a spread of the disease from the epididymis, other complications are likely. In the above series only 13 cases, 3.49%, with disease localised to the testis and epididymis were found and in each case the duration was less than eleven months.
6. Obvious involvement of the vas deferens, appears to be an early complication of tuberculous epididymitis. The total number of cases with disease of the vas deferens in the above series was 177, and 138 or 77.96% had been present for a period of under eight months.
7. Fistula formation when it occurred was an early feature in the cases under consideration. Of the total number of cases with a fistula, the fistula appeared within six months in 73.2% and within one year in 86.27%. These figures are considerably higher than those of Barney³⁴ who stated that 50% of fistulae occur within six months and 71% within one year of the onset of the epididymitis.
8. Apart from uncomplicated epididymitis, the commonest lesion was one which involved the epididymis, testis, and vas deferens with a scrotal fistula. The difference between that type of lesion and the type with the same structures involved without a scrotal fistula (E+T+C+F and E+T+C) is so great that the writer concludes that where the disease involves the epididymis, testis and vas deferens, it is to be expected that a fistula will arise in most cases, 70% of the present series being so associated.
9. Tuberculosis of the epididymis and testis with fistula formation is uncommon without involvement of the vas deferens, as only 17.07% of cases with that type of lesion were unassociated with obvious disease of the vas deferens.

Percentage monthly incidence of various genital lesions from Table No. 8

Local Lesion	1	2	3	4	5	6	7	8	9	10	11	12	15	18	24	36	48	72	84	96	
E.	75. 32	40. 54	26. 32	12. 50	28. 57	4. 44	11. 11					14. 29			21. 05	50. 40					
E+T		2. 70	3. 51	4. 17	4. 76	11. 11			40.												
E+C	6. 49	12. 16	8. 77	33. 33	4. 76	20. 76	33. 33					28. 57		33. 33	21. 05		20.				
E+F	10. 40	12. 16	14. 04	12. 5		11. 11	11. 11					7. 14			21. 05	16. 67			100		
E+C+F		2. 70	17. 54	12. 5	14. 29	11. 11	11. 11		50			14. 29	33. 33			16. 67					
E+T+F	1. 30	2. 70	1. 75		14. 29	4. 44		100	25	20	100	7									
E+T+C	2. 60	10. 81	7. 02		23. 81	11. 11	11. 11					7. 14		33. 33	5. 26						33. 33
E+T+C+F	3. 89	16. 22	21. 05	25. 05	9. 52	26. 67	22. 22		25	40		21. 43	66. 67	33. 33	31. 58	16. 67	40.	100			

TABLE NO. 9A

Three-monthly percentage incidence during the first year

Local Lesion	1 - 3	4 - 6	7 - 9	10 - 12
E.	49.52	12.22	7.14	10.00
E+T	1.92	7.78		10.00
E+C	9.13	20.00	21.43	20.00
E+F	12.02	8.89	7.14	5.00
E+C+F	5.77	12.22	21.43	10.00
E+T+F	1.92	5.56	14.29	15.00
E+T+C	6.73	11.11	7.14	5.00
E+T+C+F	12.98	22.22	21.43	25.00

(Group 2) Patients developing tuberculous epididymitis in Hospital.

Under this heading the investigator found ninety-two affected epididymes in seventy patients, 48 of whom had developed unilateral tuberculous epididymitis and 22 bilateral epididymitis while in hospital. Of the 48 unilateral cases, 19 had been admitted previously with involvement of the other side. All patients in this group were found to have at least one extra-genital tuberculous lesion.

Pain was the first symptom of the local lesion in 24, or 26.09% of the 92 epididymes, while swelling was the first indication in 52, or 56.52%, and in the remaining 16, or 17.39% pain and swelling appeared simultaneously.

The development of the local genital lesion has been worked out by the writer under similar headings to those used in the investigation of cases admitted with the condition already established. In this case, however, the time limit has been taken for maximal development of the lesion. In view of the fact, that in many, operation had been carried out early in the disease, that several patients elected to leave hospital, while others died before any local spread could be detected, the writer does not intend that the table which follows should be regarded as an exposition of the complete progress of these 92 epididymes. Rather, it should be taken as an indication of how the disease of some

of these epididymes developed and spread within a period of time limited by operation, dismissal or death, and how in others, where active treatment was not carried out, the disease remained localised for some considerable time.

TABLE NO. 10

Time in Months for Development of Maximal Superficial genital lesion in 92 cases.

Local Lesion	1	2	3	4	5	6	7	8	9	10	12	18	24
E.	21	6	3	3	2	1			1	3	7	1	6
E+T.		2											
E+C		3	1			1	1	1					
E+F	3	1	3	1			1						
E+C+F	1	1		1		1		1					
E+T+F				1									
E+T+C		3		1									
E+T+C+F	1	4	3	1			1						

TABLE NO. 10A/

TABLE NO. 10A

Percentage Monthly incidence for development of maximal genital lesion in 92 cases.

Local Lesion	1	2	3	4	5	6	7	8	9	10	12	18	24
E.	80. 77	30. 00	30. 00	37. 5	100. 00	33. 33			100. 00	100. 00	100. 00	100. 00	100. 00
E+T		10. 00											
E+C		15. 00	10. 00			33. 33	33. 33	50. 00					
E+F	11. 54	5. 00	30. 00	12. 50			33. 33						
E+C+F	3. 85	5. 00		12. 50		33. 33		50. 00					
E+T+F				12. 50									
E+T+C		15. 00		12. 50									
E+T+C+F	3. 85	20. 00	30. 00	12. 50			33. 33						

E = epididymis. T = testis. C = vas deferens. F = fistula

Only those months have been chosen which are necessary to show the duration of the disease.

In the first group, it is seen that there were 54 cases of disease confined to the epididymis (E), 21 of which lasted for one month before operation, dismissal or death. Of that number, it was definitely recorded in 13 instances that disease was confined to the globus minor, while no case was found in which the globus major was the only part involved. Six tuberculous epididymes were found which persisted for a period of two months and in every case the

whole epididymis was affected. The number of instances lasting for each of the following months can be seen by reference to table number 10. Between one and two years on fourteen occasions tuberculous disease remained localised to the epididymis.

Where the testis alone was involved with the epididymis (E+T) there are only two instances, both of two months' duration. The combination of disease of the epididymis and vas deferens (E+C) occurred only seven times, all having been present for a period of eight months or less. Fistula formation associated with epididymitis (E+F) is present nine times during a period of seven months or less, while five instances of disease of the epididymis and the vas deferens with a fistula (E+C+F) all developed within eight months. On only one occasion was there disease of the epididymis and the testis with the addition of a fistula (E+T+F) and that took four months to develop; while involvement of the epididymis, testis and vas deferens (E+T+C) occurred four times under five months. The last type, disease of the epididymis, testis and vas deferens with fistula formation (E+T+C+F), the largest group apart from the group with epididymitis as the sole lesion, occurred ten times within an eight months' period.

The investigator draws several conclusions from the

above results, all supporting those made at the end of the previous table of cases admitted with tuberculous epididymitis.

1. Tuberculous epididymitis usually starts in the globus minor. In the present series in 62% of the epididymes involved by tuberculosis for a period of less than one month, the disease was confined to the globus minor. No case was found in which the globus major was the only part involved.
2. Tuberculous disease may apparently remain localised to the epididymis for a considerable time. From Table number 10 it can be seen that in 14 instances the tuberculous process remained localised to the epididymis for a period between one and two years.
3. If the testis becomes involved from the epididymis other complications are likely, as only two instances of this combination of disease are found. Fifteen instances are found in which the disease of the epididymis and the testis is associated with disease of at least one other structure.
4. Again, it would appear that obvious involvement of the vas deferens is an early event, as it was present within a period of eight months in all cases under review in this section.
5. In these cases, it is noticed that fistula formation is an early event, as the 25 fistulae had all formed before the end of the eighth month.

(2) Acute Epididymitis.

Reference to Chapter 4 headed "The Diagnostic Standards of Tuberculous Epididymitis" shows that one of the outstanding features of tuberculous epididymitis in the opinion of all writers on this subject, is the chronicity with which the disease develops. Young⁵³ however, stresses the fact

that a tuberculous infection of the epididymis may have an acute onset, but that unlike gonococcal epididymitis the epididymis tends to remain enlarged and to become nodular and firm. Sjöstrand⁵⁰ collected 509 cases of tuberculous epididymo-orchitis from various sources and found that 68 or 13.36% of these commenced acutely. According to Sjöstrand, the first person to describe the acute form of this disease was Duplay who, in 1860 wrote an essay on, "Tuberculisation galopante du testicule" in which he described two cases. In 152 cases of tuberculous epididymitis, Keyes⁵¹ found that 34 or 22.37% commenced acutely, while Horwitz⁶⁹ in his series of 96 cases calculated an incidence of 4.17% presenting the acute form. Cope⁹⁴ reported that he had examined two or three cases of acute epididymitis due to tuberculous infection. A review of all the available literature on this subject was made by Sjöstrand⁵⁰ and he concluded that 17% was the average figure for tuberculous epididymitis commencing acutely.

In the present series under review, where many of the patients were admitted to hospital with the genital lesion already established, reliance had to be placed on the patient's history. Nine patients gave a definite account of a sudden swelling in the scrotum associated with severe pain, while 16 patients developed acute epididymitis in

hospital under medical supervision. These 25 cases were later all found to have a tuberculous origin and represent 6.21% of the total cases under scrutiny. These patients whose history suggested an acute onset of the genital lesion before admission, on examination in hospital all showed a lesion which might well have commenced insidiously. Equally, among 13 of the 16 patients who developed acute epididymitis while in hospital, it was found, as will be described later, that the lesion rapidly subsided to a condition indistinguishable from the more common subacute epididymitis with a known insidious origin. The remaining three patients were submitted to a genital operation very soon after the epididymitis had commenced and so the disease was still in an acute phase.

The figure of 6.21% of cases with an acute onset of epididymal tuberculosis in the present series, taken in conjunction with Young's⁵³ statement and Sjöstrand's⁵⁰ figure of 17%, all show that genital tuberculosis commenced acutely sufficiently often to render the tubercle bacillus being considered a possible causative agent in those cases of acute epididymo-orchitis where the nature of the infection is not immediately apparent.

The age incidence of acute tuberculous epididymitis.

Sjöstrand⁵⁰ concluded from his series of 65 cases that the acute form of the disease affects males between 20 and 24 years in the main and that 50% of cases occur between the years 20 and 30. His series and the writer's results are compared in table number 11.

TABLE NO. 11

The age Incidence of acute tuberculous epididymitis
Sjöstrand's Series (65 cases)

Age Groups in Years	15-19	20-24	25-29	30-34	33-39	40-44	45-49	50-54	55-59	60-64	65-69
Number of Cases	4	22	10	5	12	5	2	1	1	1	2
Percentage	6	33	15	7	18	7	3	2	2	2	3

Present Series (25 cases)

Age Groups in Years	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70
Number of Cases	4	6	8	4	1	1	1				
Percentage	16	24	32	16	4	4	4				

The statement made by Sjöstrand that 50% of cases occur

between 20 and 30 years of age has support in the present series where 56% of the total occurred between the years 21 to 30 but contrary to his findings the greatest incidence for a single age group was found between 26 and 30 years. In both series the onset of acute tuberculous epididymo-orchitis is seen to occur at an early age, the great majority being present before the age of 40 years.

Aetiology.

In only one case out of the 25 under review was the condition attributed to any cause and in that case the blame was placed on injury. Sjöstrand states that injury was given as the cause of the genital swelling in 9 cases out of a total of 55 cases, overexertion in 6, influenza in 3, gonorrhoea in 2 and cold in one case. Walker and Hawes²² are of the opinion that trauma plays a part in the occurrence of acute tuberculous epididymitis but do not give any statistics on the subject.

Extra-genital Tuberculous Lesions.

Extra-genital tuberculous lesions were found in all twenty-five cases under review, the localisation of these lesions being shown in table number 12.

TABLE NO. 12

Extra-genital tuberculous lesions in 25 cases of acute tuberculous epididymitis

Lesions	Number of Cases	Lesions	Number of Cases
Renal	5	Pulmonary	4
Renal and Joint	2	Pulmonary and Bone	2
Renal, Pulmonary & Bone	1	Pulmonary, Bone & Joint	2
Renal, Bone and Joint	1	Pulmonary and Joint	2
Bone	2	Joint	2
Bone and Joint	1	Abdominal	1

Number of patients with one extra-genital lesion	14
Number of patients with two extra-genital lesions	7
Number of patients with three extra-genital lesions	4

Sjöstrand found extra-genital lesions in only 25% of his cases while Walker and Hawes stated that the acute genital lesion is invariably secondary to other tuberculous lesions. Eleven patients, 44% of the total under consideration, had more than one extra-genital tuberculous lesion, seven of these, 28%, having two lesions and 4 or 16% having three lesions. Five or 20% of the patients in this section died while undergoing treatment in hospital and table number 13 shows the interval between the onset of the epididymal lesion and death.

TABLE NO. 13/

TABLE NO. 13

Details of 5 Patients with Acute Epididymitis who died

Number	Extra-genital Lesions	Additional Conditions (if any) accelerating death	Interval between Onset of Epididymitis and death in years
1	Joint	Tuberculous Meningitis	3/12
2	Pulmonary and Joint	Tuberculous Laryngitis	4/12
3	Pulmonary and Spine		4/12
4	Spine and Joint with discharging sinuses	Amyloid disease	1
5	Spine with discharging sinuses	Amyloid disease	2

Four of the five deaths which occurred in hospital belonged to the group of patients with more than one extra-genital tuberculous lesion. The remaining patient who died had one extra-genital tuberculous lesion but developed tuberculous meningitis and epididymitis at the same time.

According to Walker and Hawes there are two types of acute tuberculous epididymitis. In one, the condition occurs during a generalised tuberculosis, from which death soon follows, while in the second type, the acute lesion becomes chronic and behaves as such. From the present series, three patients can be considered as belonging to

the first type described by Walker and Hawes, as, in these cases, the onset of the epididymal lesion was associated with a marked deterioration in the patient's condition and death followed within a period of four months in each case. The remaining two deaths occurred one and two years respectively after the onset of the epididymal lesion and in both, amyloid disease was considered the precipitating cause of death. The nineteen patients who did not die in hospital all developed a chronic epididymal lesion, and corresponded to the second type described by Walker and Hawes.

Diagnosis.

The diagnosis of an acute tuberculous epididymo-orchitis has been discussed in detail in Chapter 4. Sjöstrand lays stress on the maximal age incidence between 20 and 30 years, the presence of an associated prostatitis and seminal vesiculitis and the presence of an extra-genital tuberculous lesion.

The Local Lesion.

Twelve patients in the writer's group showed bilateral involvement of the epididymes but in only two of these was there simultaneous infection of both sides. In the remaining 10 cases, the acute epididymitis was secondary to a pre-existing chronic epididymitis on the other side in 4 patients, while in 6 patients the acute epididymitis was followed at

a later date by a chronic infection of the remaining epididymis. Walker and Hawes give a figure of 50% for bilateral involvement but Sjöstrand had only 6 out of 65 cases which showed infection of both epididymes, but in all six the patient had had disease of the other side for some time before the acute infection started.

All the cases under review were characterised by a sudden pain with local swelling and in two patients the pain radiated to the loin. Fever, vomiting, headache and skin redness were all present to a varying degree. Hydrocele was not a common feature as it was present in only two cases, in one of which there was a hydrocele on both sides. In 21 out of the 25 cases, the acute lesion settled down into a chronic one, the three exceptions being patients on whom an operation was carried out very soon after the onset of the acute epididymitis. A rectal examination was carried out in only 14 cases of the total but involvement of the prostate and seminal vesicles was found in 13 of these. Sjöstrand found the prostate and seminal vesicles to be involved in 66% of all his acute cases. Sinus formation was present in 10 cases, the sinus in each of these cases appearing very soon after the onset of the disease. The testis was involved by disease in 8 cases, in five of which orchidectomy was performed, the other three being unfit for operation.

An operation was carried out on twelve patients, fifteen epididymes being removed and, as previously mentioned, orchidectomy was found necessary five times. Of the thirteen patients who did not undergo any operation for the genital disease, one refused hospital treatment and decided to return home, another did not wish to undergo an operation and the remaining eleven patients were considered unfit generally for operative interference, the usual cause being multiple tuberculous lesions.

(c) Tuberculosis of the Testis.

Young⁵³ states that tuberculosis beginning in the testis is extremely rare and that he has never seen a case. In his opinion, it is practically always secondary to tuberculous epididymitis and occurs when the globus major is involved, spreading directly by the tubuli recti. In Young's series only 8.33% of cases of genital tuberculosis had involvement of the testis and he considers it a late complication of disease affecting the epididymis. Robinson,⁴⁶ Hunt,⁴⁷ Greenberger, Greenberger and Alexander,²⁶ Eisendarth and Rolnick,⁵ Herman⁴⁸ and Thomson-Walker,⁴⁴ all support Young's view that tuberculosis of the testis is secondary to disease of the epididymis and McCrea³⁷ supports him in the belief that the disease spreads to the testis from the

globus major.

Unlike Young, Barney³⁴ and the same writer in association with Colby,³¹ believe that testicular involvement is usually an early feature following tuberculous epididymitis although in some cases the testis appears to resist for a considerable time and in other cases it is never involved. In a series of 120 cases of genital tuberculosis, Barney³⁴ found 66 testes affected by the disease. Menville⁶¹ found 38.6% of 65 cases of genital tuberculosis with testicular involvement. The results found by several investigators are shown in table number 14.

TABLE NO. 14

Investigator	Number of Epididymitis Cases	Number with Testicular Involvement	Percentage with Testicular Involvement
Cunningham ²⁴	35	19	54.29
Sussig ⁹⁵	87		39.
Negley ²⁸ (Sanatorium)			8.
(General Hospital)			14.
McCrea ³⁷			30
Reinicke ⁹⁶			50
Marion ⁹⁷			10

Mark⁹⁸ states that primary testicular disease in the

genito-urinary tract is rare but, that it may occur he believes is proved by the experiment of George Walker who injected tubercle bacilli into the aortas of 28 rabbits and found testicular disease without any epididymal involvement in 2 rabbits. Mark criticises the word testicle as used by many writers as it does not show any differentiation between the testis and the epididymis. He cites a personal case where a testis and epididymis removed at operation were sent to a competent pathologist who twice reported that tuberculous disease was present in the testis with the epididymis normal. On the third examination serial sections of the epididymis showed a tuberculous lesion.

Eisenstaedt,⁹⁹ who investigated tuberculosis affecting the testis in a series of children, concluded that tuberculosis of the testis may be primary and solitary as far as the genito-urinary tract was concerned and that, when it occurred, the disease reached the testis via the blood stream and caused an acute spread involving the whole gland. In adults, Eisenstaedt believed the same condition did not occur as the testis was always involved by a spread of tuberculosis from a diseased epididymis. Barney,¹⁰⁰ investigating abscesses of the testicle concluded that the testis was protected from infection by its thick covering, the tunica albuginea, and also by its rich blood and lymphatic supply. He stated that

blood-borne organisms reached the epididymis and testis with equal frequency and freedom but the latter seemed to have a selective function. Most testicular infections, in his opinion, are haematogenous and abscess formation of the testis is rare without epididymal involvement.

The present writer has never seen a case of tuberculosis involving the testis without an accompanying lesion in the epididymis, and no record of such a case exists in Robroyston Hospital case reports. In the present series of 402 cases, all the patients had a tuberculous epididymitis but nineteen men had undergone a genital operation prior to admission to Robroyston Hospital and so the writer is not in a position to discuss the condition of these men with relation to testicular disease. Further reference will be made to this at the close of the present section.

Incidence and time of onset of testicular tuberculosis.

The total under review in this section is 383 men and of these the writer found that there was disease of the testis in 136 or 35.51%. Unlike the onset of a scrotal fistula, no help could be obtained from the patients with regard to the onset of the tuberculous disease in the testis. In a previous chapter, cases admitted to hospital with genital tuberculosis were considered and table number 15 shows at what time, in months, disease of the testis was present, but does not give the time of onset. The number

of testes involved by disease was 124, there being 373 diseased epididymes.

TABLE NO. 15

TIME AT WHICH TESTICULAR DISEASE WAS FOUND IN 124 CASES

Time in Months	1	2	3	4	5	6	7	8	9	10	11	12	18	24	36	48	60	96	
No. of Cases	6	24	19	7	11	24	3	1	2	5	1	5	4	7	1	2	1	1	
	39.52%																		
	73.39%																		
	87.1%																		

From table number 15 it can be seen that of the total number of cases admitted with tuberculosis of the epididymis and testis, the genital lesion had been present for three months or less in 39.52%, six months or less in 73.39% and one year or less in 87.1%.

The writer received more exact information from a study of the records of these men who developed their genital lesion in hospital under medical supervision. The number of patients was small there being only 16 patients with 17 diseased testes but the time of onset was definite and table number 16 shows the number of months which elapsed between the onset of the epididymitis and the onset of orchitis in these cases.

TABLE NO. 16/

TABLE NO. 16

Time, in months, between onset of Epididymitis and Orchitis
in 17 Cases

Time in months	1	2	3	4	5	6	7
No. of Cases	1	9	3	3			1
	5.88%						
		58.82%					
			76.47%				
				94.12%			
							100%

Table number 16 shows that in all the cases of tuberculosis involving the epididymis and testis, developing in hospital, the interval between the onset of the epididymitis and the onset of the orchitis was seven months or less. The interval was less than five months in 94.12% and less than four months in 76.47% in these cases. These results support the statements made by Barney³⁴ and Barney and Colby,³¹ that testicular involvement following tuberculous epididymitis is an early feature.

The extent of the testicular disease was very difficult to assess, but in those patients who were submitted to a genital operation, the type of operation performed and the findings at operation gave some indication of the progress and extent of the disease. Of the 17 testes which developed disease in hospital, 8 were examined at operation and in four of these the disease was found to be localised to the testis opposite the globus major. That localised disease

was removed by excision in each case and the viability of the testes was not impaired. Total orchidectomy was found to be necessary in the other four cases submitted to operation as the disease involved completely the mediastinum testis. Two other patients developed their genital disease not long before death and clinically the disease appeared massive in the testis and epididymis.

A partial orchidectomy was carried out 54 times in these patients who were admitted with the genital disease already established and a total orchidectomy was necessary 55 times. Fourteen men in this group died very soon after the onset of the testicular disease.

In both groups, the disease of the testis found at each operation, with four exceptions, showed a lesion which had spread from the epididymis. From his own experience, supported by the experience and opinion of his senior colleague, the writer found that when the globus minor and body of the epididymis were the parts involved, the tunica albuginea formed the wall of an abscess cavity which could be curetted and left macroscopically clear of tuberculous disease. When the globus minor alone was involved, a similar state of affairs was frequently found and was amenable to a similar attack. In some instances there was local involvement of the testis by obvious direct spread through the tunica

albuginea and such a lesion was treated by local resection of the testicular disease. When on the other hand, the testis was found to be diseased at that portion contiguous with the globus major and body of the epididymis, it was usually found that the involvement was local but for reasons of blood-supply and therefore viability, local resection was impossible and orchidectomy had to be carried out. The four exceptions showed discrete tubercles throughout the body of the testis, with a relatively similar condition in the epididymis with minimal caseation. In short, the condition could scarcely be otherwise described than as a military tuberculosis of the testis and epididymis and almost certainly was blood-borne.

(d) Tuberculosis of the vas deferens.

In the diagnosis of genital tuberculosis, Barney,³⁶ Kretschmer,⁵² and Gibson⁵⁸ mention beading or an increase in the thickness of the vas deferens as a point in favour of tuberculosis being the cause of the abnormality. Young⁵³ makes the statement that obvious involvement of the vas deferens may be minimal or absent in the early stages of genital tuberculosis, while K. M. Walker⁵⁶ demonstrated that a thickened vas deferens was not necessarily a diseased one, as the thickness, in his opinion, could be due to involvement

of the surrounding lymphatics causing perivascular inflammation.

G. Walker,⁸⁷ Robertson and Singer,³⁶ and Thomas and Kinsella,⁸² believe that tuberculous vasitis is due to an extension of the disease from the seminal vesicles, the prostate or the epididymis, and their belief receives support from the statements of McCrea,³⁷ Young,⁵³ Barney,³⁴ Lapeyre,¹⁰¹ K. M. Walker,⁵⁶ Herman⁴⁸ and Dillon,⁹³ who have reported cases of tuberculous epididymitis where the vas deferens was involved by disease in its proximal and distal thirds with the middle third free from disease.

Up to the present, the writer has been concerned with the superficial genitalia which excludes the vas deferens from the external abdominal ring to the seminal vesicles. From the data that has already been considered, he is in a position to demonstrate the interval between onset of the epididymal lesion and the onset of apparent vasitis in these cases which developed in hospital, and, in the men who were admitted with the genital lesion, the duration of that lesion. These two groups of patients excluded many whose histories with regard to time intervals were indefinite, and others who were too young to be of any assistance. A further few histories could not be assessed owing to operative treatment having been carried out prior to the patient's

admission to Robroyston Hospital. When the general incidence of involvement of the vas deferens by tuberculosis is desired the 402 patients can be used, with the exception of 19 men who received operative treatment for unilateral epididymitis prior to admission to Robroyston Hospital; when the time of onset is the information desired, a much smaller group of patients is available.

General incidence of vasitis in cases of tuberculous epididymitis.

Kretschmer⁵² reported disease of the vas deferens in 55 out of 63 cases of tuberculous epididymitis, a percentage of 87.3. The present writer found that there was disease of the vas deferens in 206 out of the 383 men with epididymitis, a percentage of 53.79. The number of diseased vasa deferentia was 257 and on 177 occasions a genital operation was undertaken with the following operative findings. The descriptions of the vasa deferentia refer to as great a length of the vas deferens as can be displayed with traction on the vas deferens at operation through an inguinal incision.

Lower third of vas deferens involved with beading present	156 times
Lower and middle thirds diseased	5 "
Upper and lower thirds of vas deferens, middle third clear	10 "
Whole vas deferens to the external abdominal ring diseased	<u>6</u> "
Total	<u>177</u>

On clinical examination alone, the remaining 80 vasa deferentia were reported to be thickened and beaded, but no case was reported in which there was any involvement above the scrotal neck.

Time of Onset of Tuberculous vasitis in Cases of Tuberculous epididymitis.

Tables number 17 and number 17A show the number of cases with involvement of the vas deferens in the various monthly groups, for 203 diseased vasa deferentia. In 177 instances, the vasitis was present when the patients were admitted to hospital but in 26 instances the vasitis developed in hospital under medical supervision.

TABLE NO. 17

Time of onset of vasitis in 26 tuberculous epididymes

Time in Months	1	2	3	4	5	6	7	8	9	10	11	12	15	18	24	36	48	72	96	
No. of Cases	2	11	4	3		2	2	2												
	76.92%																			
					100%															

TABLE NO. 17A

Duration of vasitis in 177 tuberculous epididymes

Time in Months	1	2	3	4	5	6	7	8	9	10	11	12	15	18	24	36	48	72	96	
No. of Cases	10	31	31	17	11	31	7		3	2	10		3	3	11	2	3	1	1	
	50.28%																			
					77.97															

The 26 diseased vasa deferentia in the patients who were under observation in hospital, table number 17, all developed within a period of 8 months from the onset of tuberculous epididymitis, 76.92% being present within four months. In these patients who were admitted to hospital with a genital lesion including tuberculous vasitis, the duration of the disease in 89 epididymes, 50.28%, was less than four months and in 138 epididymes, 77.97%, was less than eight months.

The writer has been unable to find any literature on the subject of the time of onset of tuberculous vasitis but from his own results he concludes, that when it does occur, it is usually an early feature of genital tuberculosis as, combining both groups of patients, he found that vasitis was present in 53.69% within four months from the start of the epididymitis and 80.78% within eight months from the start of disease in the epididymis. The results from the present series support the views of McCrea,³⁷ Young⁵³ and others, that the spread of the disease along the vas deferens probably occurs from the prostate, seminal vesicles and epididymis. Ten cases were present in this series which showed involvement of the proximal and distal thirds with the middle third of the vas deferens free from disease.

(e) Scrotal fistulae in association with tuberculous epididymitis.

Further consideration must be given to the subject of scrotal fistula formation because of its importance to the patient and because of its surgical obtrusiveness. From the investigation so far, the writer has found that 73.2% of fistulae developed within six months, and 86.27% within one year of the onset of the epididymitis in those patients admitted to hospital with the superficial genital lesion already established, while the 25 fistulae which occurred in the patients who developed their epididymal lesions in hospital all appeared within one year of the onset of the epididymitis, 88% of the total being present within six months. In these investigations the writer chose in the former group of patients, the condition of the genital lesion on admission with its duration in months, without stating the interval between the onset of the epididymitis and the appearance of the scrotal fistula, and in the latter group, the time for the maximal development of the local genital lesion was taken, so that in these cases with disease of the epididymis and involvement of the testis or vas deferens with a scrotal fistula, the exact time of onset of the fistula was not stated. In consequence, the writer examined

the records of all the patients with fistula formation to determine the general incidence, the age incidence, the state of the extra-genital tuberculous lesions if present, and the exact time of onset of the fistulae.

General incidence.

The number of patients with scrotal fistulae was 165 or 41.04% of the total under review. That incidence figure is probably influenced by the fact that operative treatment was an early feature in many of the 402 patients, in some of whom a fistula may have developed at a later date with purely conservative treatment. Kretschmer⁵² found 33 patients with scrotal fistulae, 54 patients without fistulae, and incomplete records in a further 7 patients, so that the incidence figure in his series of 87 was 37.93%. In a series of 152 testes involved by tuberculosis Keyes⁵¹ found an associated fistula in 76, while Barney³⁴ gave his figure for the incidence in 106 cases as 77.33%. Ormond and Meyers³² had 18 patients with scrotal fistulae out of a total of 51 patients suffering from tuberculous epididymitis, an incidence of 35.29%.

Age incidence.

In the 165 patients with fistulae all age groups are represented and table number 18 shows the number and percentage of the total in each age group, with the percentage

incidence of tuberculous epididymitis for the same age groups. The difference between the two percentage figures is also shown.

TABLE NO. 18

Age Groups in years	Number of cases with scrotal fistulae	Percentage incidence of scrotal fistulae	Percentage incidence of tuberculous epididymitis	Difference between incidence of fistulae and epididymitis
- 5	7	4.24	2.98	1.26
6 - 10	1	0.61	1.00	0.39
11 - 15	7	4.24	2.98	1.26
16 - 20	21	12.73	11.59	1.14
21 - 25	36	21.82	19.10	2.72
26 - 30	32	19.39	19.42	0.03
31 - 35	15	9.09	12.94	3.85
36 - 40	16	9.70	8.46	1.24
41 - 45	13	7.88	8.70	0.82
46 - 50	5	3.03	4.48	1.45
51 - 55	8	4.85	3.98	0.87
56 - 60	2	1.21	3.23	2.02
61 - 65	2	1.21	0.67	0.54

Barney³⁹ in a study of genital tuberculosis in male children concluded that scrotal fistulae were less common in children, although he found that in his series of 11

cases a fistula was present three times. The figures in the series under review show that the percentage incidence of scrotal fistulae in the early age groups up to the group ending at 25 years, was always higher than the percentage incidence of tuberculous epididymitis, with the exception of the group 6 to 10 years where the difference was less than unity. In all the age groups the percentage incidence of fistula formation and the percentage incidence of tuberculous epididymitis show little difference, the difference being less than one per cent in 5 groups, less than two per cent in 5 groups, less than three per cent in 2 groups, and in one the difference between the two being just under four per cent.

Extra-genital tuberculosis.

In 140 patients out of the total of 165, 84.85%, at least one other tuberculous lesion was present. The extra-genital lesion was clinically and radiologically considered to be in an active condition in 120 or 72.78% of the 165 patients, while the extra-genital lesion was regarded as quiescent in 20 or 12.12%. In the remaining 25 patients, 15.15% of the total, no extra-genital tuberculous lesion was found.

	<u>Number</u>	<u>Percentage</u>
Patients with fistula formation with an active extra-genital tuberculous lesion	120	72.73
Patients with fistula formation with an inactive extra-genital tuberculous lesion	20	12.12
Patients with fistula formation with no extra-genital tuberculous lesion	25	15.15

It is accepted that the presence of active tuberculous foci predisposes to the further spread of co-existent lesions, even in parts remote from that occupying the bulk of the attention. On such a basis it would be expected that sinus formation would be more common in those patients whose epididymitis was accompanied by another major and active lesion. That there is probably little such influence is seen when the figures for fistula formation already detailed, with the state of the extra-genital lesion if present are compared with the incidence of epididymitis, similar conditions prevailing in the extra-genital lesions. The comparison of the figures given in table number 19 shows that it is probably the state of the epididymitis which determines the presence or absence of scrotal fistulae.

TABLE NO. 19/

TABLE NO. 19

State of extra-genital tuberculous lesion (if present)	The percentage incidence of epididymitis cases with fistula formation	The percentage incidence of epididymitis cases
Active	72.73	76.82
Inactive	12.12	10.94
No other lesion	15.15	12.24

The percentage incidence of patients with extra-genital tuberculous lesions.

Group of Patients	Percentage
165 patients with fistula formation	84.85
402 patients with epididymitis	88.32

Time of onset of scrotal fistulae.

It was possible to ascertain the exact interval between the development of the epididymal lesion and the appearance of the fistula in all but 2 of the 178 diseased epididymes. Table number 20 shows the number of cases and the percentage of the total for the various monthly groups, only these months being chosen in which cases occurred.

TABLE NO. 20

Time of onset, in months, of scrotal fistulae in association with 176 tuberculous epididymes

Time of onset	1	2	3	4	5	6	7	8	9	10	12	16	18	24	27	36	72
Number of cases	50	30	32	20	7	10	7	4	3	1	3	1	2	3	1	1	1
Percentage	28.41	17.05	18.18	11.36	3.98	5.68	3.98	2.27	1.7	0.57	1.7	0.57	1.14	1.7	0.57	0.57	0.57
	48.45%																
	63.64%																
	75%																
	78.98%																
	84.66%																
	94.88%											5.11%					

Barney³⁴ in his investigation stated that sinus formation was an early feature and that 50% of fistulae develop before the end of six months and 71% within one year of the onset of the epididymal lesion, while Keyes found that 70% of 76 fistulae developed within one year. From table number 20 it can be seen that of the 176 tuberculous epididymes with scrotal fistulae, 84.66% of the fistulae developed within six months of the onset of the epididymitis and 94.88% within one year.

In the present investigation the figures for the incidence of fistulae within six months and one year of the onset

of the epididymal lesion are considerably higher than those of Barney³⁴ and Keyes⁵¹ but the writer draws attention to the confirmation in the fact that of 90 diseased epididymes developing in hospital there was an associated fistula in 25, all fistulae developing within one year and 88% within six months of the start of the epididymitis.

(f) Hydrocele and its relation to tuberculous epididymitis.

In text-books of general surgery, the condition of hydrocele is usually described under two headings. Illingworth⁶⁷ uses the terms, 'idiopathic' and symptomatic, while Romanis and Mitchener¹⁰² and Bailey¹⁰³ prefer the terminology, primary and secondary. These writers describe a hydrocele which is associated with acute or chronic epididymo-orchitis as a symptomatic or secondary one and they always include tuberculosis as a causal condition. Barney,³⁴ Young,⁵³ and Menville and Priestley,²⁰ in their articles on genital tuberculosis mention the condition of hydrocele as one which is commonly associated with tuberculous epididymitis and they suggest aspiration of its contents with a view to cultural diagnosis. Young adds, that if the hydrocele is at all marked it may prevent palpation of the testis, but the globus minor and body of the epididymis however, will always be found outside the sac since these

areas are not surrounded by the tunica vaginalis. The globus major, which lies within the tunica vaginalis, if only slightly enlarged may be concealed by a hydrocele but if large, it is usually palpable outside the sac.

Sjöstrand,⁵⁰ and Eisendarth and Rolnick,⁵ include the condition of hydrocele as one of the signs of genital tuberculosis, while Robinson,⁴⁶ White and Martin,¹⁰⁴ Herman,⁴⁸ and Lowsley and Kirwin,⁴⁰ maintain that the two conditions are commonly associated. These writers do not give any findings for the incidence of hydrocele in genital tuberculosis. Kretschmer⁵² found 18 out of 94 cases with a hydrocele, an incidence 19.15%. Hammond⁶⁴ calculated his incidence figure at just under 20% while Keyes⁵¹ found a hydrocele 30 times in his series of 100 patients. Howard,²⁹ on the other hand, found it only 3 times in 158 patients.

In the present series of 383 patients, the remaining 19 patients having received their genital operation prior to their admission to Robroyston Hospital, the writer found that there was a unilateral hydrocele in 42 patients and bilateral hydrocele in 2 patients, making a total of 44 patients, or 11.49% of the total in this section. The condition was found at operation in 29 instances, while in two patients the hydrocele was associated with acute tuberculous epididymitis, in one of whom there was a hydrocele present on both sides.

The ages of the patients with tuberculous epididymitis and hydrocele, varied from 3 years to 53 years, one instance occurring in a child of 3 years, 36 instances in patients between the years of 20 and 40, and seven instances in men over 40 years.

With his own incidence figure of hydrocele in cases of tuberculous epididymitis as 11.49% and with the knowledge that the incidences found by Kretschmer,⁵² Hammond⁶⁴ and Keyes,⁵¹ were 19.15%, 20% and 30% respectively, the writer views the appearance of a hydrocele in a patient in Robroyston Hospital with marked suspicion. Any patient who presents himself at the Corporation dispensary with which the writer is associated, with evidence of a hydrocele, and giving a history of past or present tuberculous infection, is invariably recommended for admission to Robroyston Sanatorium, rather than a general hospital; sufficiently often has the hydrocele been found to have a tuberculous origin to justify the continuance of this procedure.

(g) Involvement of Inguinal Glands in cases of tuberculous epididymitis.

Many of the patients under consideration, showed on examination, the presence of enlarged inguinal glands, but that condition is sufficiently common in cases of tuberculosis.

especially when associated with enlargement of other lymph glands, that the writer cannot assess the frequency with which it is associated with tuberculous epididymitis. Furthermore, the writer has been unable to find any reference in the extensive literature on the subject of genital tuberculosis, which deals with the occurrence of enlarged inguinal glands. As in tumours of the testis, the related lymph glands are neither visible nor palpable.

In 31 patients in the present series, the inguinal glands were sufficiently large and isolated that some mention must be made of that complication. Seven of the patients were found to have bilateral inguinal adenitis while 24 had unilateral adenitis, making a total of 38 inguinal regions involved. On 36 occasions the enlarged lymph glands were associated and occurred soon after the formation of a fistula on the same side. In three instances, the patients were admitted to hospital because of a large tender fluctuant swelling or swellings in one inguinal region. One of these cases was associated with a fistula from an involved epididymis, the other two being considered as cases of tuberculous hip joint disease, because of pain and limitation of movement at the joint. Investigation of both these cases over a period of not less than a year, failed to show any disease of the spine or hip, the only

lesions found being epididymitis, vasitis, vesiculitis, and prostatitis on the same side, conditions which had been present on admission. These two men were found to be suffering from tuberculous epididymitis and no other cause of the enlarged inguinal glands could be found, and it was assumed that the scrotum had been involved without any obvious fistula formation. No investigation was undertaken to prove the tuberculous pathology of these glands and where fistula formation was present it may be presumed that the adenitis was the result of secondary infection.

CHAPTER 6 - PELVIC COINCIDENTAL LESIONS

Now that the genitalia superficial to the external abdominal ring have been studied in detail, it is appropriate that the attention should now be focussed on the genital organs which are continuous with the parts already studied, but which, as has already been pointed out, have been and possibly still are too often ignored.

Apart from operation and post-mortem examination, the accepted method of detecting diseased foci in the prostate and seminal vesicles is by digital examination of the rectum. Barney,³⁴ and Hallé and Motz,¹⁰⁵ conclude that there must be a certain percentage of error in clinical findings. McCrea³⁷ also agrees with that view and maintains that clinical records depend on the thoroughness of their maker and, in this region, in part, on the length and education of his index finger. Another difficulty in assessing disease of these organs is that Young⁵³ found many seminal vesicles involved by tuberculosis after he had performed a radical operation for their removal, while a previous clinical examination had failed to detect any disease. Cunningham,²⁴ after autopsies on patients who had suffered from tuberculous epididymitis, found disease in the prostate and seminal vesicles when no abnormality

had been found clinically during life and he concluded that in many patients, disease of the prostate and seminal vesicles was apparent only at post-mortem examination. Kretschmer⁵² and Morson³⁰ agree that negative findings on a rectal examination do not exclude tuberculous disease.

Eisendarth and Rolnick,⁵ referring to the anatomy and embryology of the prostate in relation to a rectal examination, state that, on examination the two lateral lobes of the prostate can be palpated with a median groove. Lowsley and Kirwin,⁴⁰ report that the normal seminal vesicle is movable and indistinct and that if it is easily palpated it is very often diseased.

Young⁵³ states that, in prostatic tuberculosis, the tubercles are usually confined to the neighbourhood of the ejaculatory ducts, from which the spread is by the posterior lobe to the dorsal portions of the lateral lobes, the median lobe being less frequently involved. In the diseased seminal vesicle, according to Young, multiple or conglomerate tubercles are present often with extensive caseation and always with distortion or destruction of the vesicular architecture. In many cases this destruction is so complete that no trace of the organ remains, while in others, there is extensive scarring and distortion from fibrosis. Caseous tubercles in the seminal vesicles may

coalesce and transform it into a single abscess which may extend into the surrounding tissues, to the bowel or bladder, or both. Payne,¹⁰⁶ Cope,⁹⁴ and McCrea³⁷ all maintain that tuberculous disease of the prostate and seminal vesicles is very slow to progress and very liable to become fibroid or to resolve. Healing or quiescence of tuberculous disease of the prostate and seminal vesicles has been found months or years after the operation of epididymectomy by Braasch,^{107,108} Eisendarth and Rolnick,⁵ Marinesco,¹⁰⁹ Caulk,¹¹⁰ Horwitz,⁶⁹ and Cunningham.²⁴ Chetwood¹¹¹ and Kretschmer,^{112,113} have both had cases of tuberculous calcification of the seminal vesicles and Kretschmer differentiates it from a calculus in the seminal vesicle or vas deferens. McKenzie and Seng¹¹⁴ reported one case of massive calcification of the prostate following tuberculosis.

Owing to the proximity of the prostate and seminal vesicles, Barney³⁴ believes that when the prostate is tuberculous the seminal vesicle is also involved, a statement which is also made by Young,⁵³ Herman,⁴⁸ and Cope.⁹⁴ Barney further believes that when one seminal vesicle is diseased the other is also involved. Support for these views can be obtained from the results of several investigators of this subject as seen in table number 21.

TABLE NO. 21

Investigator	Number of genital tuberculous cases	Seminal Vesicles involved	Prostate Involved
Simmonds ¹¹⁵	35	29 times	26 times
Oppenheim ¹¹⁵	27	17 "	18 "
Krzywicki ¹¹⁵ (autopsies)	15	11 "	14 "
Collinet ¹¹⁵	70	36 "	44 "
Cunningham ²⁴ (clinically)	86	41 "	49 "
Scott ¹¹⁶	227	83%	77%
Menville ⁶¹ (Autopsies)	65	67.8%	86.4%

The close association between tuberculous epididymitis and tuberculosis of the prostate and seminal vesicles has been recognised by most writers on this subject but Barney³⁹ and Howard²⁹ who investigated the records of children found that in cases of tuberculous epididymitis the rectal examination usually failed to detect any abnormality in these pelvic organs. The results obtained by several workers are shown in table number 21A.

TABLE NO. 21A

Investigator	Number of cases of tuberculous epididymitis	Disease of prostate & seminal vesicles	Disease of prostate alone	Disease of seminal vesicles alone
Walker, K.M. ⁵⁶	22	91%		
Barney ³⁴	100	76%		
Negley ²⁸	218 (96%		
	(Olive View		
	(Sanatorium		
	(84%		
	(General		
	(Hospital		
Bumpus and Thompson ⁶⁰	300		52%	35%
McCrea ³⁷	56	74%		
Sjöstrand ⁵⁰	Acute 65	66%		
	Subacute & Chronic 509	62%		
Kretschmer ⁵²	94	82.38%		
Cunningham ²⁴	Autopsies 35	71.42%		
Young ⁵³	24	100%		
de Langre ¹¹⁷		80%		
Wildbolz ⁵⁷		75.5%		

Spitzer⁸¹ states that 50 to 75% of cases of tuberculous epididymitis have palpable disease of the seminal vesicles and undoubtedly the remaining 25 to 50% have involvement of these organs which could be found at autopsy. Keyes,⁵¹

Webb-Johnson,⁵⁹ Thomas and Kinsella,⁸² Rich,⁷³ Moore,¹¹⁸ and Gibson,⁵⁸ all maintain that tuberculous epididymitis is usually associated with prostatitis and vesiculitis, while Paul¹¹⁹ states that nodules in the prostate or seminal vesicles help in the diagnosis of tuberculous epididymitis.

Post-mortem examinations of 65 cases of all types of genital tuberculosis by Menville and Priestley,²⁰ showed the prostate to be diseased in 86.4% of the cases, the epididymis in 76.2% and the seminal vesicles in 67.8%, while a further investigation by the same workers also showed that the prostate was the commonest site of genital tuberculosis. Randall¹²⁰ concluded from his investigation that the impression that the epididymis was the primary organ involved in the genital tract was fallacious. He quoted Lehman who found primary genital tuberculous lesions frequently in the prostate, and from his own investigation of 1215 autopsies he found 16 examples of abscess of the prostate, 9 of which were due to tuberculosis. The 9 cases of prostatic disease represented a percentage of 2.6 of 343 patients who died of tuberculosis out of the total of 1215. Greenberger, Greenberger and Alexander²⁶ found that the order of frequency of tuberculosis of the genital organs was the prostate, the epididymis, the seminal vesicles, and the testis. These men found that there were 21 instances

of the prostate being the only organ involved in the genitalia. The results of Schultz¹²¹ showed that there was prostatic disease in 104 or 83.2% of 125 cases, seminal vesiculitis in 78 or 64.4% and tuberculous epididymitis in 66 or 52.8%; the prostate was the only genital organ involved in 35 cases. He concluded that isolated primary tuberculosis of the epididymis was very rare. Koll¹²² described one case of primary genital tuberculosis of the prostate and accepted two others from the literature on the subject. McKenna and Sweany¹²³ also reported one case of primary prostatic disease while Harvey¹²⁴ believes that the epididymis is involved by tuberculosis from the prostate, a view that is also held by Quinby.¹²⁵ Sussig,¹²⁶ G. Walker,⁸⁷ Bothe,²¹ and Sweany¹²⁷ all maintain that primary tuberculosis of the prostate is rare while Barney¹²⁸ agrees that it is rare apart from coincidental epididymitis. Young⁵³ reports only one case of pure prostatic tuberculosis proved by operation or autopsy and Scott¹¹⁶ from his study of the literature accepted only 7 cases of which 4 were proved by autopsy.

Bothe²¹ found the prostate very frequently diseased, (65%), when other tuberculous lesions were present in the genito-urinary tract. Moore¹¹⁸ asserted that 4 to 12% of all tuberculous post-mortem examinations show uro-genital

tuberculosis and in 75 to 90% of these the prostate is involved. In other series, the following results were obtained:-

Investigator	Percentage of cases with prostatic disease
Hesse ¹²⁹	68.5
Burekhardt ¹²⁹	73
Lowsley and Duff ¹³⁰	68.9

Hodgson¹³¹ described one case of tuberculous seminal vesiculitis without any other focus in the genital tract. The diseased organ was removed at operation and three months later the patient developed epididymitis and he concluded that this was further proof that the lesion was primarily in the seminal vesicle. Young⁵³ also asserts that the tuberculous process is usually primarily in the seminal vesicle and Webb-Johnson⁵⁹ believes that epididymitis only occurs when there is disease of the prostate and seminal vesicles and that the primary lesion is in the seminal vesicle. Dillon⁹³ concludes his article on the subject of genital tuberculosis, by stating that the primary seminal tract lesion is more often in the pelvic genitalia than is supposed and that a better educated examining finger will detect more often involvement of the prostate and seminal vesicles.

Study of Present Series.

Out of the total of 402 cases of tuberculous epididymitis, 237 had one or more rectal examinations carried out while in hospital. Positive results were obtained in 207 cases or 87.34% of the total examined rectally, the remaining 30 or 12.66% not showing any clinical evidence of disease.

Apart from genital tuberculosis, other tuberculous lesions were present in 216 patients and table number 22 shows the relative frequency of the various major extra-genital parts involved.

TABLE NO. 22

Major extra-genital tuberculous lesion	Rectal examination positive	Rectal examination negative
Lungs	55	18
Kidney	110	4
Bone or Joint	18	4
Abdominal or Glandular	6	1
Total	189	27
No other lesion	18	3

A study of tables number 23 and 24 shows that tuberculosis of the prostate and seminal vesicles in the present series occurred at all ages, with approximately the same frequency in each age group as was found in the age incidence

of tuberculous epididymitis. Only two patients below 10 years of age were examined rectally and in one of these positive results were obtained. These figures are not sufficient to support the statements of Howard²⁹ and Barney,³⁹ that tuberculous prostatitis and seminal vesiculitis are rare in children with tuberculous epididymitis, but neither writer mentions the difficulty of palpating the prostate and seminal vesicles in males of pre-pubertal age.

TABLE NO. 23

Number of cases in each age group

Age groups in years	Rectal positive	Rectal negative	Age Groups in years	Rectal positive	Rectal negative
- 5	1		36 - 40	20	4
6 - 10		1	41 - 45	19	1
11 - 15	7	1	46 - 50	7	1
16 - 20	34	4	51 - 55	5	2
21 - 25	40	8	56 - 60	6	1
26 - 30	42	4	61 - 65	2	
31 - 35	24	3	66 - 70		
Totals	148	21		59	9

TABLE NO. 24

Comparison of incidence of tuberculous epididymitis with the incidence of tuberculous prostatitis and seminal vesiculitis.

Age Groups in years	Percentage incidence of tuberculous epididymitis	Percentage incidence of rectal positive	Age Groups in years	Percentage incidence of tuberculous epididymitis	Percentage incidence of rectal positive
- 5	2.98	0.48	36 - 40	8.46	9.66
6 - 10	1.00		41 - 45	8.70	9.18
11 - 15	2.98	3.38	46 - 50	4.48	3.38
16 - 20	11.59	16.43	51 - 55	3.98	2.41
21 - 25	19.10	19.32	56 - 60	3.23	2.90
26 - 30	19.42	20.29	61 - 65	0.67	0.96
31 - 35	12.94	11.59	66 - 70		

The writer now proposes to study the two groups of cases, the one in which no abnormality was found on rectal examination and the other in which evidence was detected of tuberculous prostatitis or seminal vesiculitis or both.

- (1) Group A. Patients in whom no abnormality was found on rectal examination.

TABLE NO. 25

Duration of Epididymitis in months when rectal examination made.

Genital lesion	1	2	3	4	5	6	7	8	10	24	48
Right epididymitis	4	1	2			1	1	1	2		
Left epididymitis	3	5	1	1	1	1					
Bilateral epididymitis	1	1		1		1				1	1

The number of cases under consideration in this section is 30 or 12.66% of the total examined rectally. From table number 25 it can be seen that 24 or 80% had involvement of one epididymis, the frequency of right and left sided disease being the same. The duration of the unilateral epididymitis when the rectal examination was made in all cases was ten months or less, 66.66% being within a period of three months, and 83.33% within six months. Bilateral epididymitis was present in only six instances or 20% of the total number, the time period being under six months for four cases and two and four years respectively for the remaining two cases.

(2) Group B. Patients in whom disease of the prostate or seminal vesicles or both was found on rectal examination.

This group comprises some 207 cases or 87.34% of the total rectally examined. For the purposes of detailed study, the writer proposes to subdivide these cases into three categories.

- (a) All cases who had tuberculous epididymitis with prostatitis or seminal vesiculitis or both on admission to hospital.
- (b) Men in whom the epididymitis was unilateral on admission to hospital but later became bilateral.
- (c) Men in whom disease of the pelvic genitalia was found before the onset of the epididymitis.

(a) Cases admitted with epididymitis and prostatitis or seminal vesiculitis or both.

There are 195 patients in this section who were admitted to Hospital with epididymitis and a palpable pelvic genital lesion, as 12 patients who developed their primary epididymal lesion in hospital have been deleted from the total of 207. Disease of one or both seminal vesicles without any palpable changes in the prostate was present 44 times while prostatitis without associated vesiculitis was found in 20 patients, the remaining 131 patients having disease of the prostate and seminal vesicles. By addition, there was palpable vesiculitis in 175 patients or 89.74% and prostatitis in 151 patients or 77.44%.

In order to study more fully these epididymal and associated pelvic genital lesions, the writer has divided them into two groups, the first showing the relationship between the disease of the epididymis and the seminal vesicle, and the second showing the relationship between epididymitis and prostatitis.

There is a small group of cases, 8 in number, common to both the above Groups in that both epididymes were involved with bilateral seminal vesiculitis and disease of the right and left lateral lobes of the prostate, where the duration of the epididymal lesion was so much longer than the great majority of cases, that the writer feels it

advisable to record these separately.

TABLE NO. 26

Age of epididymitis in years when rectal examination carried out.

Genital Lesions	7	8	10	12	18	32
Bilateral epididymitis with bilateral seminal vesiculitis and prostatitis	3	1	1	1	1	1

These 8 cases were all patients who had bilateral epididymitis for many years before a rectal examination was carried out and in all cases disease of both seminal vesicles and right and left lobes of the prostate was found.

(1) Epididymitis and seminal vesiculitis.

Subtracting the eight cases with epididymitis of over five years' duration from 195, the total of 187 is obtained and in table number 27 that number of lesions is studied and recorded with associated vesiculitis if present. In these cases where there was no seminal vesiculitis, prostatitis was present as all the patients in this group had a coincidental pelvic lesion to the epididymitis. The duration of the tuberculous epididymitis is shown at the time when the rectal examination was carried out.

When the right epididymis and the right seminal vesicle

are the parts involved, there can be seen 18 cases, all found within one year of the onset of the epididymal lesion. No case is present in this series where disease of the left seminal vesicle was associated with right epididymitis but there are 20 patients who had bilateral seminal vesiculitis associated with involvement of the right epididymis. All of these cases, with one exception, occurred within 8 months of the onset of the epididymal lesion, that exception being discovered when the age of the epididymitis was $1\frac{1}{2}$ years. It can be seen that there are seven cases of right epididymitis unassociated with vesiculitis.

The number of cases of left epididymitis with left seminal vesiculitis is 17, the duration of the epididymitis being seven months or less in all but two cases in which the epididymal lesion had been present for 1 and $1\frac{1}{2}$ years respectively. One case of left epididymitis of three months' duration is seen to be associated with disease of the right seminal vesicle while there are 13 patients with bilateral vesiculitis and left epididymitis, the duration of the latter group being six months or less with two exceptions at 1 and 2 years respectively. Four cases of disease of the left epididymis are seen without any palpable changes in either seminal vesicle.

TABLE NO. 27

Age of epididymitis when rectal examination carried out.

(Time in years)

Genital Lesions	$\frac{1}{12}$	$\frac{2}{12}$	$\frac{3}{12}$	$\frac{4}{12}$	$\frac{5}{12}$	$\frac{6}{12}$	$\frac{7}{12}$	$\frac{8}{12}$	$\frac{9}{12}$	$\frac{10}{12}$	$\frac{11}{12}$	$\frac{12}{12}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5	6	
	RE + RSV	5	9	1					1				2									
RE + LSV																						
RE + Bi.SV	2	6	3	2		4		2					1									
RE + No.SV		4	1		1	1																
LE + LSV	3	5	1	1		3	2					1	1									
LE + RSV			1																			
LE + Bi.SV	3	3	2	1	1	1						1		1								
LE + No.SV		1	2	1																		
BiE+ Bi.SV	2	11	10	7	6	12	5	1	4	2		12	3	7	1	2		2			3	
BiE+RSV		2	2			1	1	1														
BiE+LSV		1																				
BiE+ No.SV	1	1			2	2	1					1		1								

RE = right epididymitis. RSV = right seminal vesiculitis.
 LE = left epididymitis. LSV = left seminal vesiculitis.
 Bi.SV = Bilateral seminal vesiculitis.
 Bi.E = Bilateral epididymitis.
 No.SV = No seminal vesiculitis

Grouping the single epididymal lesions with the pelvic genital lesions, the writer arrives at the percentages shown in table number 28.

TABLE NO. 28

Associated Lesions	Number	Percentage	Associated Lesions	Number	Percentage
RE + R.S.V.	18	40	LE + L.S.V.	17	48.56
RE + L.S.V.	0	0	LE + R.S.V.	1	2.86
RE + R&L.S.V.	20	44.44	LE + R&L.S.V.	13	37.14
RE + No S.V.	7	15.56	LE + No S.V.	4	11.43

Associated Genital Lesions	Number	Percentage
Unilateral epididymitis with unilateral vesiculitis	36	45
Unilateral epididymitis with bilateral vesiculitis	33	41.25
Unilateral epididymitis with no vesiculitis	11	13.75

RE = right epididymitis. R.S.V. = right seminal vesiculitis.
 No S.V. = no seminal vesiculitis.
 LE = left epididymitis. L.S.V. = left seminal vesiculitis.

It can be seen that in the total of 80 patients with unilateral epididymitis there is involvement of one seminal vesicle, with one exception always the homolateral vesicle, in 36 or 45%, involvement of both seminal vesicles, in 33 or 41.25% and no palpable seminal vesicular disease in 11

or 13.75%, the last group, it will be remembered, all having palpable prostatic disease.

Excluding these cases with no palpable disease of the seminal vesicles, the duration of the epididymal lesion in the remaining patients was as follows:- in 57 cases, or 82.61% of the total, less than six months, in 9 or 13.04% between six months and one year, and in 3 or 4.34% between one and two years. The duration of the unilateral epididymitis in men with bilateral seminal vesiculitis was six months or less for 28 out of 33 cases, 84.85%, in men with unilateral seminal vesiculitis a duration period of six months covers 29 out of 36 cases, or 80.56% of the total.

Coming now to the study of bilateral epididymitis associated with vesiculitis the number of patients to be considered is 107, in 90 of whom (84.11%) evidence of bilateral seminal vesiculitis was found on their first examination in hospital. In 8 patients (7.48%) unilateral seminal vesiculitis was diagnosed, 7 being right-sided and one being left-sided, and in the remaining 9 men, 8.41%, no evidence of vesicular disease was palpable.

TABLE NO. 29

Number and Percentage of Associated Genital Lesions in 107 Men.

Associated genital lesions	Number	Percentage
Bilateral E + Bilateral S.V.	90	84.11
Bilateral E + Unilateral S.V. (Right 7 Left 1)	8	7.48
Bilateral E With no S.V.	9	8.41

E = epididymitis.

S.V. = seminal vesiculitis.

The duration of the epididymal lesion in the men with bilateral seminal vesiculitis varied from one month to 5 years, and table number 30 shows the numbers and percentages for the recorded time intervals.

TABLE NO. 30

Time Interval	Number of Patients	Percentage
- 3 months	23	25.56
- 6 months	48	53.33
- 1 year	72	80.00
- 2 years	82	91.11
- 5 years	90	100.

It can be seen from table number 30 that bilateral seminal vesiculitis associated with bilateral epididymitis was present at an early period, as no fewer than 80% of this group were found to have these lesions within one year of the onset of the epididymitis. The eight patients with unilateral seminal vesiculitis and bilateral epididymitis were all examined within a period of eight months from the onset of the epididymal lesion.

(2) Epididymitis and Prostatitis.

As in the previous section the genital lesions of 187 patients are here under consideration. Where there was no palpable evidence of prostatic disease, disease of the

seminal vesicles was found as all patients had a pelvic genital lesion coincidental to the epididymitis. Table number 31 shows the associated genital lesions with the duration of the epididymitis in years at the time when the rectal examination was carried out.

TABLE NO. 31

Age of Epididymitis when rectal examination carried out.
(Time in Years)

Genital Lesions	$\frac{1}{12}$	$\frac{2}{12}$	$\frac{3}{12}$	$\frac{4}{12}$	$\frac{5}{12}$	$\frac{6}{12}$	$\frac{7}{12}$	$\frac{8}{12}$	$\frac{9}{12}$	$\frac{10}{12}$	$\frac{11}{12}$	$\frac{12}{12}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5	6	
RE + RP	1	8	1									1										
RE + LP																						
RE + P(R&L)	2	7	3	2	1	4		2					1									
RE + No.P	4	4	1					1														
LE + LP	3	2	1			2	1						1									
LE + RP																						
LE + P(R&L)	3	4	3	2		1						2		1								
LE + No.P		3	2	1	1	2	1					1										
BiE+ P(R&L)	3	9	10	6	6	10	5	1	4	1		13	3	6	1	2		1			2	
BiE+ RP																						
BiE+ LP		1																				
BiE+ No.P		5	2	1	2	5	2	1		1				2				1			1	

RP = prostatitis involving right lateral lobe
 LP = prostatitis involving left lateral lobe
 RE = right epididymitis. LE = left epididymitis
 P = prostatitis of both lateral lobes
 BiE = bilateral epididymitis. No.P = no prostatitis

The number of cases admitted with right epididymitis and disease of the right lateral lobe of the prostate was 11, all with one exception being diagnosed within three months of the onset of the epididymitis. No case is present in this series with disease localised to the right epididymis and the left lateral lobe of the prostate, but when both lateral lobes of that gland were involved in association with right epididymitis there are 22 cases, all except one being discovered within a period of eight months of the onset of the epididymal disease.

There were 10 patients with disease of the left lateral lobe of the prostate and the left epididymis and again with one exception, the duration of the epididymitis was never more than seven months. There was no patient with disease of the left epididymis and the right lateral prostatic lobe, but both lobes of the prostate were diseased in 16 cases, 13 of which occurred within six months of the onset of the epididymitis.

The prostate felt normal to palpation 10 times in men with right epididymitis and 11 times when the disease was confined to the left epididymis, but as mentioned previously these 21 men all had vesicular disease.

Grouping the single epididymal lesions with the prostatic

lesions, the writer arrives at the percentages shown in table number 32.

TABLE NO. 32

Associated Lesions	Number	Percentage	Associated Lesions	Number	Percentage
RE + RP	11	25.58	LE + LP	10	27.03
RE + BP	22	51.16	LE + BP	16	43.24
RE + No P	10	23.26	LE + No P.	11	29.73

Associated genital lesions	Number	Percentage
Unilateral epididymitis with disease of one lateral prostatic lobe	21	26.25
Unilateral epididymitis with disease of both lateral lobes of prostate	38	47.5
Unilateral epididymitis with no prostatic disease	21	26.25

RE = right epididymitis.

RP = disease of right lateral lobe of prostate.

LE = left epididymitis.

LP = disease of left lateral lobe of prostate.

No P = no disease of prostate. BP = both lateral lobes of prostate.

In the total of 80 patients with unilateral epididymitis, involvement of one lobe of the prostate, always the homolateral one, occurred 21 times or 26.25%, while both lobes of the prostate were diseased 38 times or 47.5%. No prostatic disease was detected in 21 patients or 26.5% of the total.

The duration of the unilateral epididymitis in these patients with prostatitis was less than seven months in 50 or 84.75%, between seven months and one year in 6 or 10.17% and between one and two years in 3 or 5.08%. From these results it can be deduced that the association of epididymitis and prostatitis was an early feature in most of the cases under review and, that bilateral prostatitis occurred as frequently as unilateral prostatitis in association with unilateral epididymitis in the same interval of time, is shown by the following results. Of 21 cases of unilateral epididymitis and unilateral prostatitis in 18 or 85.71% palpable prostatic involvement was found within six months of the onset of epididymitis; while of 38 cases of unilateral epididymitis with bilateral prostatitis the prostatic lesion was discovered in 32 (84.21%) within the same period from the onset of the epididymal lesion.

The number of patients admitted to hospital with bilateral epididymitis was 107, of whom 83 or 77.57% were found to have disease in the right and left lateral lobes of the prostate. One case was found in which disease was only palpable in one lobe while rectal examination in 23 patients failed to detect any prostatic disease.

TABLE NO. 33Number and Percentage of Associated Genital Lesions in 107 Men

Associated Genital Lesions	Number	Percent.
Bilateral E + Bilateral P.	83	77.57
Bilateral E + Unilateral P	1	.93
Bilateral E with no P	23	21.5

E = epididymitis. P = prostatitis

The duration of the epididymal lesion in the patients with bilateral prostatitis varied from one month to five years and table number 34 shows the numbers and percentages for the recorded time intervals.

TABLE NO. 34

Time Interval	Number of patients	Percentage
- 3 months	22	26.51
- 6 months	44	53.01
- 1 year	68	81.93
- 2 years	77	92.77
- 5 years	83	100.

The association of bilateral prostatitis and bilateral

epididymitis appears to be an early feature as 81.93% of the cases shown in table number 34 were found within one year of the onset of the epididymitis. That figure closely approximates to the figure found for the association of bilateral epididymitis and bilateral seminal vesiculitis which was 80% within the same time interval. The single case of bilateral epididymitis with unilateral prostatitis was diagnosed when the epididymal lesions had been present for two months.

Recapitulation of Section (a)

The writer does not propose to draw any conclusions regarding the association of pelvic and superficial genital lesions at this stage before he has considered the remaining patients with pelvic genital disease, those in sections (b) and (c). He feels, however, that the descriptions given above of patients who were admitted to hospital with tuberculous epididymitis and lesions in the pelvic genitalia, are of necessity so involved, that certain features may be summarised with benefit to the reader.

1. The pelvic genital lesion in association with unilateral epididymitis was more frequently bilateral than unilateral as in 69 cases of unilateral epididymitis associated with seminal vesiculitis, the lesion of the seminal vesicles was unilateral in 36 or 52.17% and bilateral in

33 or 47.83%. When there was prostatic disease associated with unilateral epididymitis, it was unilateral in 21 or 35.59% of cases and bilateral in 38 or 64.41%.

2. A bilateral epididymal lesion was usually associated with bilateral pelvic disease. Of 98 cases of bilateral epididymitis associated with seminal vesiculitis, 8 or 8.16% had unilateral seminal vesiculitis and 90 or 91.84% had bilateral seminal vesiculitis and in the 84 cases of bilateral epididymitis associated with prostatitis only one or 1.19% was associated with unilateral prostatitis, the remaining 83 or 98.81% having bilateral prostatic disease.

3. When the associated epididymal and pelvic lesions were unilateral these lesions were almost invariably on the same side. In 80 patients with unilateral lesions there was only one case, 1.25%, in which the pelvic lesions was contralateral to the epididymis.

4. The pelvic and superficial genital lesions were associated at an early date. Eighty-two cases (43.85%) were examined within three months, 128 cases (68.44%) within six months, 146 cases (78.07%) within nine months and 165 cases or 88.24% within one year of the onset of the epididymal lesion.

5. In association with tuberculous epididymitis,

seminal vesiculitis was more common or more easily diagnosed than prostatitis. Twenty patients, 10.68%, had no lesion in the seminal vesicles while 44, 23.53%, had no palpable prostatic lesion.

Table number 35, which summarises to a great extent tables number 27 and 31, is inserted here that verification of the figures of the summary of section (a) may be available.

TABLE NO. 35

The relative frequency of the genital lesions in 187 cases of tuberculous epididymitis. The duration of epididymitis is given in months.

	1	2	3	4	5	6	7	8	9	10	12	18	24	30	36	48	60
Unilat E + Unilat S.V.	8	14	3	1	0	3	2	1	0	0	3	1	0	0	0	0	0
Unilat E + Bilat. S.V.	5	9	5	3	1	5	0	2	0	0	1	1	1	0	0	0	0
Bilat. E + Unilat S.V.	0	3	2	0	0	1	1	1	0	0	0	0	0	0	0	0	0
Bilat. E + Bilat. S.V.	2	11	10	7	6	12	5	1	4	2	12	3	7	1	2	2	3

Unilat E + Unilat P.	4	10	2	0	0	2	1	0	0	0	1	1	0	0	0	0	0
Unilat E + Bilat. P.	5	11	6	4	1	5	0	2	0	0	2	1	1	0	0	0	0
Bilat. E + Unilat P.	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bilat. E + Bilat. P.	3	9	10	6	6	10	5	1	4	1	13	3	6	1	2	1	2

E = epididymitis. S.V. = seminal vesiculitis. P = prostatitis.

(b) Men in whom the epididymitis was unilateral on admission to hospital but later became bilateral.

Of the total of 207 patients who had pelvic genital disease diagnosed by rectal examination, there were 23 who, admitted to hospital with unilateral epididymitis, later developed disease of the remaining epididymis. The superficial genital and the associated pelvic lesions in each patient on admission to hospital, are shown in table number 36.

TABLE NO. 36

Associated genital lesions found in 23 patients when admitted to hospital.

Epididymal Lesion	RSV	LSV	Bi.SV	RSV+RP	LSV+LP	Bi.SV+P	P	RSV+P
Left Epididymitis		2	1			9	1	1
Right Epididymitis	1			1		7		

RSV = right seminal vesiculitis. RP = prostatitis of right lateral lobe.

LSV = left seminal vesiculitis. LP = prostatitis of left lateral lobe

Bi.SV = bilateral seminal vesiculitis

P = prostatitis of both lateral lobes.

Tuberculosis developed in the other epididymis in each of the 23 patients and the time of onset (in months) of that disease after the primary hospital examination can be seen in table number 37.

TABLE NO. 37

Time of onset, in months after admission to hospital, of disease developing in the remaining epididymis in 23 patients.

Epididymal lesion on admission	1	2	3	4	5	6	7	8	9	10	11	12
Left epididymitis	1		1		2	6	1	1		2		
Right epididymitis		1	1		1	3			1			2

Consideration of table number 37 shows that 14 patients were admitted to hospital with left epididymitis and later developed right epididymitis. The pelvic genital lesion before the onset of the right epididymal lesion was bilateral in all instances with two exceptions when the homolateral seminal vesicle was the only palpably diseased organ. The bilateral pelvic lesions varied, as, in one patient both seminal vesicles were diseased, in 9 patients both seminal vesicles and both lateral lobes of the prostate were involved by a tuberculous process, while in the remaining case both lateral lobes of the prostate and the contra-lateral seminal vesicle were diseased. From these findings, it is obvious that there was palpable disease of the pelvic genitalia on the right side before the development of right epididymitis in 12 of the 14 patients or 85.71%.

Nine patients were admitted to hospital with right

epididymitis and later developed a lesion in the left epididymis. The pelvic genital lesions on admission were bilateral in 7 instances and unilateral twice. In one case the unilateral pelvic lesion was the corresponding seminal vesicle and in the other the corresponding seminal vesicle and lateral lobe of the prostate. The bilateral pelvic lesions in all 7 cases were the same, both seminal vesicles and both lateral lobes of the prostate. In these 9 patients there was palpable disease of the pelvic genitalia on the left side before the onset of the left epididymal lesion 7 times or 77.78%.

Of the 23 patients who developed their second epididymal lesion in hospital, there was palpable evidence of pre-existing bilateral pelvic genital disease in 19 or 82.61%. In all cases, the disease of the second epididymis appeared within one year after the patients entered hospital, table number 37 showing the number of cases occurring in each month up to that time.

(c) Men in whom disease of the pelvic genitalia was found before the onset of epididymitis.

While the investigation of patients suffering from tuberculous epididymitis was being carried out, the writer performed rectal examinations on all the males in hospital suffering from tuberculosis in one or more of its forms

excluding those with epididymal disease. Over 200 patients were examined on several occasions, over a prolonged period and in 30 men, palpable abnormalities of the seminal vesicles and/or prostate were found. Observation of these 30 patients was continued for up to 18 months and in 12 instances epididymal disease developed and automatically these 12 patients had to be included into the total number of patients with tuberculous epididymitis.

The present group therefore, comprises 12 patients who were admitted to hospital for extra-genital tuberculous lesions and who, on rectal examination were found to have a pelvic genital lesion. The primary epididymal lesion developed at a later date. Table number 38 shows the pelvic genital lesion found in each patient on rectal examination and the time in months after that examination for the epididymal lesion to develop. In table number 38A the localisation of the epididymal disease can be seen and the previous pelvic genital lesions are also shown.

TABLE NO. 38/

TABLE NO. 38

Time of onset in months, of primary epididymal lesion, after the diagnosis of pelvic genital disease in twelve cases.

Pre-existing pelvic genital lesion	1	2	3	4	5	6	7	8	9	10	11	12	18
RSV + RP					2								1
LSV + LP	1					3							
BiSV+ P	1					1						2	
RSV + P		1											

TABLE NO. 38A

Localisation of epididymal lesion in the same 12 cases.

Pre-existing pelvic genital lesion	Right	Left	Right and Left
R.S.V. + R.P.	3		
L.S.V. + L.P.		4	
Bi.S.V.+ P			4
R.S.V. + P	1		

RSV = right seminal vesiculitis. LP = left lateral lobe of prostate diseased.
 LSV = left seminal vesiculitis. RP = right lateral lobe of prostate diseased.
 BiSV= bilateral seminal vesiculitis.
 P = both lateral lobes of prostate diseased.

A study of tables number 38 and 38A shows that of the 12 patients in whom there was no epididymal lesion when

disease of the pelvic genitalia was found, three had disease of the right seminal vesicle and right lobe of the prostate. Disease of the left seminal vesicle and left lateral lobe of the prostate was found in four patients and disease of both seminal vesicles and both lateral lobes of the prostate in a further four. The remaining case showed disease of the right seminal vesicle and both lateral lobes of the prostate gland. Table number 38 shows the period of time between the diagnosis of pelvic genital disease and the onset of the subsequent epididymitis; table number 38A shows the localisation of the epididymal lesion. In these patients who had disease of the right seminal vesicle and right lateral lobe of the prostate, the subsequent epididymal lesion was always right sided. Similarly when the left seminal vesicle and the left lateral lobe of the prostate were involved, the epididymitis occurred on the left side. The four patients who had bilateral seminal vesiculitis and prostatitis subsequently developed bilateral epididymitis and the remaining patient who had tuberculosis of the right seminal vesicle and both lateral lobes of the prostate later developed right epididymitis.

Summary and Conclusion from Chapter 6.

From the study of these cases of epididymal tuberculosis with pelvic coincidental lesions, the writer feels that his

statistics have definitely given support to a clinical impression of which he has been more and more aware with each additional patient examined. The impression that no matter how early the tuberculous epididymitis a lesion of the prostate or seminal vesicles or both could be felt per rectum in the great majority of patients, did not gain much support from the extensive literature on the subject. As mentioned before, most writers agree that tuberculosis of the epididymis, prostate and seminal vesicles are invariably associated but as these writers rarely give the duration of the primary genital lesion, it is difficult to assess accurately their results. For many years two opposing schools of thought have been propounded, one led by Barney³⁴ who believes that prostatitis and vesiculitis follow infection of the epididymis, while the second, the greatest advocate of which is Young,⁵³ holds the view that the primary genital lesion is in the seminal vesicles and prostate, the epididymis being secondarily infected.

Barney,³⁴ Young,⁵³ McCrea, Kretschmer,⁵² Cunningham²⁴ and de Langre¹¹⁷ all mention the difficulty of diagnosis with regard to prostatitis and vesiculitis and all agree that there is a certain percentage of error in any results. These writers are also in agreement with the views that the diagnosis of epididymitis from whatever cause, is an easy

one to make but experience and a certain amount of skill are necessary to find a slightly enlarged or thickened prostate or seminal vesicle. In the present writer's opinion, with average skill and considerable experience of rectal examinations the percentage of error in any carefully investigated series will tend to cause an underestimation in the number of cases with prostatitis and seminal vesiculitis rather than an over-estimation. No reference in the literature has been found where the prostate and seminal vesicles have been found to be normal at operation or post mortem when prostatitis and seminal vesiculitis had been diagnosed at a previous clinical examination. On the other hand Young,⁵³ after some radical operations for the removal of the seminal tract found disease of the seminal vesicles and prostate when clinical examination before operation by an experienced surgeon had failed to detect any abnormality and Cunningham²⁴ found similar results after autopsies on patients who had suffered from tuberculous epididymitis. Cunningham concluded that in many patients disease of the prostate and seminal vesicles was only visible or known at a post mortem examination. Dillon⁹³ also agrees with these writers and makes the statement that a better educated examining finger will detect more often involvement of the prostate and seminal vesicles.

From the present investigation of patients with tuberculous epididymitis and pelvic coincidental lesions, an outstanding feature of the patients admitted to hospital with these conditions already established is that in 82 or 43.85% these associated lesions were found within three months and in 16 or 8.56% within one month of the onset of the epididymal lesion. The actual percentage figures taken separately are not an aid to any conclusions as the numbers depended on the interval between the onset of the epididymitis and the patient's admission to hospital, an interval which was regulated by two factors. The first factor was the variable interval between the onset of the epididymitis and the patient's visit to a doctor and the second, the interval between the notification of the disease and the patient's admission to hospital. What is worthy of note, in the writer's opinion, is that the associated lesions were present at an early date in these patients and that of 16 patients examined within one month of the onset of the epididymitis 7 had bilateral seminal vesiculitis and 8 bilateral prostatitis and of 82 patients within three months of the onset of the epididymal lesion, 44 had bilateral prostatitis and 42 bilateral seminal vesiculitis. Remembering that several authorities on this subject have stated that the diagnosis of epididymitis is an easy one to make but that the diagnosis of prostatitis and seminal vesiculitis requires skill and

experience and with the additional results of Menville and Priestley²⁰ who found that the frequency of involvement of the genitalia by the tubercle bacillus was the prostate, the epididymis and the seminal vesicle, the writer feels that his statistics, based on the records of patients admitted with tuberculous epididymitis, so far do not definitely support either the views of Barney or Young as to whether the primary genital lesion is epididymal or pelvic. Considering the difficulties in the diagnosis of prostatitis and seminal vesiculitis and with the number showing bilateral involvement of the pelvic genitalia during the early months after the onset of epididymitis the writer is, at this stage, more inclined to support the view propounded by Young.

Considering the 23 patients admitted to hospital with unilateral epididymitis but later developing involvement of the other side, the rectal examination carried out on admission showed palpable bilateral pelvic genital disease in 19 instances. Barney³⁴ admits that he has been unable to settle the manner of invasion of the second epididymis and he states "unless one takes the view that infection of the second epididymis is blood-borne, the lymphatics appear to be the most probable bridge between the prostate and the epididymis. It is true that in such an event the infection must travel against the lymph stream but Balliano

has shown that this can take place." The percentage of 82.61 of cases in this section showing bilateral involvement of the pelvic genitalia before the onset of tuberculosis in the second epididymis suggests that the pelvic genitalia have a considerable influence over disease of the epididymis and if Barney admits that the second epididymis may be due to a spread of the disease from the pelvic genitalia it appears to the present writer to be unusual to postulate one method of infection of the first epididymis and another method for infection of the second epididymis.

The author lays great stress on the last section of this chapter. Therein it will be recalled, were studied the positive rectal findings garnered from the examinations of over 200 male patients admitted for tuberculous lesions other than those of the genital organs, and who positively had no epididymitis at the time of the rectal examination. It will be further recalled that vesicular and prostatic lesions were discovered in 30 patients. Despite the most careful search the writer cannot find evidence that any of the recognised authorities have recorded a similar investigation. The fact that in 12 of these patients epididymitis developed at a later date, see table number 38, would appear to suggest the pre-existence of vesicular or prostatic lesions or possibly the co-existence of both for a considerable

period before clinical tuberculous epididymitis becomes apparent. In each case a right-sided pelvic lesion was followed by right epididymitis, a left-sided pelvic lesion preceded a left epididymitis and a bilateral lesion of the pelvic genitalia was followed by bilateral epididymitis. No case was present in this group in which infection of the epididymis followed tuberculosis of the contralateral pelvic organs.

While the numbers considered are small, the results appear disproportionately impressive and taken into consideration with what has already been said concerning the relationship of epididymitis and disease of the deeper genitalia in the two larger groups previously discussed, lead scarcely to any other conclusion than that vesiculitis and prostatitis or both precede the more peripheral genital lesion. At the very least it has been established that prostatitis, vesiculitis and epididymitis constitute a clinical unity. It might further be hazarded that such a distribution of lesions pre-supposes a central common focus.

CHAPTER 7 - ASSOCIATED RENAL LESIONS

The role of the kidney in the pathogenesis of genital tuberculosis in the male has been the subject of discussion and argument for many years and, up to the present, no decision has been reached which is accepted by all. That renal and genital tuberculosis are frequently coincidental has been stated by most writers interested in the subject of genital tuberculosis, but opinions differ greatly as to the exact relationship, if any, between the two.

The fact that cystoscopy, intravenous and retrograde pyelography are procedures which are not devoid of risk to a tuberculous patient deters some from a complete renal investigation in cases of genital tuberculosis, while others believe that the risk to the patient is greater if these procedures are left undone, in that a renal lesion may thereby be overlooked. Barney³⁴ on the one hand demands definite indications for a complete renal investigation stating that, "in the absence of symptoms pointing to the kidney, cystoscopy and ureteral catheterisation seem unwise and a pathological urine with bladder symptoms takes origin from the prostate," while on the other hand, Bumpus and Thompson⁶⁰ believe that dysuria is a symptom of urinary tuberculosis and does not occur when disease is confined

to the genital tract. They further believe that tubercle bacilli in the urine indicate renal disease and that unless the urine is negative for tubercle bacilli cystoscopy should always be carried out. A third view is held by Wells¹³² who concluded his investigation by the statement that tuberculous epididymitis is a certain sign of renal tuberculosis and demands a full investigation. The results of investigations carried out by workers with views which differ so greatly are obviously difficult to compare but the writer will later present the results found by these and other investigators on the subject of genital tuberculosis and the incidence of renal involvement.

A further difficulty, one rather outwith the scope of this investigation, but one which the writer feels must be considered, is the diagnosis of renal tuberculosis. Most articles on this subject begin with the remark that the diagnosis of renal tuberculosis with the usual clinical data may be a very easy one to make, but on the other hand the diagnosis of chronic renal tuberculosis may be exceedingly difficult.

There has been much difference of opinion regarding the significance of tubercle bacilli in the urine, especially with reference to the presence or absence of renal tuberculosis. Many patients have been found in whom tubercle

bacilli have been isolated from a ureteral specimen, but without any clinical signs or symptoms, and such findings led to the belief that tubercle bacilli could be excreted by a normal kidney, the term excretory bacilluria being used to denote this condition. Smith¹³³ believed that, with a tuberculous focus anywhere in the body it was reasonable to suppose that frequent temporary bacillaemia might occur and that it had been shown that tubercle bacilli could be excreted through normal kidneys. Ekehorn¹³⁴ stated that the earliest signs were the microscopic morbid changes in the urine, these being pyuria, generally haematuria and usually the recovery of tubercle bacilli. He found it easier to demonstrate tubercle bacilli in the urine at a comparatively early stage of renal tuberculosis and regarded the finding of the tubercle bacillus as the only pathognomonic sign. He believed that in the event of the guinea-pig inoculation proving positive the possibility of an elimination bacilluria should be borne in mind, especially if there is an active tuberculous lesion in some other part of the body. Hobbs^{135, 136} reported 1,000 post mortem examinations on patients dying of pulmonary tuberculosis. In 16.2% there was a clinical record of tuberculous lesions of the kidney. He examined a small series of kidneys from these cases and found 32% showed microscopic tuberculosis while only 18% showed macroscopic lesions. Symptoms of renal tuberculosis

had been present during life in only a small percentage of cases studied. In conjunction with Gloyne and Page he inoculated into guinea-pigs the urine from 100 cases, none of which showed any symptoms of genito-urinary tuberculosis. Six positive results were obtained. One case came to post mortem and no evidence of disease was found, so he concluded that finding tubercle bacilli is not necessarily proof of genito-urinary tuberculosis.

Foulerton and Hillier¹³⁷ reported 18 cases of tuberculosis in 9 of which a bladder specimen of urine contained tubercle bacilli. At post mortem, 6 of the 9 cases showed no evidence of tuberculosis of the genito-urinary tract. According to Hyman and Mann¹³⁸ excretory bacilluria may account for the presence of tubercle bacilli in the urine. Barney³⁴ states that there is ample proof that the kidney may allow the passage of tubercle bacilli without injury to itself and that filtration of bacteria through an apparently healthy kidney has been demonstrated by many observers, among whom are Mayer,¹³⁹ Heyn,¹³⁹ Kraemer,¹³⁹ Buday¹³⁹ and Rolly.¹³⁹ Brown¹³⁹ collected many instances of patients with pulmonary tuberculosis whose urine was found to contain tubercle bacilli, and later the kidneys of these patients were shown to be free from disease. Cunningham,¹⁴⁰ in a similar investigation could not confirm these results.

Medlar,^{141,142} and the same worker in association with Sasano,¹⁴³ after much painstaking research on the subject of excretory bacilluria, found no evidence to support its existence. Medlar examined 30,000 serial sections of the kidneys of four rabbits and 12 guinea-pigs and concluded that the normal kidney was not permeable to the tubercle bacillus. He also examined 100,000 serial sections from the kidneys of 30 patients and confirmed that view, and he with Sasano further concluded that renal tuberculosis with bacilluria can exist for a long time without symptoms and that small renal foci can and do heal. In a further research, Medlar examined the kidneys at post mortem examination of 30 patients who had died of pulmonary tuberculosis, none of whom exhibited any clinical symptoms of renal involvement during life. He found definite tuberculous lesions in 22, no evidence of tuberculosis in 2 and excess scarring which he considered was due to healed tuberculous lesions in 6 patients. These views have had ample support from the investigations of Bumpus and Thompson,¹⁴⁴ Ormond and Myers,³² Tage Kjaer,¹⁴⁵ Carroll and Murphy,¹⁴⁶ K. M. Walker,⁵⁶ King,¹⁴⁷ Henline,¹⁴⁸ Lieberthal,¹⁴² Hinman,¹⁵⁰ Herman,⁴⁸ Munro,¹⁵¹ Band,¹⁵² Dalldorf¹⁵³ and most authorities at the present time are in agreement that normal kidneys cannot excrete tubercle bacilli. Band¹⁵⁴ recently demonstrated

that small tuberculosis foci in the kidneys may heal and that the tubercle bacilluria is sometimes a transient feature.

Miller and Lustock,²⁷ and also Medlar,¹⁴¹ stated that the presence of tubercle bacilli in the bladder urine was not pathognomonic of renal tuberculosis since the urine may be infected from a tuberculous genital lesion.

Colby⁶² found that in routine weekly examinations of the urine of tuberculous patients undergoing sanatorium treatment, small amounts of albumen were noted in urines previously normal and with no associated urinary symptoms. When these urines were inoculated into guinea-pigs a surprisingly high percentage gave a positive result for tubercle bacilli. He concluded that, in the presence of albuminuria, guinea-pigs have been positive for tuberculosis before the appearance of blood and pus and so he has come to regard the constant presence of even small amounts of albumen as a very early indication of renal involvement.

Jacobs¹⁵⁵ stated that renal tuberculosis is insidious in onset and that the disease is well established before symptoms occur as the outstanding symptoms are all referable to the bladder. Woodruff and Bumpus,¹⁵⁶ Addison,¹⁵⁷ and Braasch and Scholl,¹⁵⁸ agree that renal tuberculosis may be very difficult to diagnose as the urine may be normal except for occasional pus cells and the usual urinary symptoms may

be absent. They also find that repeated guinea-pig inoculations may be necessary before a positive result is obtained. Greenberger, Wershub and Auerbach,¹⁵⁹ and Mack^{160,161} all agree that tuberculosis of the kidney may be very difficult to diagnose early as there may be no symptoms of the disease.

After their investigations, Carroll and Murphy¹⁴⁶ stated that renal tuberculosis is more common in cases of pulmonary tuberculosis than is realised and is often characterised by an absence of clinical symptoms referable to the urinary tract. Cellular elements are frequently meagre and minimal renal tuberculosis may run a very benign course. Chute¹⁶² agrees that incipient and mild renal tuberculosis is more common than is generally recognised, while Kretschmer¹⁶³ found that it occurred in children and infants more often than was commonly supposed. LeFur and Lamiaud¹⁶⁴ stressed the fact that a tuberculous bacilluria without other findings was often found in the early stage of renal tuberculosis.

Wade¹⁶⁵ considers that intermittent haematuria is usually the first symptom of renal tuberculosis and later frequency and slight pyuria develop, to be followed later by a marked pyuria. According to Illingworth,⁶⁷ the onset of renal tuberculosis is usually insidious. Frequency of micturition is the first and most characteristic symptom but haematuria is of frequent occurrence and may be the first

indication of the disease. Pain in the loin is sometimes present but is not a notable feature. At first, the urine is clear or slightly turbid and contains scanty pus cells. Later the pus cells increase and tubercle bacilli may be found. A thorough investigation is necessary, including cystoscopy, catheterisation of the ureters, intravenous and retrograde pyelography, to determine the extent of the disease and to give additional evidence of the healthy state of one kidney, if the disease is unilateral.

Association of Renal and Genital Tuberculosis.

The association of renal and genital tuberculosis has been stressed by many writers on the subject of genital tuberculosis and tables No. 39 and 40 show the actual number when reported and the percentage incidence of that association obtained by some of those workers.

TABLE NO. 39/

TABLE NO. 39The frequency and Percentage Incidence of Renal Tuberculosis
in cases of Genital Tuberculosis

Investigator(s)	No. of cases of genital tuberculosis	No. with Associated Renal Tuberculosis	Percentage incidence of Renal Tuberculosis
Barney ³⁴	154	18	11.69
Keyes ⁵¹	100	20	20.
Ormond & Myers ³²	35	15	43
Miller & Lustock ²⁷	61	15	24.59
Salleras ¹⁶⁶	104		7.
Wells ¹³²	55	31 - 35	56.36 - 63.64
Manville & Priestley (P.M.) ²⁰	62		51.6
Menville (P.M.) ⁶¹	65		77.7
Negley ²⁸	139	43	33.
Wildbolz ⁷⁴			50
Bumpus & Thompson ⁶⁰	300	110	36
Young ⁵³	22		27
Greenberger, ²⁶ Greenberger & Alexander	67	51	76.1
Thomson-Walker ⁴⁴			37

TABLE NO. 40The Frequency and Percentage Incidence of Genital Tuberculosis
in cases of Renal Tuberculosis

Investigator	No. of cases of Renal Tuberculosis	No. with Associated Genital Tuberculosis	Percentage incidence of Genital Tuberculosis
Bumpus ¹⁶⁷			70.
Kretschmer ¹⁶⁸	123	39	31.71
Braasch ^{107,108}			73.
Jeck ¹⁶⁹	54	27	50.
Caulk ^{170,171}			75.

Jacobs¹⁷² stated that genital and renal tuberculosis are frequently associated. He investigated in Robroyston Hospital 23 males and 20 females suffering from renal tuberculosis and he found that 18 males, 78.26% of the males, had coincidental genital tuberculosis. His conclusion was that any patient with tubercle bacilli in the urine, must in the absence of genital tuberculosis, be suffering from renal tuberculosis. If genital tuberculosis is present, this should never be taken as the source of the infection for an investigation of the upper urinary tract will show that the greater number of these patients have a coincidental renal lesion.

In a recent article, Wells¹⁷³ placed epididymitis as second to increased frequency of micturition in the order of frequency of the presenting features in renal tuberculosis. He considers epididymitis as a danger signal of renal tuberculosis which has in the past been too often neglected. Every patient, in his opinion, with tuberculous epididymitis should be submitted to renal investigation as in well over 50% of cases, a surgical lesion of the kidney can be found. He holds the view that epididymitis is, for all practical purposes, due to spread of infection from the urinary stream along the lumen of the vas.

Herman⁴⁸ gives the figure of 40% for the association of genital and renal cases of tuberculosis and Stevens¹⁷⁴ makes the statement, "if urinary tuberculosis is diagnosed the suspected lesion in the epididymis will be found to be tuberculous in more than 90% of cases." Greenberger, Greenberger and Alexander,²⁶ writing on the frequent association of the two conditions state that in those cases of genital tuberculosis in whom renal tuberculosis cannot be proved it should be suspected. Lee and Bowes¹⁷⁵ mention the long recognised connection between genital and renal tuberculosis with the spread from the kidney to the epididymis, but only 9 of their 89 cases of tuberculous epididymitis appeared to follow renal tuberculosis.

Rosencrantz¹⁷⁶ quotes Thomas and Kinsells as stating that the spread of tuberculosis to the epididymis may come from the kidney. Barney³⁹ investigated genital tuberculosis in male children and found that only one out of 11 cases had renal tuberculosis. Mack¹⁶¹ makes the point that although the two conditions are frequently associated, the renal lesion may be silent.

Thomas, Stebbings and Rigos,⁷⁶ Martin,⁴⁵ Cunningham,²⁴ Robinson,⁴⁶ Hunt,⁴⁷ Bugbee,¹⁷⁷ de Langre¹¹⁷ and Reinicke,⁹⁶ all stress the frequent association of renal and genital tuberculosis, while Legueu¹⁷⁸ is of the opinion that urinary infection spreads to the genitalia in the male or vice versa. Gibson⁵⁸ and Negley²⁸ both insist that no case of genital tuberculosis should be dismissed without a full renal investigation especially if the urine is positive for tubercle bacilli, while Mombaerts and Laroche¹⁷⁹ advocate a full renal investigation in cases of genital tuberculosis with dysuria and albuminuria. Spitzer⁸¹ goes further than most writers and concludes from his investigation that the occasions on which there is genital tuberculosis without renal involvement are extremely rare.

Investigation of present series of cases.

Among the 402 cases of tuberculous epididymitis, 140 or 34.82% were diagnosed as also suffering from renal

tuberculosis. In addition, there was a further group of 101 cases, 50 of whom were labelled as probably suffering from renal tuberculosis and 51 as possible cases of renal tuberculosis.

Diagnosis of renal tuberculosis proven	140 or 34.83%
Diagnosed as probable cases of renal tuberculosis	50 or 12.44%
Diagnosed as possible cases of renal tuberculosis	<u>51</u> or 12.69%
Total	<u>241</u> or 59.95%

No special renal investigations were undertaken in the remaining 161 patients, to determine whether or not renal tuberculosis was present.

Group 1 - Patients suffering from renal tuberculosis.

Forty-four of the 140 patients in this group were admitted to hospital as cases of genital tuberculosis, 66 as suffering from renal tuberculosis, 7 presented combined renal and genital lesions and 23 with an extra genito-urinary tuberculous lesion, the last being localised in the lungs on 5 occasions, in the spine 10 times, the ankle twice, the knee 3 times, and the hip once. The remaining two patients had multiple tuberculous lesions.

A tuberculous lesion outside the genital and urinary

systems was found in 82 patients of the total of 140, the remaining 58 having no other demonstrable focus. These extra genito-urinary lesions were found in the following positions, lungs 50 times, bones or joints 23 times, abdomen or glands 5 times, and the meninges on 4 occasions.

The ages of the patients suffering from renal tuberculosis varied from 11 to 65 years and table number 41 shows the incidence in each age group.

TABLE NO. 41

Age Incidence of 140 Cases of Renal Tuberculosis

Age Group (years)	Number	Percentage	Age Group (years)	Number	Percentage
11-15	4	2.86	41-45	11	7.86
16-20	24	17.14	46-50	9	6.43
21-25	22	15.71	51-55	4	2.86
26-30	26	18.57	56-60	3	2.14
31-35	23	16.43	61-65	3	2.14
36-40	11	7.86			
Age Group (years)	Number	Percentage			
21-40	82	58.57			
31-40	34	24.29			

In the present series the age incidence of renal

tuberculosis was highest in the group between 26 and 30 years and 106 cases (75.71%) occurred between the ages of 16 and 40 years.

The diagnosis of renal tuberculosis in the 140 patients was reached by the following methods:-

Complete examination (cystoscopy, examination of ureteral specimens, and pyelography, intravenous or retrograde) + operation	67	patients
Complete examination (no operation)	40	"
Cystoscopy (ureteric catheters obstructed) and pyelography	18	"
Clinical and pyelographic examinations ..	8	"
Clinical examination (patients refused complete examination)	5	"
Post mortem examination	2	"

The localisation of the disease was as follows:-

Right kidney	37	Patients
Left kidney	32	"
Both kidneys	70	"
Horse-shoe kidney	1	Patient

A rectal examination was carried out in 114 of the 140 patients now being considered, with positive results in 110 or 96.49%. Various combinations of disease in the deep genitalia were found, the frequency of these being shown in table number 42 with the epididymal state, whether unilateral or bilateral.

TABLE NO. 42Results of Rectal Examination in 114 patients suffering from Renal Tuberculosis and Tuberculous Epididymitis

Localisation of Deep Genital Lesion	Number of Cases	Associated Epididymal Lesion	
		Number of Unilateral Cases	Number of Bilateral Cases
Right and left lateral lobes of prostate	10	6	4
Left seminal vesicle	2	2	
Right seminal vesicle	5	3	2
Both seminal vesicles	11	4	7
Left lobe of prostate + Left seminal vesicle	8	6	2
Right lobe of prostate + Right seminal vesicle	7	7	
Both lateral lobes of prostate + right seminal vesicle	2	1	1
Both lateral lobes of prostate + both seminal vesicles	65	12	53
No deep genital lesion found	4	2	2

The patients with disease involving the kidney and epididymis were divided into two groups, the first comprising those in whom the diagnosis of the renal lesion preceded the genital one, and in the second, those patients who were classified as suffering from disease of the epididymis before any renal involvement was found. The writer found

this division into two groups a most difficult one to make because of the impossible task of determining the onset of renal disease in the absence of symptoms, a point which has been stressed by many workers and has already been elaborated in this investigation. That fact, however, in the writer's opinion only causes difficulty in the determination of the patients who should be placed in the second category, since a genital lesion, which is obvious to both the patient and his physician, is much less likely to be overlooked in a patient suffering from renal tuberculosis than is an asymptomatic renal lesion in a patient with genital disease. The writer wishes to stress the fact that in the two groups, the one essential difference rests on the question of which condition was diagnosed first, not necessarily which condition started first. He maintains, however, that where the renal lesion was found before the epididymal condition it is much more likely that the renal disease started before the epididymitis. When the opposite is the case, he cannot concede that the genital tuberculosis always preceded the renal tuberculosis. There are several instances, which will be mentioned later, when patients arrived in hospital with renal tuberculosis and who later developed their primary epididymal lesion during their hospital stay. Unfortunately, that number is small,

as most patients had both conditions when they came to hospital and reliance had to be placed on careful histories and on investigations undertaken before the admission of the patient to hospital.

Group 1A. Patients in whom Renal Tuberculosis was discovered before Tuberculous Epididymitis.

In this section there are 67 men who were diagnosed as suffering from renal tuberculosis before there were any palpable signs of epididymitis. Fifty-six of these patients were admitted to hospital with both conditions but definite indications were present in the patients' histories and previous examinations which determined the exact onset of the epididymal lesion in relation to the renal disease. The remaining 11 men developed both conditions while in hospital. An additional 11 men, making the total 78, were admitted to hospital with epididymitis, all having had urinary symptoms suggestive of renal disease for a longer period than the epididymal lesion and the renal lesion was only definitely diagnosed by a full investigation in hospital.

The interval between the knowledge that renal tuberculosis was present and the onset of the epididymitis varied greatly in the 67 men (Table No. 43).

TABLE NO. 43

Time of Onset of Epididymitis after diagnosis of Renal Tuberculosis in 67 patients.

Time in Months	1	2	3	4	5	6	7	8	9	10	12	15	18	21	24	36	48	60	84	120
No. of Cases	1	8	6	5	3	5	3	4	2	2	7	2	6	1	7	1	1	1	1	1

The 11 cases admitted with the urinary symptoms of longer duration than the established epididymitis, were examined in hospital and the renal disease was found to be bilateral 7 times and unilateral in 4 instances. The age of the epididymal lesion varied between one month and two years, as shown in table number 44.

TABLE NO. 44

Age of Epididymal Lesion on Patients' Admission to Hospital (11 cases of Renal Tuberculosis)

Time in Months	1	2	3	5	6	24
No. of Cases	2	3	2	2	1	1

At least one rectal examination was made in 62 of the total of 78 patients in this section and palpable deep genital disease was found in 60 or 96.77% of those examined. Various combinations of pelvic disease were discovered, the frequency of these being shown in table number 45.

TABLE NO. 45

Results of Rectal Examination in 62 Patients suffering from Renal Tuberculosis and Tuberculous Epididymitis.

Localisation of Deep Genital Lesion	Number of Cases	Associated Epididymal Lesion	
		Number of Unilateral Cases	Number of Bilateral Cases
Right and left lateral lobes of prostate	8	4	4
Left seminal vesicle	1	1	
Right seminal vesicle	3	3	
Both seminal vesicles	6	3	3
Left lobe of prostate + left seminal vesicle	5	4	1
Right lobe of prostate + right seminal vesicle	5	5	
Both lateral lobes of prostate + both seminal vesicles	31	8	23
Both lateral lobes of prostate + right seminal vesicle	1	1	
No deep genital lesion found	2	2	

The writer then examined the records of these men to find out the duration of the epididymitis at the time when the pelvic lesions were discovered. In 11 patients renal tuberculosis was diagnosed and a rectal examination revealed

deep genital involvement some time before the onset of the primary epididymal lesion; these 11 cases will be considered separately later. Of the 49 remaining patients with renal, epididymal and vesiculo-prostatic disease, the duration of the epididymitis at the time of the rectal examination was possible to ascertain with some degree of accuracy in all with two exceptions. These two exceptions have been omitted from table number 46 which shows the age of the epididymitis when the rectal disease was discovered and the state of the epididymal lesion whether unilateral or bilateral.

TABLE NO. 46

Deep and Superficial Genital Lesions in 47 cases of Renal Tuberculosis, with the duration of the Epididymal Lesion when the Pelvic Lesion was discovered.

Number of cases with duration of epididymitis in months											Pelvic Genital Lesions in Epididymitis Cases							
											Unilateral Epididymitis				Bilateral Epididymitis			
1	2	3	4	5	6	7	8	12	60		P.	Corr. S.V.	Bi.SV.	Corr. P+SV	P+ Bi.SV	P.	Bi.SV.	P+ Bi.SV
6											2	2	1	1	2			
	13										2		2		3		2	2
		8									2				2			4
			2								1			1				1
				4										1				2
					8						1				3	1		2
						1												1
							1											1
								3										3
									1									1

P = bilateral prostatitis. Corr.S.V.=corresponding seminal vesiculitis
 Bi.SV = bilateral seminal vesiculitis. Corr.P+SV=corresponding lateral lobe prostatitis and seminal vesiculitis.

The 11 men who did not have any lesion in the epididymis on admission, developed one, from one month to 1½ years after the pelvic genital lesion had been discovered. Table number 47 shows the pelvic genital lesion found and the time of onset of the epididymitis after the pelvic lesion had been discovered. The localisation of the epididymal lesion is shown in table number 47A.

TABLE NO. 47

Time of onset of epididymitis, after discovery of pelvic genital disease in 11 cases of renal tuberculosis.

Localisation of Pelvic Disease before Epididymitis	No. of Cases	Time of Onset of Epididymitis (in months) After Rectal Examination					
		1	2	5	6	12	18
Right seminal vesicle + right lateral lobe of prostate	3			2			1
Left seminal vesicle + left lateral lobe of prostate	3	1			2		
Both seminal vesicles + both lateral lobes of prostate	4	1			1	2	
Right seminal vesicle + both lateral lobes of prostate	1		1				

TABLE NO. 47A

Localisation of Epididymal Lesion in the same 11 cases

Localisation of Pelvic Lesion	No. of Cases	Right Epididymis	Left Epididymis	Both Epididymes
Right seminal vesicle + right lateral lobe of prostate	3	3		
Left seminal vesicle + left lateral lobe of prostate	3		3	
Both seminal vesicles + both lateral lobes of prostate	4			4
Right seminal vesicle + both lateral lobes of prostate	1	1		

The significance of these findings should be taken into consideration with what has already been said in chapter 6. Therein it will be recalled, were given the results of the rectal examinations of the 200 unselected patients, which examinations resulted in the discovery of what apart from this investigation would have been totally unsuspected prostatitis and seminal vesiculitis.

Group 1B. Patients in whom Genital Tuberculosis was discovered before Renal Tuberculosis.

From the total of 140 cases of renal tuberculosis associated with tuberculous epididymitis, the writer found 78 in whom the genital lesion was diagnosed after the renal lesion, these men constituting Group 1A, already mentioned.

The remaining 62 patients he placed in Group 1B. because the genital lesion was diagnosed before a full renal investigation had been carried out and consequently before a diagnosis of renal tuberculosis had been made.

In the consideration of the 62 patients in the present section, the writer cannot definitely determine which lesion preceded the other. Remembering the conclusions of Jacobs,^{155,172} Carroll and Murphy,¹⁴⁶ Greenberger, Wershub and Auerbach,¹⁵⁹ Chute¹⁶² and others, that a renal lesion may be well established before any symptoms arise, he feels that in many, the onset of the urological symptoms follows so closely on the appearance of the epididymitis, that the renal lesion probably preceded the genital one.

Forty-four of the 62 men on admission to hospital were found to have symptoms referable to the urinary tract, 17 had no urological symptoms and one patient was admitted after a nephrectomy and an orchidectomy, both for tuberculosis, had been carried out elsewhere.

The 17 men without urological symptoms all suffered from tuberculous epididymitis at the time of admission to hospital and routine examinations revealed pyuria and tuberculous bacilluria. Complete renal investigations were carried out and unilateral renal disease was found in 14 men, and bilateral renal tuberculosis in 3 men. One

patient in this group had a unilateral epididymal lesion while 16 had bilateral epididymitis. The duration of the superficial genital lesion varied between one month and two years, table number 48 showing the duration in each patient.

TABLE NO. 48

The duration and localisation of the Epididymal Lesion when Renal Tuberculosis was diagnosed in 17 cases without Urological symptoms. The Renal involvement is also shown.

No. of Cases	Duration of Epididymitis on Admission to Hospital (Months)		Renal Involvement Found in Hospital	
	Unilateral	Bilateral	Unilateral	Bilateral
1		1	1	
2		2	2	
1		3	1	
3		4	3	
2		5	1	1
2	6	6	1	1
1		8		1
1		9	1	
2		12	2	
2		24	2	
Total 17		16 bilateral 1 unilateral	14 unilateral 5 bilateral	

The urological symptoms of the 44 cases varied and table number 49 shows the number of patients with each complaint.

TABLE NO. 49/

TABLE NO. 49

Urological Symptom(s)	Number of Patients
Frequency of micturition	16
Haematuria	2
Frequency and haematuria	12
Frequency, haematuria and dysuria	4
Frequency and dysuria	7
Haematuria and dysuria	2
Dysuria	1

The duration of these symptoms varied greatly as did the duration of the epididymitis. In 5 cases the symptoms started at the same time as the patient discovered a scrotal abnormality while in 3 men the urological symptoms were of longer duration than the epididymal lesion. Table number 50 shows the renal symptoms with their duration and the localisation of the renal disease in 31 out of the 44 cases. The duration and localisation of the epididymal lesion is also shown.

TABLE NO. 50/

TABLE NO. 50

The Duration of the Urological Symptoms with Localisation of Renal Lesion and the Duration and Localisation of Epididymitis in 31 men.

Urological Symptom(s)	Localisation of Renal Lesion	Months		Localisation of Epididymitis
		Duration of Urological symptoms	Duration of Epididymitis	
Frequency of micturition	B	10/365 yrs.	10/365 yrs.	B
Frequency of micturition	B	2 months	84 mths.	U
Frequency of micturition	B	36	6	B
Frequency of micturition	B	24	24	B
Frequency of micturition	U	3	5	U
Frequency of micturition	B	2	3	B
Frequency of micturition	U	2	2	B
Frequency of micturition	U	6	36	B
Frequency of micturition	B	3	60	U
Frequency of micturition	U	12	12	U
Frequency of micturition	U	1	6	U
Frequency and haematuria	B	2	180	B
Frequency and haematuria	B	12	60	B
Frequency and haematuria	B	1	5	U
Frequency and haematuria	U	4	7	B
Frequency and haematuria	B	36	18	U
Frequency and haematuria	B	18	2	U
Frequency and haematuria	B	1	132	B
Frequency and haematuria	B	1	1	B
Frequency and haematuria	U	6	18	B
Frequency and dysuria	U	3	12	B
Frequency and dysuria	B	1	24	U
Frequency and dysuria	U	2	6	B
Frequency and dysuria	B	5	12	B
Frequency and dysuria	Horse-shoe kidney	6	12	B
Haematuria	B	2	12	U
Haematuria	U	2	12	B
Haematuria and dysuria	B	1	36	B
Frequency, haematuria and dysuria	B	2	72	U
Frequency, haematuria and dysuria	U	2	18	B
Dysuria	U	1	2	B

B = bilateral

u = unilateral

In 12 instances, either the duration of the urological symptoms or the duration of the epididymitis was not known accurately and consequently the relationship could not be assessed. Table number 51 shows all the available particulars of these 12 patients.

TABLE NO. 51

Available Particulars of 12 Patients

Urological Symptom(s)	Months			Localisation of Epididymitis
	Localisation of Renal Lesion	Duration of Urological Symptoms	Duration of Epididymitis	
Frequency of micturition	B	Unknown	12	B
Frequency of micturition	U	do.	48	B
Frequency of micturition	B	do.	10	B
Frequency of micturition	U	do.	72	B
Frequency of micturition	U	do.	108	B
Frequency and haematuria	B	do.	60	B
Frequency and haematuria	B	do.	168	U
Frequency and haematuria	B	do.	84	B
Frequency and dysuria	B	do.	6	B
Haematuria and dysuria	B	do.	84	B
Frequency, haematuria, and dysuria	B	do.	Unknown	B
Frequency, haematuria, and dysuria	B	do.	84	B

A rectal examination was made in 52 of the 62 patients in this group and positive results were obtained in 50 or 96.15%. The frequency with which the various structures of the pelvic genitalia were involved is shown in table number 53. The epididymal state, whether unilateral or bilateral is also shown.

TABLE NO. 53

Results of Rectal Examination in 52 Patients suffering from Renal and Epididymal Tuberculosis.

Localisation of Deep Genital Lesion	Number of Cases	Associated Epididymal Lesion	
		Number of Unilateral Cases	Number of Bilateral Cases
Right and left lateral lobes of prostate	2	2	
Left Seminal Vesicle	1	1	
Right Seminal Vesicle	2		2
Both Seminal vesicles	5	1	4
Left lobe of prostate + left seminal vesicle	3	2	1
Right lobe of prostate + right seminal vesicle	2	2	
Both lateral lobes of prostate + both seminal vesicles	34	4	30
Both lateral lobes of prostate + right seminal vesicle	1		1
No deep genital lesion found	2	1	1

The records of these men were examined, as with these in Group 1.A., to determine the age of the epididymal lesion when the deep genital disease was palpated. The result of each examination given, table number 54, is that found on the first rectal examination carried out in hospital. In no case in this group was a rectal examination made before there was obvious epididymal disease.

TABLE NO. 54/

Suspected cases of renal tuberculosis.

Apart from the group of cases of proved renal tuberculosis in association with tuberculous epididymitis, a further 101 patients were regarded as possibly suffering from renal tuberculosis. On admission or during their hospital stay, abnormal constituents were found in the urine of these men, albumen being present in all and pus cells in 76 or 75.24%. The urines of 77 men were examined for tubercle bacilli and a positive result was obtained 50 times and a negative result in 27 instances. The patients with tuberculous bacilluria were considered as probable cases of renal tuberculosis, while the remaining patients in this section were classified as possible cases of renal infection. For the purposes of detailed study, the writer has divided the 101 patients into three groups.

- Group A. Patients with albuminuria, whose urine was not examined for tubercle bacilli.
- Group B. Patients with albuminuria, whose urine was negative for tubercle bacilli.
- Group C. Patients with albuminuria and tuberculous bacilluria.

The ages of the 101 patients under consideration varied from 3 to 63 years, the number with the percentage of the total for each age group being shown in table number 55.

TABLE NO. 55

Age Incidence of 101 Cases of Tuberculous Epididymitis,
suspected of having Renal Tuberculosis.

Age Groups in Years	Number of Cases	Per Cent.	Age Groups in Years	Number of Cases	Per Cent.
- 5	2	1.98	36 - 40	10	9.9
6 - 10	-	-	41 - 45	8	7.92
11 - 15	4	3.96	46 - 50	5	4.95
16 - 20	9	8.91	51 - 55	5	4.95
21 - 25	20	19.8	56 - 60	3	2.97
26 - 30	21	20.79	61 - 65	3	2.97
31 - 35	11	10.89			

The relationship between the times of onset of the urinary signs and the epididymitis was impossible to ascertain in all but a few of the patients. Fourteen patients were admitted to hospital and found to have abnormal constituents in their urine and later these patients developed epididymitis, while 82 men were found to have both urinary and genital infections. Of the remaining 5 patients, the urinary signs were found to follow the epididymitis in 3 instances, and twice the onset of both was apparently simultaneous.

Group A. Patients with albuminuria, whose urine was not examined for tubercle bacilli.

In this group are 24 patients, all having albuminuria

and 14 having an associated pyuria. In addition 5 of these men suffered from frequency of micturition, one of painless haematuria and one of dysuria, but in no case was a definite cause of the symptoms and signs found. Cystoscopy and pyelography were not carried out in these men, and in only 9 instances was a rectal examination performed but in each of the nine cases an abnormality was discovered in the pelvic genitalia. The pelvic and superficial genital lesions are given in table number 56.

TABLE NO. 56

Pelvic and Genital Lesions in 9 cases of Suspected Renal Tuberculosis

Associated Lesions	Number of Cases	Associated Lesions	Number of Cases
Bilateral Pelvic Lesion + Unilateral Epididymitis	3	Unilateral Pelvic Lesion + Unilateral Epididymitis	1
Bilateral Pelvic Lesion + Bilateral Epididymitis.	4	Unilateral Pelvic Lesion + Bilateral Epididymitis	1

The age of the epididymal disease in all cases with four exceptions, varied between wide limits when first seen and is shown in table number 57. The four exceptions developed the superficial genital lesion in hospital after albuminuria and pyuria had been discovered at a previous examination,

the epididymal lesion being unilateral in three instances and bilateral in one.

TABLE NO. 57

Duration of the Epididymal Lesion(s) in 20 patients on their Admission to Hospital. The number of Bilateral and Unilateral Cases is also shown.

Duration of Epididymitis in months	No. of Cases.	Unilateral Epididymitis	Bilateral Epididymitis
1	6	2	4
2	3	1	2
3	2	2	-
5	1	-	1
6	3	1	2
8	1	-	1
36	1	-	1
72	2	1	1
Unknown	1	1	-

As previously mentioned, 7 patients had urinary symptoms and table number 58 lists these symptoms and shows their relationship with the onset of the epididymal lesion. The age of each patient is also shown along with the results of the rectal examination if one was carried out.

TABLE NO. 58

Urinary Symptoms of 7 Patients and their-Time of Onset with regard to start of Epididymitis.

Urinary Symptom(s)	Time of Onset (in months) with relation to Epididymal Lesion			Age of Patient in years	Pelvic Genital Lesion if known
	Before	After	At same time		
Frequency of Micturition	3			22	P+ Bi.S.V.
Frequency of Micturition			†	41	R.S.V.
Frequency of Micturition	3			18	Not known
Frequency of Micturition		Prob- ably.		38	Not known
Frequency of Micturition		12		24	P+ Bi.S.V.
Haematuria			†	26	R.S.V.
Dysuria	5			16	Not known

P = bilateral prostatitis. Bi.S.V. = bilateral seminal vesiculitis.
R.S.V. - right seminal vesiculitis.

A tuberculous lesion apart from the genital and possible renal ones was found in 21 out of the 24 patients, the localisation of these lesions being shown in table number 59.

TABLE NO. 59

Localisation of Extra Genito-urinary lesion in 21 patients.

Localisation of Lesion	Number of Patients
Lungs	12
Bone and Joint	8
Abdomen and Glandular	1
No Other Lesion	3

Group B. Patients with albuminuria whose urine was negative for tubercle bacilli.

The 27 patients in this group were found, on admission to hospital, to have albuminuria and 24 had, in addition, a pyuria. Five patients gave a history of frequency of micturition, six complained of haematuria, one of frequency and haematuria, and one man admitted to frequency and dysuria. One other patient complained of pain in the region of his left kidney.

The urine of each of the 27 patients was examined for the tubercle bacillus with a negative result. On only five occasions was a guinea-pig inoculated with urine, the remaining twenty-two specimens being examined by direct smear. The direct examination was carried out on one occasion only, 19 times, on two occasions twice and on one occasion three examinations were made.

A cystoscopic examination was carried out on two patients, the bladder of one showing a normal-looking mucosa while in the second, some infection was found around the left ureteric orifice which appeared dilated and slightly retracted. Unfortunately the latter patient elected to leave hospital very soon after the examination and no further results were obtained. Intravenous pyelography showed normal appearances in both kidneys in the patient whose bladder appeared normal on cystoscopy.

In 12 of the 27 patients, a rectal examination was made very soon after their admission to hospital and palpable involvement of the deep genitalia was found in 9 instances. Table number 60 shows the results of these rectal examinations with the associated superficial genital lesion.

TABLE NO. 60

State of Superficial and Deep Genital Lesions in 12 Patients.

Bilateral Deep Genital Lesion + Unilateral Epididymitis	Bilateral Deep Genital Lesion + Bilateral Epididymitis	No Deep Genital Lesion + Unilateral Epididymitis	No Deep Genital Lesion + Bilateral Epididymitis
2	7	2	1

The duration of the epididymitis on admission varied between one month and three years (table number 61) in all the patients, with four exceptions who developed the superficial genital lesion while in hospital, after pyuria had

been discovered at a previous examination. A rectal examination was carried out in only one of the four cases, bilateral prostatitis and seminal vesiculitis being found prior to the onset of bilateral epididymitis.

TABLE NO. 61

Duration of the Epididymal Lesion(s) in 23 Patients on their Admission to Hospital. The Number of Unilateral and Bilateral Cases is also shown.

Duration of Epididymitis in Months	No. of Cases.	Unilateral Epididymitis	Bilateral Epididymitis
1	6	3	3
2	5	3	2
4	2	2	-
5	1	1	-
6	2	-	2
7	1	-	1
12	1	-	1
24	4	1	3
36	1	1	-

Table number 62 shows the time of onset of the urinary symptoms relative to the onset of the epididymitis in the 14 patients with urological symptoms. The age of the patient is also shown with the results of the rectal examination where available.

TABLE NO. 62

Urinary Symptoms of 14 Patients and their time of onset relative to the Onset of Epididymitis.

Urinary Symptom(s)	Time of Onset (in months) with relation to Epididymal Lesion			Age of Patient in Years	Pelvic Genital Lesion if known
	Before	After	At Same time		
Frequency of Micturition	6			45	Not known
Frequency of Micturition	4			38	Not known
Frequency of Micturition		24		29	Not known
Frequency of Micturition		12		38	P.
Frequency and Dysuria	3			28	P.
Frequency of Micturition	6			23	No Lesion found
Frequency and Haematuria			†	39	P. + Bi.S.V.
Haematuria		5		21	No Lesion found
Haematuria	1			40	P. + Bi.S.V.
Haematuria	3			21	P. + L.S.V.
Haematuria	2			53	Not known
Haematuria		12		33	Not known
Haematuria		Unknown		51	Not known
Pain Left Kidney Region		4		23	Not known

P. = bilateral prostatitis. Bi.S.V. = bilateral seminal vesiculitis
L.S.V. = Left seminal vesiculitis.

As in the previous group (A), the number of patients in Group (B) with tuberculous lesions outwith the genital and urinary tracts was calculated and found to be 22.

TABLE NO. 62

Localisation of Extra Genito-urinary Lesion in 22 Patients.

Localisation of Lesion	Number of Patients
Lungs	15
Bone and Joint	7
No Other Lesion	5

Group C. Patients with Albuminuria and Tuberculous Bacilluria.

From the urine tests of 77 men a positive result for tubercle bacilli was obtained in 50 instances. These 50 men all had an albuminuria and in addition 38 had a pyuria. There was a history of symptoms referable to the genito-urinary tract in almost half of these men, 5 complaining of haematuria, 8 of frequency of micturition, 7 of haematuria and frequency, 1 of haematuria and dysuria, 2 of frequency and dysuria and 1 of haematuria with pain in the right lumbar region, making a total of 24 or 48% with urological symptoms.

Cystoscopy was carried out in six patients and intravenous pyelography in 5; these procedures were offered to a further 4 men but were refused. The cystoscopic results of each case are tabulated below.

Cystoscopic Examinations

Case 1 - Bladder mucosa appeared normal, no kidney specimens collected.

- Case 2 - Bladder mucosa appeared normal, no kidney specimens collected.
- 3 - Marked cystitis, both kidney specimens negative for tubercle bacilli.
- 4 - Slight cystitis, right ureteric orifice dilated and injected but urine from right kidney negative for tubercle bacilli.
- 5 - Slight cystitis, left ureteric orifice inflamed, but urine from left kidney negative for tubercle bacilli.
- 6 - Slight cystitis, both ureteric orifices normal in appearance and specimens from both kidneys negative.

The intravenous pyelograms of the 5 patients examined all showed normal kidney shadows.

A rectal examination, on admission to hospital, was made in 30 patients and in all a positive result was obtained. The associated pelvic and superficial genital lesions are shown in table number 63 for all these patients with four exceptions who developed epididymitis after admission to hospital. These four cases will be considered later when the records of six patients admitted to hospital without epididymitis are examined.

TABLE NO. 63/

TABLE NO. 63

Pelvic and Genital Lesions in 26 Cases of Suspected Renal Tuberculosis.

Associated Lesions	Number of Cases	Associated Lesions	Number of Cases
Bilateral Pelvic Lesion + Unilateral Epididymitis	6	Unilateral Pelvic Lesion + Unilateral Epididymitis	4
Bilateral Pelvic Lesion + Bilateral Epididymitis	14	Unilateral Pelvic Lesion + Bilateral Epididymitis	2

The duration of the epididymal lesions (table number 64) on admission to hospital, varied between one month and $2\frac{1}{2}$ years in 42 out of the total of 44 patients who had a superficial genital lesion when first examined. The two remaining men were unable to give the time of onset of the epididymitis.

TABLE NO. 64/

The duration of the epididymal lesions (table number 64) on admission to hospital, varied between one month and $2\frac{1}{2}$ years in 42 out of the total of 44 patients who had a superficial genital lesion when first examined. The two remaining men were unable to give the time of onset of the epididymitis.

TABLE NO. 64

Duration of the Epididymal Lesion(s) in 42 Patients on their admission to Hospital. The number of Bilateral and Unilateral cases is also shown.

Duration of Epididymitis in Months	No. of Cases	Bilateral Epididymitis	Unilateral Epididymitis
1	8	1	7
2	7	2	5
3	4	2	2
4	4	3	1
5	4	3	1
6	7	6	1
7	1	1	
10	3	2	1
15	1	1	
18	2	2	
30	1	1	

As previously mentioned, 6 men were admitted to hospital with albuminuria, pyuria and tuberculous bacilluria, without any epididymal lesion; the last condition developed during the hospital treatment. The admission state of these patients with their subsequent epididymal lesion are shown in table number 65.

TABLE NO. 65

Admission State and Subsequent Epididymal Lesion of 6 Patients suspected of having Renal Tuberculosis

Age in Years	Site of Other Tuberculous Lesions	Admission State			Epididymal Lesion Developing in Hospital
		Urinalysis	Urological Symptoms	Deep Genital Lesions	
30	Spine		Frequency & Haematuria.	P+Bi.SV	Bilateral
3	Knee	(Albuminuria	None	Not known	Bilateral
35	Lungs	(Pyuria	None	Not known	Bilateral
43	Lungs	(Tuberculous	None	P+Bi.SV	Bilateral
26	Spine	(Bacilluria (in all	Frequency & Haematuria	P+Bi.SV.	Bilateral
47	Spine		Frequency & Haematuria	P+Bi.SV.	Bilateral

Bi.SV. = bilateral seminal vesiculitis. P. = bilateral prostatitis.

The records of the 24 men who complained of urological symptoms were studied to find the relationship between the onset of these symptoms and the appearance of the epididymal lesion. It was found that the urinary symptoms preceded the epididymitis by a variable period in 15 instances and followed the epididymal lesion in one case. In 5 men the epididymitis and the urinary symptoms were apparently simultaneous in onset, while in 3 instances the patients were

unable to say which commenced first. Table number 66 lists the urological symptoms and when possible the exact time is given between these and the onset of epididymitis. The age of the patient and the pelvic genital lesions when known, are also included.

TABLE NO. 66/

TABLE NO. 66

Urinary Symptoms of 24 Patients and their Time of Onset relative to the Onset of Epididymitis.

Urinary Symptom(s)	Time of Onset Relative to Onset of Epididymitis (in months)			Age of Patient in Years	Pelvic Lesion if known
	Before	After	At Same Time		
Haematuria			+	36	Not known
Haematuria	3			14	Not known
Haematuria			+	20	Not known
Haematuria			+	22	P.+Bi.SV.
Haematuria			+	35	RP+RSV.
Frequency of Micturition	Time Uncertain			56	P.+Bi.SV.
Frequency of Micturition	6			48	P
Frequency of Micturition	12			43	Not known
Frequency of Micturition	----	Unknown	----	14	Not known
Frequency of Micturition			+	33	RP + RSV
Frequency of Micturition	----	Unknown	----	27	P
Frequency of Micturition		12		30	P.+Bi.SV.
Frequency of Micturition	1			65	P.-Bi.SV.
Haematuria & Frequency	----	Unknown	----	30	RP. + RSV.
Haematuria & Frequency	6			28	P.+Bi.SV.
Haematuria & Frequency	1			30	Not known
Haematuria & Frequency	6			23	P.+Bi.SV.
Haematuria & Frequency	3			52	Not Done.
Haematuria & Frequency	3			26	P.+RSV.
Haematuria & Frequency	5			45	P.+Bi.SV.
Haematuria & Dysuria	2			30	P.+Bi.SV.
Frequency & Dysuria	6			47	RP.+ RSV.
Frequency & Dysuria	Many weeks			43	P.+Bi.SV.
Haematuria & pain right lumbar region	4			47	P.+Bi.SV.

P = bilateral prostatitis. Bi.SV = Bilateral seminal vesiculitis.
 RP = right lateral lobe prostatitis. RSV = right seminal vesiculitis.

Forty-one of the 50 men in this section had at least

one other tuberculous lesion apart from a genito-urinary infection (table number 67).

TABLE NO. 67

Localisation of Extra-genito-urinary Lesion in 41 Patients.

Localisation of Lesion	Number of Patients
Lungs	20
Bone and Joint	18
Abdomen and Glands	2
Multiple	1
No Other Lesion	9

Summary of Chapter No. 7.

Elsewhere, the writer has quoted the views of Jacobs,^{155,172} Addison,¹⁵⁷ Mack,^{160,161} Braasch and Scholl,¹⁵⁸ and others, that renal tuberculosis may be very difficult to diagnose, owing to the frequent absence of symptoms referable to the urinary tract and to the fact that renal tuberculosis is often well established before symptoms develop. Jacobs,¹⁷² after his investigation of 43 cases of renal tuberculosis in Robroyston Hospital, concluded that the cases in which clinical symptoms, cystoscopy and pyuria without organisms point to urinary tuberculosis, but the bacteriologist fails to find tubercle bacilli, have an incidence of 15-20% of the total number of

cases of renal tuberculosis.

From the material that constitutes the present chapter the writer found that there were 140 patients, 34.83% of the total 402 cases, with definite renal tuberculosis and 101, 25.12%, with suspected renal disease. Consideration of the records of these 241 men showed that a complete urological investigation, cystoscopy with catheterisation of the ureters and pyelography, was carried out in 131 men and of these patients renal tuberculosis was diagnosed in 125 or 95.42%. Cystoscopy with or without intravenous pyelography was performed on 133 patients and in these men renal tuberculosis was diagnosed 125 times or 93.98%, while intravenous pyelography with or without cystoscopy was carried out in 139 patients and 95.68%, 133 of these patients, were considered to have renal tuberculosis. A definite diagnosis of renal tuberculosis was reached in the 140 cases by a combination of two or more of the following examinations, clinical, cystoscopy with ureteric catheterisation, intravenous pyelography or post mortem. In the 101 cases of suspected renal disease, only 8 cystoscopies and 6 intravenous pyelographic examinations were carried out. On cystoscopic examination 4 out of the 8 patients were found to have cystitis and in one other patient infection of the bladder was seen in the region of a dilated ureteric orifice. The six pyelograms all showed

normal kidney shadows. From these findings it cannot be proved that these 101 patients were free from renal tuberculosis as in only four patients were ureteric specimens taken and consequently all the patients with these four exceptions did not have a complete renal investigation which, as has been seen from the results of other workers, is necessary to reach a diagnosis of renal tuberculosis. The four exceptions all had a cystitis of unknown origin but the kidney specimens of urine failed to show tubercle bacilli on one examination, results which do not exclude renal tuberculosis as Jacobs pointed out in his article that in 15-20% of cases of renal tuberculosis the bacteriologist fails to isolate the tubercle bacillus. On the other hand, there is much evidence to support the view that these 101 patients probably suffered from renal tuberculosis. All suffered from epididymal tuberculosis and 84, 83.07% had definite tuberculous lesions outwith the genito-urinary tract. Albuminuria was present in every patient and in addition 76, 75.25%, had pyuria, 45 or 44.55% had urological symptoms and 50 or 49.5% had a tuberculous bacilluria. If these 101 patients are considered as having suffered from renal tuberculosis, the association of the two conditions, renal and epididymal tuberculosis, occurred in 241 men or 59.95% of the total series. The remaining 161 patients of the total 402 did not undergo any renal investigation since there was neither

sign nor symptom to suggest any necessity for such an investigation; but it is to be remembered that these were the earlier cases in this series and under present standards such failure to investigate would be deemed negligent. It is possible that at least in some, a "silent" renal lesion as described by Mack¹⁶¹ was present. In the writer's opinion and from his experience since the present investigation started, the men with epididymal tuberculosis in whom tubercle bacilli cannot be isolated from the kidney urine are extremely few in number. Frequently the bladder mucosa has appeared healthy, the urine has been free of albumen, yet, guinea-pigs have been found to be tuberculous after inoculation with the urine from the kidneys of these patients. Pyelography has frequently shown normal kidney shadows in these patients but, accepting the results of Medlar¹⁴² and Band¹⁵² sub-clinical tuberculous lesions of the kidney may be diagnosed on bacteriological findings alone.

The exact relationship between the onset of renal and epididymal tuberculosis in the cases under review was next considered by the writer. From the 140 cases of proved renal tuberculosis, 78 were known to have the renal lesion before the onset of epididymitis. In the remaining 62 men, the time of the diagnosis of each condition was taken as the standard and consequently they were classified under the heading of Group 1B in which the genital diagnosis preceded

the renal one. On closer study of these 62 men, it was found that 17 had no urological symptoms, yet in a complete renal investigation, a renal tuberculous lesion was discovered. The duration of the epididymal lesion in 16 of these cases was one year or less and in one case, two years, the renal lesion being found to be unilateral in 14 instances and bilateral 3 times. Twelve of the 62 men had urological symptoms but were unable to state either the time of onset of these symptoms or when the genital lesion appeared and two men were diagnosed as cases of renal and epididymal tuberculosis in another hospital. Of the remaining 31 cases, the onset of the urological symptoms and the appearance of the superficial genital lesion were apparently simultaneous in 5, the symptoms preceded the genital lesion in 3 and followed it in 23 cases.

In the 101 patients with suspected renal tuberculosis, 45 had urological symptoms. The symptoms preceded the genital lesion in 25, followed the genital lesion in 7 and probably followed it once. In 8 men the urological symptoms apparently commenced simultaneously with the onset of epididymitis while the relationship was unknown in 4 cases. The epididymal lesion developed in hospital in 14 of the 101 patients and two other patients could not give the time of onset of the genital lesion. The duration of the

epididymitis, on admission to hospital, in the remaining 85 patients was less than one year in 72 or 84.71%.

Table number 68 shows the relationship, when known, between the onset of the urological symptoms and the appearance of the epididymitis in 185 patients. That total is reached by the addition of the 140 patients with proved renal tuberculosis and the 45 cases of suspected renal disease with urological symptoms.

TABLE NO. 68

Relationship between the Time of Onset of Urological Symptoms and Tuberculous Epididymitis in 185 patients.

No. of Cases with Urological Symptoms before Epididymitis.	No. of Cases with Urological Symptoms after Epididymitis.	No. of Cases with Simultaneous Onset of Symptoms and Epididymitis	No. of Cases in which Relationship Unknown
106	31	13	35

Subtracting the 35 cases in which the times of onset of the urological symptoms and epididymal lesion were unknown the total number of cases with a known relationship becomes 150. The number of cases in which the urological symptoms preceded the genital lesion is 106 or 70.67% and if the views of Jacobs,^{155,172} Braasch and Scholl,¹⁵⁸ and others, are accepted, the renal lesion may well have preceded the genital one in the 13 cases with apparently simultaneous onset of

the urological symptoms and epididymitis; thus, in 119 cases or 79.33% it may be presumed with some assurance that the renal lesion started before the epididymitis. In the 31 cases, in which the genital infection was present before there were any urological symptoms, it is impossible to state which lesion commenced first but in over 60% of the cases the urological symptoms appeared within one year of the start of the epididymitis. Since renal tuberculosis is often well established before the onset of urinary symptoms, the writer is of the opinion that the renal lesion was probably the initial one in the genito-urinary tract in these cases. Table number 69 shows the interval between the onset of epididymitis and the start of the urological symptoms in 30 of these cases; one record is excluded as the patient was unable to give the required information.

TABLE NO. 69

Interval in Months between the Epididymal Disease and the Onset of Urological Symptoms in 30 Cases.

Each Division Represents One Patient																													
1	1	2	3	3	4	4	4	5	6	7	9	10	10	11	11	11	11	12	16	23	23	30	35	48	57	70	82	131	178
16.67%																													
33.33%																													
63.33%																													

Rectal examinations were carried out in 114 of the 140 cases of proved renal tuberculosis with positive results in 110 or 96.49%. In the 101 probable cases of renal tuberculosis 51 patients were examined rectally with positive results in 48 or 94.12%. By addition, rectal examination of 165 patients with renal tuberculosis revealed palpable prostatitis and seminal vesiculitis in 158 or 95.76%. The difficulties of palpating pelvic genital disease have been stressed in a previous chapter, difficulties sufficient to account for 4.24% or 7 negative results out of 165 cases. The writer feels that already he has established a clear relationship between tuberculous epididymitis, vesiculitis and prostatitis, and renal tuberculosis. This relationship will be elaborated in the immediately following chapter.

CHAPTER 8THE PATHOGENESIS OF TUBERCULOUS EPIDIDYMITIS

The problem of how the tubercle bacillus reaches a single epididymis has caused considerable argument for many years and up to the present, no solution has been obtained which is accepted by all who are interested in this subject. All are agreed that genital tuberculosis is secondary to some other tuberculous focus in the body, these extra-genital lesions being obvious in 88.32% of the present series, and so the problem is one of the spread of the bacillus to the epididymis from a remote part of the body and not from the outside.

The writer considered the pelvic tuberculous lesions coincidental to an epididymitis in chapter 6 and quoted the views of many workers who considered the two conditions were invariably associated. Disagreement was present, however, as to the exact relationship of that association, and the views of two schools of thought, one led by Barney³⁴ and the other by Young,⁵³ were discussed (Chapter 6. Summary and Conclusions). It will be remembered that Barney considered that the primary genital focus was usually situated in the epididymis, the prostate and the seminal vesicles becoming secondarily infected from the epididymis, while Young believed

that the primary genital lesion was situated in the seminal vesicles and prostate. The present writer considered his own findings (Chapter 6) and found that of 187 patients who were admitted to hospital with the superficial and deep genital lesions already established, in 82 or 43.85% the associated lesions were discovered within three months and in 16, 8.56%, within one month of the onset of the epididymal lesion. These figures may be misleading in that the reader may gather that only 43.85% of the total number had both conditions when the age of the epididymitis was three months or that 8.56% had pelvic and superficial genital lesions when the latter had existed for one month. In point of fact, all the patients in that section were admitted to hospital at varying intervals and these figures give the percentage of the patients admitted one month and three months respectively after the onset of the epididymitis. Of the 16 patients who had an epididymitis of one month's duration, 7 had bilateral seminal vesiculitis and 8 bilateral prostatitis, and of the 82 patients within three months of the onset of the epididymal lesion, 44 had bilateral prostatitis and 42 bilateral seminal vesiculitis. Consideration of a further 23 patients (Chapter 6.2.B(b)) who were admitted to hospital with unilateral epididymitis, but who later developed disease of the second side, the rectal examination carried out on

their first hospital examination showed palpable bilateral pelvic disease 19 times. In the group comprising an additional 12 patients (Chapter 6, 2.B(c)) who did not have epididymal disease when prostatitis and seminal vesiculitis were palpated, but who later developed epididymitis, a right pelvic lesion preceded a right epididymitis, a left pelvic lesion preceded a left epididymitis and a bilateral pelvic lesion was followed by bilateral epididymitis. These results convinced the writer that the deeper genital lesion preceded the more superficial genital one.

Harvey,⁵⁵ Gibson,⁵⁸ Martin,⁴⁵ Cunningham,²⁴ Barney,³⁴ Barney and Colby,³¹ Band,¹⁵² Whiteside,¹⁸⁰ and Horwitz,⁶⁹ all consider that the infection of the epididymis is blood-borne and that the infection of the prostate and seminal vesicles follows at a later date. Barney believes that in the majority of cases the disease reaches the genital tract from the blood stream. Its attack upon the epididymis, testis or seminal vesicle may be accounted for, in his opinion, by the supposition that these organs have a secretory function and the disease gains a foothold because of an overdose of bacilli or lowered resistance of the part. Barney continues by stating that from an embryological standpoint the testis and kidney are much alike and that there is ample proof that the latter may allow the passage of tubercle

bacilli and other organisms without injury to itself. The present writer concluded from the results of other workers and his own results, that injury (Chapter 3.d.) and infection, for example gonorrhoea (Chapter 3,e) were not important aetiological factors and he accepted the findings of Medlar and Sasano,¹⁴³ and Band¹⁵² that the normal kidney did not allow the passage of tubercle bacilli. McGavin,⁷⁹ considering cases of non-tuberculous disease of the epididymis, considered that blood spread was unlikely as the testis was uninvolved and Latham⁸⁹ reported one case of epididymitis associated with septic meningitis in which the globus major was the part attacked. Ormond and Meyers³² agreed with Latham in that disease spread by the blood stream, attacked the globus major of the epididymis. Barney,³⁴ Young,⁵³ K. M. Walker,⁵⁶ G. Walker,⁸⁷ and others stated that tuberculous epididymitis usually started in the globus minor and that view receives support from the present study (Chapter 5 b.1) where 33 out of 88 cases, 37.5%, admitted to hospital within two months of the onset of the epididymitis, showed disease localised to the globus minor, while there were only 5 instances, 5.68%, in which the globus major was the only part of the epididymis involved. Mark⁹⁸ quoted the results of an experiment by G. Walker in which tubercle bacilli were injected into the aorta of each of 28 rabbits with resulting

testicular disease in 2 but without any case showing epididymal involvement. Wells¹³² considers that these people who believe in the blood-spread infection of the epididymis make an unconscious analogy between epididymitis and tuberculosis elsewhere, and he considers that with a blood infection, for example mumps, the resulting genital lesion is in the testis and not in the epididymis. Barney¹⁰⁰ makes the further statement that blood-borne organisms reach the epididymis and testis with equal frequency and freedom but the latter appears to have a selective action. K. M. Walker⁵⁶ arguing against the blood infection of epididymitis writes that in mumps, pyaemia, scarlet fever and typhoid, it is the body of the testis and not the epididymis which is involved, a viewpoint that is also expressed by Robinson,⁴⁶ and Eisenstaedt⁹⁹ after the investigation of a case of tuberculosis of the testis in a child, considered that it was caused by blood infection as there was an acute spread of the disease involving the whole gland and no other lesion in the genital tract was discovered. It will be remembered that in the present study of cases with testicular disease, Chapter 5, c., the disease of the testis was found to be maximal at the mediastinum testis or in that part of the testis adjacent to the globus major, in all cases with four exceptions. In these four cases, the body of each testis

was sectioned at operation and was found to be studded by discrete tubercles, which the writer considered could only be due to a blood-borne infection. In all the other cases of tuberculosis involving the testis, the infection appeared to have spread from the epididymis.

Menville and Priestley,²⁰ Greenberger, Greenberger and Alexander,²⁶ and Thomas, Stebbins and Rigos,⁷⁶ reported from their investigations that the prostate was the organ in the genital tract most commonly affected by tuberculosis. The results of Lowsley and Duff¹³⁰ supported that view as these workers investigated 25 patients with prostatic tuberculosis and found that in 16 patients there was an accompanying epididymitis. The present writer concluded from his own results that pelvic genital disease preceded the more superficial genital infection and he reported 12 personal cases in which disease of the prostate and seminal vesicles was found before the epididymal lesion developed. Young,⁵³ Miller and Lustock,²⁷ Thomas and Kinsella,⁸² Rosencrantz,¹⁷⁶ Dillon,⁹³ Randall,¹²⁰ Braasch,^{107,108} K. M. Walker,⁵⁶ and Hawes,²² Nitch,⁹² Quinby,¹²⁵ Harvey,¹²⁴ and Schultz,¹²¹ are all in agreement that the pelvic genital lesion is present before there is epididymitis, and that the epididymal lesion is due to a spread of the disease from the prostate and seminal vesicles. Hodgson¹³¹ reported a personal case in

which he diagnosed tuberculous seminal vesiculitis and confirmed that condition later at operation; three months after the operation an epididymal lesion developed on the same side. Lowsley and Kirwin⁴⁰ quoted Guyon as stating that the primary genital tuberculous lesion was in the seminal vesicles. From the results of these workers and from his own investigations and experience, the present writer does not doubt that the pelvic genital lesion in tuberculosis precedes the more superficial epididymal lesion.

In Chapter 7 the writer considered renal tuberculosis in association with genital tuberculosis. He found that 140 of the total 402 cases of epididymitis, 34.83%, had definite renal disease proved by either operation or complete renal investigations or both. A further 101 cases, 25.12%, he considered as probably suffering from renal tuberculosis, making a total of 241 or 59.95% of the total 402 cases with renal disease. The remaining 161 patients, 40.05%, of the total, did not undergo any renal investigations. The writer next considered the relationship between the time of onset of the renal disease and the genital disease and he found that, of the 150 cases where the time of onset of the epididymitis was known, 119 or 79.33% had a pre-existing renal lesion. In the 31 remaining cases of the 150, it was impossible to state which was the earlier lesion but in over

60% of these 31 cases, urological symptoms appeared within one year of the onset of the epididymal lesion. Accepting the views of Jacobs,^{155,172} Mack,^{160,161} Addison,¹⁵⁷ and others, that renal tuberculosis is usually well established before urological symptoms develop, the writer concluded that the renal lesion in these 31 cases was probably the initial one in the genito-urinary tract.

The writer has satisfied himself that in the great majority of the cases, the sequence of events in genito-urinary tuberculosis is from the kidney to the pelvic genitalia and from there to the epididymis. Thomas and Kinsella⁸² stated that tuberculous epididymitis develops as a retrograde infection from the prostate and seminal vesicles as in gonorrhoea and that the infection is taken to the kidney by the blood and from the kidney to the prostate and seminal vesicles by means of the urine. Braasch¹⁰⁷ reported, that coincidental renal and genital tuberculosis in the female was rare but in 171, 73% of 234 males, renal and genital disease co-existed. Spitzer⁸¹ writing on genital tuberculosis, stated that he wished to impress that it was impossible for him to consider genital tuberculosis and urinary tuberculosis as two complete entities, and his mission was to emphasise the fact that these conditions could in no way be separated. The occasions in which genital disease existed without renal tuberculosis

were extremely rare according to Spitzer. K. M. Walker⁵⁶ accepts the fact that prostatitis and seminal vesiculitis precede epididymitis. In the aetiology of prostatic disease Walker mentions four routes of infection, blood stream, continuity, urethra direct and the urine. All pathways are met with according to that worker but he believes that the urine is the commonest source of prostatic disease. Any deposit in the urine would naturally collect in the lowermost part formed in the upright position by the prostate and infective material is brought into contact with the prostatic urethra for a long time. In the prostatic urethra are natural crypts where tubercle bacilli may lodge. The same worker in association with Hawes²² repeated these views in a further investigation. Mombaerts and Laróche,¹⁷⁹ Morson³⁰ and Webb-Johnson⁵⁹ also consider that the urine carries the infection from the kidney to the prostate and seminal vesicles. Schultz¹²¹ believes that the prostate plays a most sinister part in the development of tuberculosis of the male genitalia. In his opinion if it were not for this gland which marks the junction of the genital and urinary systems, tuberculous epididymitis would be as infrequent an associate of renal tuberculosis in the male, as tuberculosis of the fallopian tubes in the female. The prostate, according to Schultz, is the link between renal and genital tuberculosis and from

the prostate other parts of the genital system become involved. He concludes that the male direction of spread is testipetal from the kidney to the prostate and then to the epididymis. Barney and Colby³¹ give unintentional support to the view of associated renal and genital disease by their criticism of Young's opinion. They state that Young believes that the seminal vesicle is involved more often than the epididymis and sometimes the seminal vesicle is extensively involved before the epididymis is attacked. Barney and Colby believe that these views of Young are seriously vitiated by the fact that in his series urinary tuberculosis co-existed, and so it was reasonable to suppose that extensive prostatitis and vesiculitis were due to renal tuberculosis. Campbell,^{83,84} believes that genital tuberculosis without renal disease is haematogenous in origin but with renal tuberculosis the infection reaches the genital tract by way of the urinary passages. Wells¹³² considers that in genital tuberculosis there is always a pre-existing lesion of the kidney. If the kidney lesion were always found, he states that there would be general acceptance of that view, but, in the case of epididymitis without obvious kidney damage, the kidney has been diseased and has probably healed. Medlar^{141,142} and Band¹⁵² demonstrated healed lesions in the kidneys of patients who had suffered from tuberculosis.

Their work showed that healed tuberculous microscopic foci in the kidneys are the rule in patients dying from pulmonary tuberculosis. Their evidence suggested that the involvement of the kidneys is blood borne and bilateral and, as long as the focus is small it may heal but once it has passed beyond a certain size or involved the tubules in the pyramids of the kidneys a progressive lesion is established. These results would account for patients in whom tubercle bacilli were discovered in both kidney urines and who later developed a unilateral surgical lesion. Mack¹⁶⁰ confirmed the results of Medlar in that he found tubercle bacilli in the urinary specimens of many patients with advanced pulmonary tuberculosis, but with no urological symptoms. Menville⁶¹ on microscopic examinations of post-mortem material found evidence of renal tuberculosis in 77.7% of cases with genital tuberculosis and in his opinion it justified the belief that, in most cases the genital lesion follows the renal lesion. The most frequent pathway, Menville thought to be the tuberculous urine bathing the posterior urethra. Young⁵³ agrees that if the kidney is tuberculous, the spread is from the kidney to the prostate and seminal vesicles and thence to the epididymis. Thomas, Stebbins and Rigos⁷⁶ assert that genital tuberculosis almost always follows or is accompanied by renal tuberculosis and

that the most common genital focus is in the prostate, the bacilli reaching it from the urine.

With an established tuberculous lesion of the prostate and seminal vesicles, there are three pathways by which infection may reach the epididymis, by the blood stream, by the lymphatic vessels or by the vas deferens. The blood supply to the contents of the scrotum is threefold (Chapter 2, b), the spermatic artery supplying the testis, but also giving branches to the epididymis, the largest one passing to the globus major, the artery to the vas deferens supplying blood to the body and the tail of the epididymis and the cremasteric artery supplying the lower poles of the epididymis and testis. Also, in chapter 2,b, various lymphatic anastomoses were described, between the testis and the epididymis, between the epididymis, vas deferens, seminal vesicle and prostate and between the testis, epididymis and the kidney, which show that a lymphatic continuity exists between the epididymis, testis, vas deferens, seminal vesicle and the prostate. In the same chapter, the vas deferens was also described.

No support from clinical observations or experiments from the literature could be found to suppose that a prostatic or seminal vesicular infection may be carried to the epididymis by means of the arterial system. The arteries supplying

the scrotal contents and the prostate and seminal vesicles have no direct junction; the internal pudendal, the inferior vesical and middle haemorrhoidal arteries carry blood to the prostate, the middle, inferior vesical and the middle haemorrhoidal arteries supply the seminal vesicle, while the blood supply of the epididymis comes from the aorta, the superior vesical artery and the cremasteric branch of the deep epigastric artery.

K. M. Walker⁵⁶ asserts that tuberculous infection of the epididymis starts at the globus minor where one expects a descending infection to begin (the present writer would prefer to use the term ascending instead of descending). He supports the view that the spread takes place through the lymphatic system as, at operation, the vas deferens is very often obviously diseased in its upper and lower thirds, with the middle third free. Histological examination by Walker showed that, at the prostatic end the lymphatic channels were involved while at the epididymal end the mucosa of the vas deferens was diseased. In his opinion, these results support the lymphatic spread of the infection and the distribution suggests two opposing waves of infection, a centrifugal or primary one from the prostate to the lymphatic channels and a centripetal or secondary one in the lumen of the vas deferens due to the flow of infective

secretions from the epididymis. These findings and conclusions are repeated in a further article by the same writer in association with Hawes.²² McCrea³⁷ does not give his own view of the spread to the epididymis but he admits that lymphatic spread from the prostate and seminal vesicles is possible. He reports that tubercles have been found in the lymphatics of the sheath of the ductus deferens by Cholzoff. Dillon⁹³ concludes that the first appearance of tuberculous infection at the lower pole of the epididymis is fairly conclusive evidence of its extension from the central organs by the lymphatics down the vas deferens. Young⁵³ states that the infection may reach the epididymis from the prostate and seminal vesicle by means of the lymphatic system or the lumen of the vas deferens.

In an article on the operative treatment and pathology of acute epididymitis, Cunningham and Cook¹⁸¹ discussed gonococcal epididymitis and concluded that the infection reaches the epididymis from the prostate and seminal vesicles by way of the vas deferens. Robinson,⁴⁶ writing on the spread of tuberculosis to the epididymis mentions the vas deferens as a possible channel for infection arising in the prostate and seminal vesicles as occurs in gonorrhoea. Osmond,¹⁸² in a letter to a medical journal, raised the question of epididymitis following acute gonococcal infection

and he received answers from Doble¹⁸³ and Purcell.¹⁸⁴ Doble replied that the gonococcus formed a toxin which was sucked up the vas deferens by back pressure and caused inflammation of the epididymis while Purcell replied that the epididymitis was caused by a spread of the infection along the vas deferens from the seminal vesicle. In a discussion on non-specific epididymitis, Slesinger¹⁸⁵ regarded the lumen of the vas deferens as the route of the infection to the epididymis and he considered that the infection came from the urine, while Robinson,¹⁸⁶ in the same discussion, asserted that the infection came from the posterior urethra from the urine and passed along the vas deferens. Writing on chronic non-tuberculous disease of the epididymis, McGavin⁷⁹ mentioned three pathways for the infection to reach the epididymis, blood, lymphatic channels of the vas deferens and the lumen of the vas deferens. When the infection passes by way of the lumen of the ductus deferens, McGavin believes that the organisms reach the urine from the kidney or from the prostate and seminal vesicles. Retrograde infection then occurs and he considers that it is possible when a man is straining at heavy work, a little urine may be forced past the vesical sphincter, though without incontinence as the sphincter urethrae membranacea is still effective. The urine under pressure in the

posterior urethra is unable to pass to the exterior and may be driven by drops into the ejaculatory ducts and so to the vasa deferentia. The proof that the urine may pass upwards along the vas deferens towards the epididymis has been observed by Yates Bell,¹⁸⁷ who reviewed four cases of urinary fistulae following orchidectomy, the fistulae being through the inguinal incisions. Young⁵³ also asserts that often after epididymectomy, reflux may extend up the vas and urine may escape through a fistula in the groin, a phenomenon which has also been observed by Bailey.³⁵ Bessesen¹⁸⁸ had a case in which the urine passed through the ejaculatory duct and the vas deferens to the epididymis, since urine escaped from the epididymis after incision. The present writer had one case in which there was an escape of urine deliberately coloured with methylene blue from a fistula in the inguinal region after epididymectomy. Belfield¹⁸⁹ stated that peristalsis was a normal function of the seminal duct and that the prostatic urethra was the catch basin. He had observed retrograde urination, that is, the escape of urine through a vasostomy incision, when a strong desire to micturate had been resisted and he stated that experimentally it had been shown that argyrol in the bladder may be forced through a scrotal sound. Belfield concluded that, in patients with a frequently occurring

gonococcal epididymitis, retrograde passage of urine from the urethra to the vas deferens seemed the probable cause of recurrent epididymitis and seminal vesiculitis. Cumming and Glen,¹⁹⁰ writing on the procedure of puncture of the vas deferens as a means of cure for chronic seminal vesiculitis asserted that, in gonorrhoea, chronic seminal vesiculitis with or without prostatitis was a source of constantly recurring urethritis and epididymitis.

After his investigation of patients suffering from tuberculous epididymitis, de Langre¹¹⁷ stressed the association of renal and genital tuberculosis and he held the opinion that the prostate and seminal vesicles were always involved in cases of tuberculous epididymitis. He considered that the spread of the infection to the epididymis was carried by the urine along the vas deferens. Wells,¹³² writing on the subject of tuberculous epididymitis, was convinced that the lumen of the vas deferens was the pathway for infection to the epididymis. According to that worker, the lumen of the vas deferens is undoubtedly the route for septic infections, as the epididymitis which occurs in patients with prostatic enlargement is usually rapid in onset, a condition which is more consistent with a spread along the vas lumen than with lymphatic spread. Wells, comparing tuberculous and gonococcal epididymitis mentioned

that in gonorrhoea, the sudden onset of epididymitis often followed infection of the posterior urethra. Similarly, according to that worker, in septic cystitis, severe epididymitis may follow instrumentation, suggesting a mechanical factor rather than an exacerbation of an insidious focus such as you might expect in lymphatic spread. Braasch¹⁰⁷ and Webb-Johnson,⁵⁹ support Wells in the view that septic infections may pass along the lumen of the vas deferens and infect the epididymis and both authors assert that acute epididymitis may be prevented by vasectomy prior to a trans-urethral or surgical prostatectomy. Webb-Johnson also states that in influenza, typhoid and bacillus coli infections the epididymis is infected by way of the vas deferens. Nitschke¹⁹¹ supports these workers and he concluded that a patient with a posterior urethritis should not allow his bladder to become distended as pressure will be conveyed to the posterior urethra and that may force infection along the lumen of the vas deferens.

Experimentally, Rolnick⁹⁰ found that he was unable to inject fluids through the vas deferens beyond the tail of the epididymis and he concluded that bacteria from an infected seminal vesicle travel along the lumen of the vas deferens but are prevented from passing upwards beyond the tail by the same mechanical or anatomical factors that

prevented the forcing of fluids beyond the tail. Cooper⁹¹ also believed that there was an obstruction in the globus minor and he decided that there was a valve present. In an article on the mechanism of epididymitis, Rolnick¹⁰ decided that extension of disease to the epididymis by way of the lymphatic channels had not been demonstrated, clinically or experimentally. Infection along the sheath of the vas deferens was possible, in his opinion, but an unlikely occurrence, and he was convinced that all the available evidence pointed to the lumen of the vas deferens as the pathway. Rolnick quoted Lommel who produced epididymitis experimentally, by allowing infectious material to pass up the ejaculatory duct, and the rapid onset of the disease indicated the route by the duct lumen. In the section on the local physiology, Chapter 2.c., it will be remembered that mention was made of the fact that the vas deferens when stimulated, undergoes true peristalsis from the epididymis to the posterior urethra. Peristalsis of the vas deferens undoubtedly occurs during coitus and the peristalsis was first demonstrated by Fick in 1856 and since then has been confirmed by Waddell¹² and Macht.¹³ Lommel¹⁴ has also shown that stimulation of the hypogastric nerves or irritation of the verumontanum produces active waves of peristalsis. According to Rolnick, reverse peristalsis has never been demonstrated but it has been shown that when

fluid is injected into the vas deferens and the vas then stimulated, the fluid progresses backwards by gradual stages to the epididymis following each peristaltic wave towards the posterior urethra, and so the fluid enters the epididymis. Lommel noted that bacteria will not pass up the ejaculatory duct from the posterior urethra if the verumontanum is normal but when it is inflamed the passage of the bacteria is possible. Belfield¹⁸⁹ demonstrated that urine may pass through a needle in a vasostomy wound when the ejaculatory duct was patulous and relaxed. Rolnick concluded from his study that, with the involvement of the verumontanum during a posterior urethritis, organisms may be drawn in or carried up the ejaculatory duct. He further added that normally the sphincter of the ejaculatory duct is in a tonic state of contraction but when inflamed it loses its tone and organisms may enter and travel upwards. A resulting oedema and partial or complete occlusion of the ejaculatory duct on the affected side now occurs and the seminal vesicle, which has now become involved, has very little or no drainage through the swollen ejaculatory duct. The organisms and pus in the seminal vesicle and ampulla increase and, having little or no means of egress, are finally kicked back to the epididymis, as a result of active peristalsis of the vas deferens. The inflammatory oedema which develops, when

the epididymis is infected, occludes the tubule at the junction of the tail and vas deferens. At the junction of the upper end of the globus minor and the body of the epididymis the upward extension of the process within the tubule becomes blocked as a result of the mechanical factors, possibly the valvular arrangement described by Cooper, and, in this way, organisms and pus are locked in the tail of the epididymis. Tension in the tail increases and inflammation around increases, and the organisms are carried through the intercellular space, lymphatics and capillaries to the surrounding tissues, to the body and globus major by peri-epididymitis.

George Walker⁸⁷ reported that Oppenheim and Löw had found that by stimulating the hypogastric nerves, they could produce reverse peristalsis. These workers also achieved the same result by stimulation of the verumontanum and they concluded that with infection of the posterior urethra, irritation may produce reverse peristalsis. O'Connor¹⁹² reported two patients with retention in whom the bladder was emptied and a silver solution inserted. The following morning, vas ligation was carried out prior to cystoscopy and indwelling catheter insertion, and when the vas deferens was opened the silver solution was obtained. In his discussion, O'Connor recapitulated the story of the two patients

with silver solution in the lumen of the vas deferens following bladder instillation, after catheterisation. The solution was recovered at the time of vas resection, less than 24 hours after, and the patients had urinated several times in the interim. He concluded that these findings support the experimental work of Rolnick, claiming that infection progresses from the posterior urethra to the tail of the epididymis by way of the lumen of the vas deferens. O'Connor continued his conclusions by saying that these observations strengthen the belief that epididymitis occurring after the vasa have been ligated, is probably due to a pre-existing deposit of infective material in the tail of the epididymis and not to subsequent infection by the lymphatics or along the sheath of the vas deferens.

The present writer is convinced that his own results lend support to the view that the spread of tuberculosis to the epididymis takes place, in the majority of cases, by the lumen of the vas deferens. He found that the incidence of tuberculous epididymitis was highest during the years of maximal sexual potency, when the peristalsis of the vas deferens would be expected to be most active. Furthermore, from the anatomy of the vas deferens he found that the vas consisted of a thick layer of unstriped muscle running in a longitudinal direction only, with the mucosa arranged in

longitudinal folds. With active peristalsis of that structure, it is reasonable to suppose that actual shortening of the vas deferens occurs, followed by relaxation with possible resulting suction towards the epididymis. That reasoning does not take into account the views of Oppenheim and Löw who reported that they had demonstrated reverse peristalsis, which if true, would certainly account for the spread of infection to the epididymis. The writer is also convinced from his study and from his experience since this investigation started, that patients with tuberculous epididymitis have or have had a tuberculous bacilluria from a clinical or so-called sub-clinical lesion of the kidneys. He feels that in many of these cases, the kidney lesion becomes quiescent or even heals and urological symptoms may never occur. The urological symptoms manifest themselves at a late date in renal tuberculosis and most clinicians are prone to wait for these before suspecting renal tuberculosis. Within recent years, it has been the practice in Robroyston Hospital to investigate fully all cases of tuberculous epididymitis with or without urological symptoms and the percentage showing renal involvement as demonstrated by the isolation of the tubercle bacillus from the kidney urine, has been almost 100%. Many of these patients have not shown destructive lesions of the kidney as judged by intravenous or retrograde pyelography and close observation has

been instituted as a practice in these cases.

The tuberculous prostate or seminal vesicle appears to be the link between the kidney and the epididymis. With tubercle bacilli in the urine, the step is a short one to the posterior urethra and thence to the prostate and seminal vesicles. It is possible, as suggested by one writer, that heavy work or straining may force a little urine into the posterior urethra, past the vesical sphincter and the urine under pressure there may be forced into the ejaculatory ducts and so to the vasa deferentia. In a patient with tuberculous cystitis following renal tuberculosis, it is easy to appreciate how an irritable bladder tends to force urine into the posterior urethra, often at a time inconvenient for micturition, and in such a case even if the patient resists the warning, a small amount of urine with tubercle bacilli may lodge in the posterior urethra. Part of the mechanism of micturition takes place in the posterior urethra and again, urine containing tubercle bacilli may lodge there. By these methods infection of the prostate and seminal vesicles probably occurs and the risk of extension to the epididymis by way of the vas lumen is always present. With involvement of the prostate and seminal vesicles the corresponding lymphatic channels are probably next to be invaded and the obvious chain of channels along the vas deferens

may be palpably involved. When the epididymis becomes involved, the lymphatic channels, particularly these draining the area of the globus minor, also become involved and clinically the channels which accompany the artery to the vas may be enlarged. In that way, the clinical picture, described by Walker⁵⁶ and also noted by the present writer, of epididymitis associated with thickening of the lower and upper thirds of the vas deferens with the middle third free of disease, may be observed. The writer feels that this condition is due to prostatitis, seminal vesiculitis, and epididymitis with centripetal and centrifugal lymphangitis; a lymphangitis which is not continuous and therefore is unlikely to have had any influence on the occurrence of the epididymal lesion. Recently the writer had a case of vasitis, prostatitis and seminal vesiculitis without epididymitis. The histological examination showed occlusion of the vas deferens with tuberculosis of the surrounding tissues, a condition which would be noted clinically with ease if it were always a precursor of epididymitis.

Against the theory of blood spread of the infection to the epididymis the writer might add that there is no case record in Robroyston Hospital where there was coincidental tuberculosis of the fallopian tube and the kidney. Also, the frequency of bilateral involvement of the epididymis is

in favour of a local spread, since in surgical tuberculous lesions where blood spread is accepted, for example, in the joints or in the bones, it is an extreme rarity to have symmetrical involvement. In the case of renal tuberculosis where blood-borne bilateral involvement is accepted, the bilaterality occurs at or about the same time. With the same blood supply to the testis and epididymis, and moreover, with a large branch of the spermatic artery passing to the globus major, it would indeed be strange if the primary superficial genital lesion were usually situated in the globus minor of the epididymis were one to accept the theory of haematogenous origin.

Finally, in the results of treatment, the writer will review 12 patients with unilateral epididymitis in whom vasectomy of the healthy vas deferens associated with the healthy epididymis, was carried out and follow-up of most of these cases over some years has yet failed to show an epididymal lesion.

CHAPTER 9THE TREATMENT OF TUBERCULOUS EPIDIDYMITISA. (a) Conservative Procedures.

1. General.
2. Ultra Violet Light (Heliotherapy)
3. Radiotherapy.
4. Phototherapy.
5. Tuberculin.

(b) Operative Procedures.Local Operations.

1. Curettage of Epididymis.
2. Epididymo-vasectomy or Epididymectomy
with (a) injection into the vas deferens,
(b) vasectomy on the contra lateral
side in unilateral cases.
3. Orchidectomy.

Radical Operations.

1. Radical operation (Young)
2. Radical Operation (Loughnane)

(a) Conservative Procedures.

1. General. To those treating tuberculosis in its protean manifestations, general conservative treatment must always be the key-stone on which is built the hope of ultimate improvement and cure. No matter what may be the

localisation of the tuberculous lesion, whether it be the larynx, the lung, the bone or the joint, the first line of treatment always aims at resting the affected part and it is generally realised that body rest, at least initially, plays an essential part in local rest.

The sanatorium régime, with its rest hours, fresh air, nourishing food and life under hygienic conditions, is by many considered to be ideal for the treatment of genital tuberculosis. A further point in favour of sanatorium treatment is the presence of other tuberculous lesions, which, as was seen in a previous chapter, are obviously present in a large percentage of cases and in fact were present in 88.3% of the present series. Most of the investigations dealing with the results of treatment of tuberculous epididymitis are concerned mainly with the various operative procedures, but as many of these operations were undertaken in a sanatorium, it may be assumed that the authors were in favour of that régime. Colby⁶² and Herman⁴⁸ maintain that pre-operative and post-operative sanatorium care are essential, while Robinson⁴⁶ stresses the value of fresh air, food and rest as adjuvants to operative procedures. Horwitz⁶⁹ considers that hygienic and climatic influences play important parts in the treatment of genital tuberculosis, especially in the post-operative period.

Local rest, advocated by Thomson-Walker⁴⁴ and Herman,⁴⁸ may be maintained by the use of a suspensory bandage or by the testes being elevated by a pad of wool or a bridge of adhesive strapping across the thighs.

2. Ultra Violet Light (Heliotherapy). Miller and Lustock²⁷ give great support to ultra violet light in the treatment of tuberculous epididymitis and they also advise radiation of the prostate and seminal vesicles if these organs are involved. Miller,¹⁹³ in a further article, stresses his liking for quartz-light therapy but says that the treatment of genital tuberculosis is essentially surgical when the lesion can be extirpated. Webb-Johnson⁵⁹ also favours ultra violet light, as does Wang,¹⁹⁴ the latter preferring it for post-operative sinuses. Thomas and Kinsella¹⁹⁵ believe that heliotherapy is beneficial in genital tuberculosis but that it should not exclude surgical procedures.

Young⁵³ states that he has found remarkable cures or arrestations in a few cases of very extensive urogenital tuberculosis, in which surgical intervention was contra-indicated, the treatment used being that of rest, feeding and fresh air with heliotherapy the most effective curative agent. He has seen the marvellous effects of the sun's rays in a dry climate, in cases of surgical tuberculosis

where, extensive tuberculous disease of bones and joints, fistulae and ulcerative processes cleared up under heliotherapy combined with sanatorium treatment. Humphris¹⁹⁶ finds it difficult to restrain his enthusiasm when writing about ultra violet light in the treatment of cases of surgical tuberculosis but he properly advises extreme caution when the patient suffers from pulmonary tuberculosis. Rollier¹⁹⁷ holds the opinion that there is no localisation of tuberculosis of which the reaction towards sunlight is more diverse than the tuberculous epididymis. Sometimes he finds that even when voluminous caseous nodules are present, absorption begins at once and continues rapidly; in other cases, he finds that the tendency to retrogression is very slight. In the latter type of case he recommends opening the lesion, allowing it to drain and then treating it with direct sunlight. Rollier admits that numerous contra-indications have been advanced to heliotherapy in phthisis but the only one he believes to be valid is one, not confined to pulmonary tuberculosis, but met with in all forms of the disease. When a patient is obviously ill from his disease with marked toxæmia and hectic fever, the sunlight treatment is liable to do more harm than good and should not be used, in his opinion, at least, until rest has improved the patient's general condition. Rosselet¹⁹⁸

concludes from his work on the subject, that success in heliotherapy must not be attributed solely to the action of the light, as, the quality of the air breathed and of the nutrition absorbed, are, with rest, also factors of great importance. He agrees with Humphris that both general and local irradiations are desirable and that if anything, the general irradiation must be regarded as the more important. Bumpus and Thompson⁶⁰ and Bailey³⁵ consider heliotherapy beneficial in the treatment of genital tuberculosis, but Wildbolz⁷⁴ found it disappointing.

3. Radiotherapy. Amstad¹⁹⁹ admits that his experience of radiotherapy in the treatment of tuberculous epididymitis is confined to the advanced case, either bilateral, or where a previous operation had removed one testis. He feels that in this type of case which, in some hands would be castrated, conservative treatment is the method of choice. The treatment of a dozen such cases has convinced him that radiotherapy is most efficacious. He does not advocate its application in recent cases, or in very acute ones, since the reaction provoked may be much more violent than is desirable and considers that this form of treatment should be given carefully by skilled hands and that it constitutes a useful adjuvant to heliotherapy. Ullman,²⁰⁰ after observation of 24 cases over a

period of 8 years, concluded that X-ray therapy was very valuable for testicular disease while Vogt²⁰¹ considered that form of therapy beneficial when operation was contra-indicated. Fruend,²⁰² on the other hand found radio-therapy of doubtful value in cases of genital tuberculosis, but considered that it may check further extensions, although he thought it wise to remove the diseased areas by surgical means.

4. Phototherapy. Amstad¹⁹⁹ does not favour phototherapy by itself and he believes that the arterial hyperaemia which results is certainly an important and an easily demonstrable factor in the action of the sun's rays, but it is very doubtful if it is the chief factor in heliotherapy. Lowsley and Kirwin⁴⁰ do not favour this form of treatment in patients with tuberculous epididymitis while Thomas and Kinsella¹⁹⁵ advocate hot applications or sitz baths to alleviate the pain and swelling in acute epididymitis.

5. Tuberculin. Sutherland²⁰³ favours tuberculin therapy in the treatment of tuberculosis, especially non-pulmonary conditions, but he does not give any results of the treatment of genital cases. He maintains that beneficial results are obtained in patients suffering from renal tuberculosis. Sutherland considers that tuberculin may

be used in any afebrile case of pulmonary tuberculosis, irrespective of the extent of the disease, but he prefers that the tuberculous lesion be early or one with doubtful X-ray signs in which the diagnosis had only been confirmed by the subcutaneous tuberculin test. Morson³⁰ and Young⁵³ found tuberculin therapy very disappointing in their hands and the latter writer published results observed after several years, of 35 cases of genital and urogenital cases which, for various reasons were not operated upon and most of whom received tuberculin.

TABLE NO. 70

Results, after several years, of 35 cases of Genital and Urogenital Tuberculosis treated by Tuberculin.

(Observed by Young)

	No. of Cases	Dead	Improved	Unimproved	Well
Genital Cases	17	5	2	6	4
Urogenital Cases	18	9	3	6	-

Young concluded from the results shown in table number 70 that a certain small proportion of cases of urogenital tuberculosis may recover spontaneously or be arrested for a long time but that these results demonstrate the hopeless inferiority of non-operative treatment in general. Lelongt²⁰⁴

claimed a 33% cure in 70 cases with tuberculin therapy and Freshman²⁰⁵ also favours conservative treatment with tuberculin but gives no results. Webb-Johnson,⁵⁹ Barney and Colby,³¹ O'Neil and Hawes,²⁰⁶ Herman⁴⁸ and Cunningham,²⁴ have all found that tuberculin therapy is most useful after some form of operation for the removal of the diseased areas. Bailey³⁵ considers that it can do no harm and therefore he advises a post-operative course and he mentions the dosage recommended by Nitch as follows:- 12 injections of Koch's T.R. at weekly intervals commencing with a dose of 1-10,000 m.g. and increasing each week by 1-10,000 m.g., the maximum dose of 1-1,000 m.g. being given during the 10th, 11th and 12th weeks. Thomson-Walker⁴⁴ advises tuberculin (T.R.), the commencing dose being 1-10,000 m.g., rising to 1-1,000 or 1-800 m.g. Lowsley and Duff¹³⁰ advise tuberculin therapy in the treatment of prostatic tuberculosis.

(b) Operative Procedures.

Lee and Bowes¹⁷⁵ in an excellent article on the results of the treatment of genital tuberculosis in the male, found that general treatment, rest and tuberculin improve some but in the majority of cases these forms of treatment fail to stop the spread of the disease and they concluded that

surgical procedures were completely justified. The great majority of surgeons who treat genital tuberculosis concur that, when possible, some form of operative treatment is advisable and even necessary. The writer, sifting a large number of articles on this subject, has been unable to find one authority who advises purely conservative treatment for all cases. The usual contra-indications to operation are, advanced extra-genital lesions or the existence of a degree of medical or surgical illness which would make the risk of operation unjustifiable. Disagreement does arise however in the choice or type of operation to be employed in tuberculous epididymitis, the real disagreement having lasted almost 25 years since Young,²⁰⁷ a skilled operator in prostatectomy by the perineal route, introduced his revolutionary ideas in his paper "The radical cure of tuberculosis of the seminal tract", published in 1918, in which he described an operation for the removal of the seminal vesicles, ampullae, and both lateral lobes of the prostate through the perineum and the epididymis and vas deferens through the groin. Before that publication, most surgeons had undertaken some form of local operation varying from curettage of the epididymis to complete removal of the scrotal contents, these procedures still being practised by some to this day. Finally, a plea for early

operation was advanced by Robertson and Gilbert²⁸ who reviewed 7 cases from the literature with one personal case, of co-existent cancer and tuberculosis of the testis.

1. Curettage of the Epididymis. Keyes²⁰⁸ reported in 1928 that several Italian surgeons were treating tuberculous epididymes by curettage, with favourable results. The procedure adopted consisted of injecting small amounts of an iodine solution into the tuberculous nodule when this had not undergone caseation. If caseation had supervened the nodule was incised, the cheesy portion being curetted out and 10% iodoform and glycerine injected, these injections being repeated on the 3rd and 7th days as healing progressed. To those familiar with bone and joint tuberculosis, the analogy with the antiseptic paste injections advocated by Calot is too obvious to be missed.

Five cases of curettage were reported by Keyes and he submits that the procedure is desirable in people with one testis removed. His technique consisted of splitting the epididymis through its length, curetting out all the tuberculous foci and leaving the focus open with the edges sutured to the skin. He found that healing was slow but usually about eight or nine months later only a nodule remained with a sinus, the rest of the epididymis being

normal. At this point he excised the remaining areas of tuberculosis. To those unskilled in epididymectomy this procedure offers an alternative to the hazards of epididymectomy, where one testis has already been removed and certainly avoids endangering the blood supply of the remaining gland. Thomson-Walker⁴⁴ also reported favourably on curettage of the epididymis.

2. Epididymectomy. The history of operations on the epididymis was written by Marinesco²⁰⁹ in 1912. Berard²¹⁰ in 1834 performed the first known partial epididymectomy, partaking of the nature of a curettage of the cauda of the epididymis, and by 1851 Malgaigne,²¹⁰ Jobert²¹⁰ and de Lamballe²¹⁰ were performing complete and extensive epididymectomies. Bardenheuer²¹⁰ in 1880 is credited with the first real description and showed its value in 34 cases. Villeneuve²¹⁰ gets the credit of performing the first epididymectomy in France in 1889 and he emphasised the great value of the testis for its internal secretions as well as for its psychic effect. Young⁵³ reviewing the operation of epididymectomy states, "The introduction of this operative procedure so long ago should have put an end to the unnecessary removal of the testis which is alas, the common practice among surgeons the world over to this day." The operation is referred to by Barney and Colby³¹ as epididymo-vasectomy and they state that it was perfected by Cabot and

described by Cabot and Barney²¹¹ in 1913. They advised division of the vas deferens beyond the internal abdominal ring, usually free in that area, an observation which has also been made by K. M. Walker,⁵⁶ Lapeyre¹⁰¹ and the present writer. In the opinion of Barney and Colby, castration may be necessary but if possible, even a little part of the testis should be left as it shows a great tendency to heal. Among the surgeons who have reported on the treatment of genital tuberculosis, the following favour epididymectomy as the operation of choice:-

Barney ³⁴	Spitzer ⁴¹	Caulk ¹¹⁰
Barney and Colby ³¹	O'Neil and Hawes ²⁰⁶	Bissell ²¹³
Thomson-Walker ⁴⁴	Söderlund ²¹²	Webb-Johnson ⁵⁹
Wang ¹⁹⁴	Greenberger, Greenberger and Alexander ²⁶	
Cunningham ²⁴	Bumpus ¹⁶⁷	Cecil ^{214,215}
Campbell ^{83,84}	Robertson & Singer ³⁶	Osgood ⁶⁵
Keyes ⁵¹	Nitch ⁹²	Robinson ⁴⁶
Morson ³⁰	de Langre ¹¹⁷	Thomas & Kinsella ¹⁹⁵
Ormond and Meyers ³²	Hunt ⁴⁷	Eisendarth & Rolnick ⁵
Wells ¹³²	Negley ²⁸	Wildbolz ⁷⁴
Braasch ¹⁰⁸	Bumpus & Thompson ⁶⁰	Herman ⁴⁸
Hammond ⁶⁴	Bailey ³⁵	

The end results of cases of genital tuberculosis treated

by epididymectomy vary greatly. Lapeyre²¹⁶ reported 75% cured and stated that survival from four to ten years after operation was expected. Cunningham²⁴ in 32 cases had 62% cured, 7 having died within 10 years, while Simon²¹⁶ reported that 54 out of 92 men were alive and free of tuberculosis but he did not state any time. Results obtained by other workers are:-

Von Bruns ²¹⁶	reported 46% unilateral cases cured, 3-34 years
	56% bilateral cases cured, 3-30 years.
Berger ²¹⁶	60.4% cured, no time stated
Wildbolz ²¹⁶	80% cured after 'bilateral castration'
Frohnstein ²¹⁶	80% cured for 10 years

Hunt²¹⁶ followed 49 cases operated on at the Mayo Clinic, by single or double epididymectomy with or without castration. The percentage well or greatly improved was 88.5%, and he found the testis atrophied in 40%, unchanged in 52% and larger in 8%. Marion²¹⁶ followed 25 cases for several years and found that 4 died from 1 to 7 years later of pulmonary tuberculosis, their genital lesion being cured. In two cases later castration was necessary and in 19 or 76%, a cure resulted.

Following a unilateral operation several investigators have noted the recurrence rate of involvement of the other side. In 166 unilateral cases, Boguljüboff²¹⁷ noted a

recurrence rate of 76%. Berger²¹⁸ noted a recurrence rate of 60.4% and Barney³⁴ found that of 49 cases of unilateral disease, within 3 years of orchidectomy 37% had disease of the opposite side. Keyes⁵¹ had a recurrence rate of 60.9% in a similar series, while Young⁵³ followed 85 cases treated by simple orchidectomy and found that 46% remained well or improved, while 31% of 45 unilateral cases recurred on the opposite side. Young's operative mortality was nil and his remote mortality was 29%.

Lee and Bowes¹⁷⁵ in their comprehensive survey into the results of surgical treatment of genital tuberculosis in the male, reviewed much of the available literature on the subject. They cited the results of 89 personal cases treated between 1921 and 1930, and reviewed during 1932. The majority of these patients had either orchidectomy or epididymectomy carried out, but a small group had undergone the radical operation of Young, named by the writers orchido-vaso-vesiculectomy. A further small group of patients had no operative procedure for their genital disease, conservative treatment only being used. The results found by Lee and Bowes were as follows:-

Group 1 - Conservative Treatment Only.

11 Cases. Pulmonary tuberculosis present in the majority.

Present condition on review:-

Apparently active	1	(bilateral)
Apparently inactive	6	
Dead (phthisis)	4	

Group 2 - Local Operation.

62 cases, 21 with involvement of the seminal vesicles prior to operation.

Apparently cured	29 (6 bilateral)	46.6%
Recurrence in prostate or seminal vesicles	3	4.9% (1 bilateral)
Recurrence in opposite epididymis	22	35.5%
Died without further urogenital lesions	8	13.0% (1 bilateral)
Gross recurrence rate	40.3%	

Recurrence of opposite epididymis in 54 unilateral cases, 40.7%

Group 3 - The 21 cases of Group 2 with Seminal Vesiculitis.

Apparently cured	10	47.6% (2 bilateral)
Recurrence in opposite epididymis	8	38.1%
Died without further urogenital lesions	3	14.3%
Gross recurrence rate	38.1%	

Recurrence rate of opposite epididymis in 19 cases, 42.1%

Group 4 - Radical Operation.

16 cases with seminal vesicles involved in all.

Apparently cured	9	56.3%
Recurrence rate of opposite epididymis	6	37.5%
Post-operative deaths	1	6.2%
Gross recurrence rate	40.1%	

Recurrence rate of opposite epididymis in 14 uni-
lateral cases, 42.9%

Lee and Bowes found that the cause of death could not
always be ascertained.

<u>Cause of death ascertained.</u>		<u>Cause of death not ascertained</u>
Immediate -		
Post-operative	1	5 Cases
Remote -		
Pulmonary)	
Tuberculosis) 7	
Miliary Tuberculosis)		
Renal Tuberculosis	1	
Probable Tuber- culosis	5	Total 19

These writers concluded that their mortality rate from
all causes, from 2 to 12 years, was 21.3% and that the re-
currence rate was about 40%.

Barbilian²¹⁹ studied the late results of epididymectomy
in genital tuberculosis. In 145 cases there were done,

48 castrations, 5 incisions or incisions with curettage, and 92 epididymectomies. He investigated 25 of the last group two months to 23 years after operation, with the majority within 2 to 4 years after operation. Three had died (1 of appendicitis, 1 pleurisy and 1 cachexia associated with a tuberculous knee) and of the remaining 22 cases, he found no mental disturbances which in his opinion often follow castration, and no atrophy of the testis. Bar-bilian also found that epididymectomy may cause a retrogression of disease elsewhere, for example in the prostate and seminal vesicles. He stated that a definite cure may be obtained if there is no testicular infection and even when the microscope might reveal such invasion the results are satisfactory and he concluded that these good late results made epididymectomy rather than castration the operation of choice.

Additional Procedures to Epididymectomy.

(a) Injection into the vas deferens.

Some surgeons, of whom von Bungner²¹⁶ was the earliest, have suggested an additional procedure to epididymo-vasectomy. Instead of simple ligation of the cut end of the vas deferens, they injected iodoform and glycerine or phenol along it with a view to hastening a cure in the seminal vesicles.

Young²²⁰ later suggested that the vas should be injected with pure carbolic acid, 1 to 2 ccs., and then brought out through the wound in the groin and sutured to the skin for drainage and if possible for further injections. Cunningham²⁴ modified that procedure by washing one drachm of crude phenol up through the vas into the bladder which had four ounces of water inside. He maintained that the results were good but the practice has ceased as far as can be judged from the current literature.

(b) Vasectomy on opposite side.

Barney³⁴ quoted Legueu as having stated "In the presence of bilateral vesicular disease the second vas should be systematically ligated in the course of a unilateral operation. We then avoid at once the infection of the healthy testicle and serious involvement of the prostate." Lapeyre, according to Barney was more radical and resected the healthy vas deferens as a routine measure and he stated that, after double section of the vasa as after double castration, the cure of vesiculo-prostatitis was more frequent than after a unilateral operation.

While Barney himself believes that the initial epididymal infection is blood borne, he has been unable to settle to his own satisfaction the mode of onset of the

second side. He considers that vasectomy is helpful in preventing the spread to the second epididymis. Negley²⁸ advocates vasectomy on the healthy side owing to the high percentage of cases becoming bilateral, while Wells¹³² agrees but stresses the need of having the patient's consent. Braasch¹⁰⁸ and Cecil^{214,215} both recommend vasectomy, also Robertson and Singer³⁶ who consider that the second epididymis is involved by spread down the vas deferens from the seminal vesicles and prostate. Webb-Johnson⁵⁹ holds the view that the procedure brings the seminal vesicles to rest and also prevents spread. Morson,³⁰ and Barney and Colby,³¹ state that the principle of vasectomy is good as infection from the prostate and seminal vesicles may be ascending. Other authorities who advise vasectomy of the healthy vas deferens are, McCrea,³⁷ Campbell,^{83,84} and Thomas and Kinsella.⁸²

Frequently the writer has met with opposition from a patient with unilateral epididymitis, when section of the vas deferens associated with the healthy epididymis, has been proposed. It will be remembered that the incidence of tuberculous epididymitis is highest during the years of maximal sexual potency and in this series under review, 252 or 62.69%, occurred between the years of 16 and 35 (chapter 3). The opposition from the patient is usually

twofold, one reason being advanced without hesitation and the other, with some diffidence. The former reason, is the difficulty experienced by the patient of understanding the necessity or advisability of an operation on the normal as well as the abnormal side; the latter is the unwillingness of a patient to forego the pleasures of parenthood and, as he imagines the satisfaction of physical sexual relationship.

Barney⁶⁴ found that in 85% of patients with genital tuberculosis examined, the semen did not contain spermatozoa even with only one epididymis involved. Keyes⁵¹ agrees with these findings of Barney and says that it is probably accounted for by the obstruction of the vasa deferentia, that of the healthy side being obstructed at the urethral end by the prostate. Belfield⁹ states that the formation of spermatozoa by the testes is unnecessary for normal life, and without it, sex power, desire and masculinity are unaffected. He concluded that spermatogenesis is not an essential function of the testis. Marinesco¹⁰⁹ agrees that even after double epididymo-deferenterectomy, sexual powers are unimpaired while Horwitz⁶⁹ found that after epididymo-vesectomy there was no testicular atrophy or sexual weakness, a finding confirmed by Vecki.²²¹ Simon, according to Barney, reported that sex function remained normal for from 10 to

20 years in 29 cases of double castration, and Sandford²²² observed, that while sex potency is rarely affected by genital tuberculosis, sterility is the rule even with involvement of but one epididymis and he suggested occlusion on both sides in the vesicles as the cause. Simmonds²²³ found tubercle bacilli in the semen of patients suffering from genital tuberculosis, a finding which was accepted by G. Walker. Papin,²²⁴ in a paper on genital tuberculosis in women, asserted that women might contract the disease from men with tubercle bacilli in the semen, a fact which he says was proved by Gorowitz.

Accepting the conclusions and the results of these workers, his senior colleague and the writer have for many years proposed the procedure of vasectomy of a healthy vas deferens, to a patient with unilateral epididymitis, only after it has been explained fully to that patient the probability of sterility, the risks of local spread if the operation is not carried out and the continuance of sexual potency if the operation is carried out.

3. Orchidectomy.

The procedure of orchidectomy has found disfavour in the treatment of tuberculous epididymitis by all the surgeons who advocate epididymectomy and also by those who practise

the radical operation. In the acute form of the disease, Walker and Hawes²² advise orchidectomy while Eisenstaedt⁹⁹ reported that tuberculosis of the testis in children was due to a spread of the disease by way of the blood stream and that orchidectomy was the only suitable treatment. Writing on the subacute and chronic forms of tuberculous epididymitis, Barney and Colby³¹ advised leaving even a little of an involved testis as it shows a great tendency to heal.

Söderlund²¹² investigated statistics of a series of patients, 37 of whom had undergone unilateral orchidectomy and 24 epididymectomy. The immediate results were in favour of castration to judge by the frequency of dismissal with fistulae, 20% after castration and 50% after epididymectomy; the late results were in favour of epididymectomy. The 37 castrated patients were followed up and of 27 traced, 6 were dead and 6 had tuberculosis of the other epididymis. With the exception of one case, all these recurrences and fatalities occurred within 3 years of operation. The 20 patients on whom an epididymectomy had been performed, were traced and Söderlund found that 3 were dead and only 2 showed extension of the disease to the other side. He concluded his article on the subject by favouring epididymectomy as the operation for genital tuberculosis.

Finally, it is the contention of these surgeons who practise epididymectomy or orchidectomy, that the lesion of the prostate and seminal vesicles which usually precedes epididymitis, heals after these operations. Among the surgeons who lay much stress on this point are, Robinson,⁴⁶ Eisendarth and Rolnick,⁵ Herman,⁴⁸ Barney,³⁴ and Braasch.¹⁰⁸ Barney and Colby³¹ investigated a series of 113 patients in whom disease was present in the prostate and seminal vesicles 69 times. Some time after the operation they found that the prostatitis and seminal vesiculitis had cleared up in all but 2 patients in whom perineal infiltration occurred. Kretschmer^{112,113} has found that calcification of the seminal vesicles may occur following tuberculous infection.

RADICAL OPERATIONS.

1. Radical Operation (Young)⁵³

The group of surgeons who advise and carry out a radical operation, believe that genital tuberculosis begins in the prostate and seminal vesicles and from there spreads to the epididymis and they hold the view that any operative procedure for the correct treatment of tuberculous epididymitis must include removal of the seminal vesicles and part of the prostate.

According to Young, the pioneer and greatest advocate

of the radical operation by the perineal route, the first seminal vesiculectomy was carried out by Ullmann in 1889. Twelve years later 32 cases were to be found in the literature on this subject. Young developed the operation and advocated removal of the seminal vesicles, ampullae, and both lateral lobes of the prostate through the perineum, after which the epididymis and vas deferens were extracted through the groin, both operations being carried out at the one session. He found that where only one vesicle was removed the chance of involvement of the remaining epididymis was almost as great as after simple epididymectomy and where the entire diseased areas were radically removed, it could be done without opening the urinary tract. He also found that after the radical operation, micturition returned to normal and even coitus was only slightly impaired, the ejaculated fluid being much less in amount.

Young reviewed the results of radical excision of the seminal tract in 24 cases with the following results:

Operative Deaths	1	Mortality	4%
Alive and apparently cured of genital tuberculosis		13,	54%
Alive but cannot be called well (2 having bladder symptoms and 1 a urinary fistula)		3,	12.5%

During 9 years, 5 have died, all of tuberculosis. One has a troublesome urinary fistula and 3 have prostatic fistulae from which a few drops of urine escape during micturition. He considers these as safety exits which usually heal as soon as the tuberculous process is completely healed. Sacco²⁰⁵ reported a series of cases in which there were 33% failures with simple castration and 100% cures with orchi-vaso-vesiculectomy (8 cases). Dillon⁹³ is an advocate of the radical operation but gives no results. Whiteside uses epididymo-vasectomy when the disease is early or moderate, that is, epididymitis, vasitis and slight prostatitis. For late cases Whiteside¹⁸⁰ uses the radical operation and discusses 22 cases in which the testis, epididymis, vas deferens, seminal vesicles and prostate on one or both sides were removed. He found that he obtained an absolute cure in 4, 9 died of pulmonary tuberculosis, 3 died within months of local infection and 6 he could not trace. His operative mortality was nil. Quinby¹²⁵ reported 7 cases in which the radical operation had been carried out, with good immediate results.

2. RADICAL OPERATION (LOUGHNANE).²²⁶

Loughnane's epididymo-vaso-vesiculectomy is carried out "en bloc", by the inguinal route at one sitting. He demonstrated 4 specimens from patients treated in that way, in one of whom urine escaped through the wound.

B. TREATMENT AND EARLY RESULTS OF PRESENT SERIES.

In Robroyston Hospital, where over 600 patients with pulmonary and all forms of non-pulmonary tuberculosis are treated, the basis of possible cure is rest and conservative treatment. It has been recognised that tuberculosis is a constitutional disease, and unlike the procedure in a general hospital, patients when admitted need not necessarily be considered as suitable for early surgical intervention, but it has been found from experience that they gain materially from a prolonged period of rest and careful watching before surgical measures are considered. The problem of choosing the proper time and the procedures to be carried out rests mainly with the writer and his senior colleague. While this may not be the place to make a categorical statement, the consensus of senior opinion in Robroyston Hospital is that genital tuberculosis is a sequel to renal tuberculosis, which in itself is secondary to some other tuberculous focus. These extra-genital tuberculous lesions must be investigated and if necessary treated, and frequently these lesions present their own separate and difficult problems. One of these problems is the estimation of the effect of a genital operation on the extra-genital lesions. It may be argued that the question of a genital operation should not arise, but from experience, it has been found

that there are several advantages to be gained by an operation on the superficial genitalia. It has long been realised that to operate and control a focus of tuberculosis is frequently followed by an improvement and, with continued sanatorium treatment, even possibly healing, of distant tuberculous lesions. Frequently the visiting urologist is presented with a case in which tubercle bacilli have been isolated from both kidney urines, and consequently it is known that the patient suffers from bilateral renal tuberculosis. If the intravenous and retrograde pyelograms show marked distortion of one kidney, with the other kidney shadow appearing normal, the urologist has made it a practice to remove the obviously diseased kidney. Follow-up of these cases often shows that months or years later, the pyelograms of the remaining kidney are normal and the urine is free of pus and tubercle bacilli and the kidney has been presumed healed. The writer's senior colleague frequently has to decide how to treat a patient with advanced cavitation disease in the upper part of one lung with a small lesion in the upper part of the other lung. With a failure of the less radical forms of collapse therapy, he is often compelled in the patient's interest to perform a thoracoplasty on the worse side. The results of such treatment definitely bear out the wisdom of that decision. It seems reasonable to the writer, therefore, that to remove an area of disease

which is causing part of the toxæmia from which a patient suffers, will be beneficial to the patient and to the other areas of disease.

Where genital tuberculosis is concerned, the writer cannot state that operative treatment has had beneficial results on the primary renal lesion. He has found however, that one good result of a superficial genital operation, is the tendency for the tuberculous prostate and seminal vesicles to improve and even heal. That fact has been confirmed by the investigations of Braasch,¹⁰⁸ Robinson,⁴⁶ Kretschmer,⁵² Eisendarth and Rolnick,⁵ Herman,⁴⁸ Cunningham, Barney,³⁴ Horwitz⁶⁹ and Barbilian²¹⁹ and will receive added support later from the present study. The cosmetic result which follows a genital operation is considered important by the patient and his wife. While this viewpoint cannot be obvious to those whose contact with patients and their relations is other than prolonged and intimate the writer has tactfully questioned many pairs of married people very fully and confirmed that impression. Elsewhere, chapter 8, it has been shown that the spread of disease to the epididymis takes place by the lumen of the vas deferens and in a patient with unilateral epididymitis, epididymectomy and vasectomy of the healthy vas deferens will prevent the spread of the tuberculous process to the

remaining epididymis. In the treatment of the present series, it will also be shown later, that operative removal of a diseased epididymis will definitely tend to shorten the duration of an associated fistula.

Remembering that all the patients with genital tuberculosis receive constitutional treatment as a routine, why then are not all these patients submitted to an operative procedure? To the reader, one outstanding feature of these patients will be obvious. On many occasions the writer has reported the presence of extra-genito-urinary tuberculous lesions which the majority of these patients have, and, on many occasions it has been seen that there was a multiplicity of lesions in some patients with pulmonary lesions predominating. It will be readily understandable that the general condition of many of these patients was very poor, where pulmonary tuberculosis had caused dissemination of the disease to the kidney and thence to the epididymis, and consequently, operative treatment was not considered advisable. On the other hand many patients with multiple tuberculous lesions have received operative treatment, but in these patients resistance to tuberculosis has been high and it was considered that the removal of tuberculous epididymes might increase that resistance. One of the most important causes therefore,

which mitigates against operative treatment in patients with genital tuberculosis, is the general condition of the patient, usually dependant on the activity of extra-genito-urinary lesions. Another factor which rules out surgical intervention is the unwillingness of some men to undergo a genital operation. This reason is a very important one as will be found later, when the writer records the number of patients who refused operative treatment. It is hardly the duty of a medical attendant to attempt to coerce a patient in this matter, especially where religious grounds for refusal exist, but the writer feels that a full and frank explanation should be given to each man before he submits himself to an operation, the extent of which depends on the conditions found at operation. The question of sexual relationship always takes the forefront of these discussions and it must be explained to the patient that most men are sterile with even unilateral epididymitis and, equally important, that there is no interference with the sexual act after bilateral epididymectomy. Age does not appear to play an important part in the decision to avoid operative treatment except in the very old, but the writer has noticed that in a patient over 40 years, the genital lesion tends to be more fibrotic in type with less chance of associated fistula formation. The presence of fistulae

does not influence the writer or his senior colleague against interference but rather makes them carry out some form of operative treatment to shorten the duration of the sinuses. Bilateral epididymal disease does not in itself rule out surgical intervention as often, removal of the epididymes will prevent the appearance of scrotal fistulae, promote healing of prostatic and seminal vesicular tuberculosis, and, if sinuses are present, be an aid to their healing. The writer therefore finds, that there are several factors which mitigate against operative intervention in genital tuberculosis, but he would suggest that the main one is the active state of the extra-genitourinary lesions and a corresponding impairment of the patient's general condition with the possibility that trauma, even surgical trauma, may be blamed for further dissemination of the disease.

For descriptive purposes, the writer has divided the 402 cases into two groups, the one comprising those men who had conservative treatment alone and the other, those men who had operative intervention in addition to the general treatment; in the former group are 157 patients, in the latter 245 patients.

Estimation of the ages of the patients in these two sections, table number 71, shows that the difference in the

operated and non-operated patients was very slight up to the age of 15 years. From 16 to 40 years, that is, during the most active years of a man's life, the difference is appreciable between the two sets of patients. No fewer than 76.33% of the patients who had surgical therapy, occurred between these years while the percentage of the patients who received conservative treatment alone during the same years was 63.06%. From 41 to 65 years, the percentage of men who did not undergo any form of operative treatment was almost 30, while 16.74% of the operated group occurred within the same limits. Thus, it seems that the influence of age is slight in the decision to operate in patients with genital tuberculosis, but there seems to be a tendency to carry out surgical treatment in the younger, and as one might expect, fitter men.

TABLE NO. 71/

TABLE NO. 71

Age Incidence of 402 Patients, with reference to Treatment.

Age Groups in Years	No. of Patients with no operation	Percentage with no operation	Percentage with operation	No. of Patients with operation
- 5	7	4.46	2.04	5
6 - 10	1	0.64	1.24	3
11 - 15	3	1.91	3.67	9
16 - 20	22	14.01	9.80	24
21 - 25	21	13.38	22.45	55
26 - 30	25	15.92	21.63	53
31 - 35	15	9.55	15.10	37
36 - 40	16	10.19	7.35	18
41 - 45	19	12.10	6.53	16
46 - 50	11	7.01	2.86	7
51 - 55	9	5.73	2.86	7
36 - 60	3	1.91	4.08	10
61 - 65	5	3.18	0.41	1

Age Groups in Years	Percentage Non-operated	Percentage Operated	Difference
- 15	7.01	6.94	0.07
16 - 40	63.06	76.33	13.27
41 - 65	29.94	16.74	13.20

When consideration is given to the extra-genitourinary lesions of the two groups, table number 72, it is seen that, among the patients who received operative treatment, the number without any obvious extra-genitourinary lesion was appreciably higher than the corresponding number in the group of patients who received constitutional treatment only. It

may be assumed that the patients without any other obvious lesion were, on the average, in much better general condition than those with some other tuberculous foci.

TABLE NO. 72

Extra-genitourinary Lesions in the Operated and Non-operated Patients

Localisation of Extra-genitourinary Lesion	No. of Patients Conservative Group	Percentage Conservative Group	Percentage Operated Group	No. of Patients Operated Group
Lungs	60	38.22	38.78	95
Lungs & Joint	7	4.46		
Bone	3	1.91	0.82	2
Bone & Joint	28	17.83	6.94	17
Abdomen	4	2.54	2.86	7
Lungs, Bone and Joint	9	5.73		
Lungs and Bone	1	0.64	9.80	24
Lungs & Abdomen	1	0.64		
Lungs, Bone & Abdomen			0.82	2
Lungs & Glands			0.41	1
Abdomen & Bone			0.41	1
No other lesion	44	28.03	39.18	96

Other interesting facts which emerge from a study of table number 72 are, that the percentage of single extra-genitourinary lesions in the unoperated group of patients was 42.68 while the percentage in the operated group was 42.41 and the percentage of patients with pulmonary tuberculosis was practically the same in both, 49.68 in the former and 49.79 in the latter. It would appear from these findings

that the difference in the numbers with no obvious extra-genitourinary lesions in the two groups, was accounted for by the increased number of patients in the non-operated section with multiple lesions, and who were consequently not suitable for operative treatment.

Apart from the findings already given, a study of the 157 patients who did not receive operative treatment, shows that 56, 35.67%, died in hospital. Ten of these 56 men had scrotal fistulae and the fistulae showed no evidence of healing. Eighteen patients, 9 with fistulae, showed a deterioration of their general condition during their hospital stay and on dismissal the fistulae were unchanged. The genital lesion was unchanged in a further 13 patients with fibrotic epididymitis without any scrotal sinuses. Of the remaining 70 patients, 30 were considered as being suitable for a genital operation but each man refused and decided to leave hospital, no change having taken place in the genital disease. Four patients of the 70 were dismissed from hospital soon after admission, 2 because of an infectious disease and 2 because of the outbreak of hostilities in 1939. Of the 36 remaining patients, only 9 showed any improvement with constitutional therapy alone. Excluding the 34 patients who were not in hospital for any length of time, these 9 patients who improved, represent a percentage of 7.31 of the 123 patients. In table number 73 details of

the 9 patients are shown and it also demonstrates that 7 men had scrotal fistulae, 10 fistulae in all. Table number 74 shows the healing time of these fistulae with conservative treatment alone.

TABLE NO. 73/

TABLE NO. 73

Details of 9 Patients whose genital disease improved with conservative treatment.

Age of Patient (years)	Other tuberculous lesions	Localisation of genital lesion	Genital Organs Involved	Duration of genital lesion on Admission	Duration of Hospital Treatment in Months	Condition of genital lesion on dismissal	Treatment
2	None	U	E+T+C	2	5	swelling less	general
2	None	B	R=E+T+C+F+G L=E+T+F+G	6 6	7 7	(sinus healed (fibrotic	general with local rest
3	Abdomen	B	R=E+F L=E+F	3	9	(sinus healed (swelling less	general & local rest
14	None	B	R=E+F L=E+F	5	9	(sinus healed (fibrotic	general & local rest
2½	Bone and Joins	U	E+F	4	22	sinus healed	general & heliother- apy
20	Lungs and Bone	U → B	L=E+C R=E+F	1 Not present	84 84	Fibrotic sinus healed	general & local rest
40	Lungs	B	R=E+C L=E+C	4	11	swelling less	general & local rest
7	Bone and Joint	U	E+F	3	3	sinus healed	general & local rest
16	Lungs	U	E+F	2	12	sinus healed swelling less	general & local rest

E = Epididymis T = Testis C = Vas deferens F = Scrotal sinus G = Inguinal glands

U = Unilateral B = Bilateral U → B = Unilateral becoming bilateral

R = Right L = Left

TABLE NO. 74Duration and Healing Time of Ten Scrotal Fistulae with
Conservative Treatment alone

(7 Patients)

Number of Fistulae	Duration of Fistulae on Patient's Admission	Duration of Hospital stay until fistulae healed	Total Duration of Fistulae
1	One week	22 months	22 months, 1 week
2	3 months	7 months	10 months
2	1 month	9 months	10 months
1	1 month	6 months	7 months
1	1 month	3 months	4 months
1	1 month	12 months	13 months
1	3 months	9 months	12 months
1	developed in hospital	42 months	42 months

Tuberculin therapy was utilised in 12 of the 157 patients who did not have any operative treatment for their genital disease. The 12 patients all suffered from renal tuberculosis and in none was there any intra-pulmonary disease. Three of these patients died in hospital, 3 dismissed themselves with the treatment unfinished and without any obvious clinical change in the epididymitis, while in the remaining 6 patients the epididymitis was fibrotic and remained so during their stay in hospital.

Heliotherapy was only used on one occasion, in a patient $2\frac{1}{2}$ years of age, with multiple tuberculous abscesses over both hands and feet in addition to unilateral epididymitis with a scrotal fistula. All the superficial abscesses,

including the scrotal sinus, healed in 22 months with general treatment and heliotherapy.

The number of patients who received operative in addition to conservative treatment for genital tuberculosis was 245, 60.95% of the total number under consideration. Forty of these patients were admitted to Robroyston Hospital after a genital operation had been performed elsewhere, usually in a general hospital. The tendency for radical local operative measures to be performed in general hospitals, as noted and deprecated by Young,⁵³ is noticeable in this group in which a unilateral operation was carried out 34 times (epididymectomy 8, orchidectomy 26) and both sides received treatment 6 times (epididymotomy 1, epididymectomy 1, orchidectomy 4); consequently out of a total of 46 operations, orchidectomy was the operation selected in 34 or 73.91%.

Detailed examination of these 40 patients, shows that of the 6 patients who had a bilateral operation prior to admission only 2 showed any abnormality of the surviving external genitalia, when examined in Robroyston Hospital. Bilateral inguinal fistulae were present in 1 patient after previous orchidectomy and the writer suggests that the presence of these was probably accounted for by a failure to follow up and remove the diseased vas deferens; he

realises, only too well the temptation, when performing orchidectomy, of ligating the spermatic bundle at a convenient level in the inguinal wound, a level which is well below the external abdominal ring. The second patient who showed an abnormality was one in whom a bilateral epididymotomy had been performed and, on admission the patient was found to have bilateral epididymitis. The operation of epididymotomy has not been considered a useful one in Robroyston Hospital for the treatment of genital tuberculosis and consequently has never been practised. The fact that, in this patient, a bilateral epididymitis persisted after epididymotomy, would suggest that the impression held by the writer and his senior colleague, is a correct one.

Examination of the 34 cases which received unilateral operative treatment, showed that 12, 35.29%, were completely free of genital disease, while 22 had disease of the remaining epididymis but no abnormality on the operated side. Eighteen of the 22 patients had epididymitis and 4 had epididymitis and orchitis, 3 of each group having a scrotal fistula in addition. A further operation was considered advisable in 4 of the 22 patients but in each case it was refused, while the general condition of 16 was so bad that operative intervention was not possible. The remaining

2 patients had fibrotic epididymitis and operative treatment was considered unnecessary. It would appear then, that of the 40 patients who were considered suitable for operative treatment in a general hospital, 24 or 60% were later admitted to a sanatorium with further genital disease. Of these 24 patients, 8, 33.33%, died in the sanatorium, 8, 33.33%, were considered unfit for further operative proceedings, 5, 20.83% were offered further surgical treatment and in the remaining 3 patients, 12.5%, no further operative treatment was considered necessary. Elsewhere the writer has reported the views of several workers that pre-operative and post-operative sanatorium care is essential in the treatment of genital tuberculosis. He recognises the fact that these patients are usually in the prime of life and it is a very serious thing to send them to a sanatorium for a considerable period, but he feels that the patient must be made to realise the seriousness of his condition so that loyal and intelligent co-operation should be given. This co-operation is essential for, as Kingston Fowler said when discussing the treatment of pulmonary tuberculosis "no fool was ever cured of pulmonary tuberculosis". This obiter dictum can be applied with equal truth to patients with genital tuberculosis.

In Robroyston Hospital 205 patients were considered

suitable for surgical treatment of their genital disease, and table number 75 shows the type of operation carried out in each case.

TABLE NO. 75

Operative Procedures	No. of Patients
Unilateral Epididymectomy	58
Bilateral Epididymectomy	46
Epididymectomy + Orchidectomy	18
Epididymectomy and partial Orchidectomy on the same side	15
Epididymectomy and partial orchidectomy + orchidectomy	8
Bilateral epididymectomy and bilateral partial orchidectomy	7
Epididymectomy + Epididymectomy and partial orchidectomy	19
Incision of scrotal abscess	1
Unilateral orchidectomy	28
Bilateral orchidectomy	5
Vasectomy of healthy vas deferens	12

Vasectomy of the healthy vas deferens, when carried out, was associated in every case, with a genital operation on the contra-lateral side. The writer now proposes to investigate these patients in separate groups, according

to the type of operation carried out.

Group 1 - Patients who had Unilateral Epididymectomy.

Unilateral epididymectomy was carried out in 58 patients of whom 5 died in hospital. Only one death occurred within six months of the operation and that was due to pulmonary embolism on the 10th post-operative day and constituted an operative mortality of 1.72%.

Twenty patients had scrotal fistulae associated with the epididymitis and in table number 76 the duration of each fistula prior to the genital operation and the time taken for healing to occur in 17 patients are shown. The remaining 3 patients were dismissed one month, six weeks, and two months respectively after operation with the fistulae unhealed. The duration of these fistulae before operation was one month, six months and 7 years respectively.

TABLE NO. 76/

TABLE NO. 76

Duration of 17 Fistulae prior to Operation of Unilateral Epididymectomy and time taken for healing to occur after operation.

Duration in months of fistulae prior to operation.	Time in Months for healing to occur after operation					
	1	2	3	4	5	6
1	1	1	4			
2	1	2	2			
3					1	
4				1		
5			1			
6			1			
7	1	1				
8						

Total 17.

It can be seen from table number 76 that the healing time after operation was longer than the duration before operation in 8 cases, shorter in 5, and equal in 4 cases.

An inguinal incision was used in all the 58 operations and in each case healing resulted by first intention, with two exceptions where a small wound sinus persisted for one month and four months respectively. A rubber drainage tube was inserted through the scrotal fistula in each of nine

patients and in an additional 2 patients, in whom there was extensive caseation of the epididymes, a rubber tube was inserted into the scrotum and brought through the lower end of the inguinal wound. The wounds of these last two patients healed by primary intention the drainage tubes having been removed 48 to 72 hours after operation. No drainage was instituted in 11 patients with scrotal fistulae, but, in each case, at operation, the sinus was excised and the clean edges sutured.

The macroscopic appearances of the diseased epididymes at operation, showed that fibrosis was the predominating pathological process in 18 patients, 9 of whom showed in addition involvement of the epididymal end of the vas deferens. Fibro-caseous disease was present in 40 patients and in these men there was apparent disease of the vas deferens in 21 instances. Hydrocele of the tunica vaginalis was encountered in 6 of the 58 operations, 10.03%.

Vasectomy of the contra-lateral healthy vas deferens was carried out in 6 men whose ages ranged from 24 to 52 years. The orthodox operation was performed 4 times, while in the remaining 2 patients, the inguinal incisions were enlarged and the scrotal contents delivered for examination. When no abnormality of the testis or epididymis was found, these organs were returned to the scrotum within

their coverings, before vasectomy was undertaken.

In addition to the operative and constitutional treatment a course of tuberculin was given to 4 patients. In no case was there any obvious change in the genitalia after the tuberculin.

Group 2 - Patients who had Bilateral Epididymectomy.

In 46 patients, bilateral epididymectomy was carried out, and of these patients, 3 died while in hospital. The causes of death were, miliary tuberculosis in one patient who also had spinal tuberculosis, uraemia following renal tuberculosis in the second, and meningitis in the third patient who also had extra-genital tuberculosis. The intervals between the operation and death in these 3 cases were 4, 5 and 9 months respectively.

Fistulae were present in 20 patients, both halves of the scrotum being affected in 6 and one side only in 14, making a total of 26 fistulae. Table number 77 shows the duration and healing time for 23 fistulae, 2 patients dying before healing had occurred and 1 patient dismissing himself from hospital with the sinus unclosed.

TABLE NO. 77/

TABLE NO. 77

Duration of 23 Fistulae before Bilateral Epididymectomy and the Healing Time after Operation.

Duration in Months of Fistulae prior to operation	Time in Months for Healing to occur after operation							
	1	2	3	4	5	6	7	12
1		1						
2		1			1	1		
3	2	1		1				
4		1	2					
5		1	1					
6	1							1
7			1					
8								
9				1				
12			1	1			1	1
15		1		1				

Total 23

Table number 77 shows that the time for healing to take place after operation was less than the duration of the fistula before operation in 16 instances, greater in 5 and the same in 2 instances.

The inguinal approach was used in all the operations, bilateral epididymectomy being carried out at one session 33

times and at two sessions 13 times. In the latter group the intervals between the operations varied, 5 being less than one month, 3 less than six weeks and 2 just within a two months' period. The remaining intervals were 8 months, 3 years and 4 years respectively, the second operation taking place after the re-admission of the patient to hospital.

A small rubber drainage tube was inserted through a scrotal fistula 11 times and in 10 instances where no sinus existed the drainage tube was brought through the inguinal wound. The latter group of 10 patients all showed healing of the wound by primary intention. Four of the remaining patients developed a sinus in the inguinal wound, two healing after six months, one after three months and one still showing very slight discharge on dismissal two months after operation. All the other inguinal wounds healed by primary intention.

The macroscopic appearances of the diseased epididymes showed that fibrosis was the predominating change in 34, in 13 of which there was obvious disease of the vas deferens. Fibrosis with caseation was found in 58 instances and in this group there was obvious vasitis in 22 instances. Hydrocele of the tunica vaginalis was met with on two occasions.

Group 3 - Patients who underwent Epididymectomy on one side and Orchidectomy on the other.

Eighteen patients had the two operations, epididymectomy on one side and orchidectomy on the other, carried out at one session and none of these patients died while in hospital.

Fifteen men had 17 scrotal fistulae before operation, the fistula being present on the side of the testicular involvement 11 times and on the epididymitis side twice in these men with unilateral fistula formation. The duration of 15 fistulae prior to operation and the healing time after operation, is shown in table number 78, two men with scrotal fistulae discharging themselves from hospital two months after the operation with the sinuses unhealed.

TABLE NO. 78/

TABLE NO. 78

Duration and Healing Time of 15 Scrotal Fistulae in relation to Operation

Duration in Months of Fistulae before operation	Time in Months for Healing to occur after Operation						
	1	2	3	4	5	6	7
1			1				
2	2	1		1			
3	2						1
4			1				
5			1				
6			1				
8			1				
12			1	1			
18		1					

Total 15

The duration period prior to operation was longer than the healing time after operation 11 times, shorter 3 times and equal once.

An inguinal wound was used in all the operations and these wounds healed by first intention with one exception, when after orchidectomy, a slight amount of discharge from the lower end of the wound continued for three months. Tube drainage was instituted in 9 patients, on one side in

8 and on 2 sides in one. The tube was inserted through the scrotum in 9 patients, 7 of whom had scrotal fistulae and in one instance the tube was brought through the inguinal wound which healed by primary intention.

All operation findings showed caseation with fibrosis as the pathological changes in the epididymes and testes. Disease was localised to the epididymis on 10 occasions and to the epididymis and vas deferens 8 times. The testis was involved with the epididymis in 4 instances without any obvious disease of the vas deferens, and in 14 instances with associated deferential disease. In 2 patients, the testis showed numerous isolated tubercles throughout its substance, necessitating removal of the organ.

Group 4 - Patients who had Epididymectomy and Partial Orchidectomy.

The procedures of epididymectomy and partial orchidectomy were carried out in 15 patients, none of whom died in hospital. Fistulous formation in the scrotum prior to operation in these men occurred in 9 instances, the duration and healing times for 8 being shown in table number 79. In one instance the patient with a fistula of six months' duration was dismissed from hospital one month after his operation, the fistula being unhealed.

TABLE NO. 79

Duration and Healing Time of 8 Fistulae in relation to Operation

Duration of Fistulae prior to operation in months	Time in Months for Fistulae to heal after Operation					
	1	2	3	4	5	6
1		1				
2	1					1
3	1	1				
4			1			1
5						
6						
10			1			

Total 8.

In the 8 fistula, the healing time after operation was longer than the duration before operation 3 times and shorter 5 times (table number 79).

The inguinal approach was used in all cases and tube drainage was instituted 7 times, in 4 instances through the scrotal fistulae, and in 3 instances through the lower end of the inguinal wound. In 12 patients the wounds healed by first intention and in the other 3, through which the drainage tubes were placed, healed within two months of the operation.

The macroscopic appearances of the diseased tissues

showed caseation to be present in all, and each case was classified as fibro-caseous in type. Disease of the vas deferens was obvious in 12 patients and a hydrocele of the tunica vaginalis was found in 5 patients. Involvement of the testis was usually localised above the hilum opposite the globus major but, in 2 cases portions of the testis estimated at five-eighths, and one half of the whole organ, respectively, were removed without any interference with its blood supply.

Contra-lateral vasectomy was carried out in one patient.

Group 5 - Patients who had Orchidectomy on one side and Epididymectomy and Partial Orchidectomy on the other.

The operations of orchidectomy and epididymectomy and partial orchidectomy were carried out in 8 patients, one of whom died of meningitis ten days after the operations, a death which was considered to be directly attributable to the operation. Eight scrotal fistulae were present in 6 patients, and the healing time of these fistulae after operation was shorter than the duration before operation in 5, longer in one and equal in 2 (table number 80).

TABLE NO. 80

Duration and Healing Time of 8 Fistulae in relation to Operation

Duration of Distulae before Operation in Months	Time, in months, for healing after Operation					
	1	2	3	4	5	6
2	1					
3		1	2	1		
4			2			
18			1			

Total 8.

Drainage of the scrotum was employed on 9 occasions, 6 times through a scrotal fistula and 3 times through the inguinal wound. All the inguinal wounds healed by first intention.

In each case at operation, disease was found to be present in both epididymes and testes and in 9 instances involvement of the vas deferens was also found. Hydrocele of the tunica vaginalis was met with on four occasions. The testis was so extensively diseased on one side in each patient that the complete removal of the organ had to be undertaken, while on the other side there was superficial disease opposite the globus major 5 times and on three occasions a quarter, a half and three quarters respectively, had to be removed to eradicate the local disease. In these

three cases there was no interference with the viability of the organ. Section of the testis after orchidectomy in one case, showed that the organ was studded with small discrete tubercles.

Group 6 - Patients who had Bilateral Epididymectomy and Bilateral Partial Orchidectomy.

Bilateral epididymectomy and bilateral partial orchidectomy was carried out in 7 patients without any operative mortality. Five patients each had a scrotal fistula and the healing time of these fistulae after operation was shorter than the duration before operation in 3, longer in 1, and equal in 1 (table number 81).

TABLE NO. 81

Duration and Healing Time of 5 Fistulae in Relation to Operation

Duration time in months before Operation	Healing time in months after operation				
	1	2	3	4	5
1					
2			1		
3			1		
6	1				
12			1		1

Total 5

All the inguinal wounds healed without any complications. Drainage of the scrotum was utilised on 8 occasions, twice through a scrotal fistula and on 6 occasions through the inguinal incision. At operation, in all cases, fibro-caseous disease was found to involve the epididymis, testis and vas deferens. On seven occasions superficial areas of the testis were removed and on seven occasions portions varying from one tenth to one sixth of the organ were excised. In every case the involvement of the testis was found to be situated above the hilum opposite the globus major of the epididymis.

Group 7 - Patients who had Epididymectomy on one side and Epididymectomy and Partial Orchidectomy on the other.

No operative deaths occurred in this group of 19 patients. Unilateral fistula formation was present in 7 patients and with one exception, all these fistulae were present on the same side as the testicular disease. The duration time before operation and the healing time after operation are shown in table number 82, where it can be observed that the healing time was shorter than the duration in 4, and longer in 2 instances, one patient with a fistula being dismissed before healing had taken place.

The usual inguinal incision was used, and drainage of the scrotum was carried out on one side in 11 patients,

and on both sides in one patient. In six instances the drainage was used in association with a fistula, and in 3 of these, the edges of the sinus were trimmed and the tube passed through the scrotum; in the other three cases the inguinal wound was utilised as the means of exit for the tube. Apart from two cases where healing was not complete for two and four months respectively, all inguinal wounds healed by first intention.

TABLE NO. 82

Duration and Healing Time of 6 Fistulae in relation to Operation

Duration of Fistulae in Months before Operation	Healing time in months after operation						
	1	2	3	4	5	6	12
1							
2							
3					1		
4	1						
5			1				
6		1					
8	1						
9							1

Total 6.

Macroscopically, fibrosis appeared to be the predominating

process in 6 instances, and fibrosis with caseation in 32 instances. Disease of the vas deferens was obvious on 25 occasions and on one of these there was marked beading of the vas in its upper and lower thirds, with the middle portion free, a phenomenon noted by Walker,⁵⁶ and the writer in a previous chapter (Chapter 5). Involvement of one testis was found in each of the 19 patients but in no case was orchidectomy necessary. Superficial disease of that organ was present in 15 instances and that was removed by curettage, while in the other four men half of the testis of each man was diseased and bisection of the organ was necessary. In one of these last four men there was some doubt concerning the viability of the remaining portion of the testis but time and patience removed that doubt. Hydrocele of the tunica vaginalis was met with on three occasions in these operations.

Group 8 - Patient who had incision of Scrotum.

The above operation was carried out on one patient who suffered from unilateral epididymitis with an acute scrotal abscess. The operation was of a temporary nature but the patient decided to leave the hospital shortly afterwards.

Group 9 - Patients who had Unilateral Orchiectomy.

Unilateral orchidectomy was the operative procedure in 28 patients, 5 of whom had, in addition, vasectomy of the contra-lateral vas deferens. The death of three of these patients occurred within four months of the operation, the causes being meningitis in 2 and broncho-pneumonia in 1, and consequently the operative mortality was 10.71%. Scrotal fistulae were present in 16 patients and the details of 13 fistulae are shown in table number 83. The remaining 3 patients with fistulae left hospital very soon after the operation with the sinuses unhealed.

TABLE NO. 83

Duration and Healing Time of 13 Fistulae in relation to Operation

Duration in months before Operation	Healing time in months after Operation					
	1	2	3	4	5	6
1		2	1			
2	1	2	1			
3		1	1			
4			1			
5						
6			1			
7			1	1		

Total 13.

The healing time of these 13 fistulae after operation was shorter than the duration before operation in 6, longer in 4, and equal in 3 instances. Tube drainage was utilised in 10 patients, eight of whom had scrotal fistulae. Healing of all the inguinal wounds did not give any trouble, with one exception in which there was an escape of urine from a sinus at the lower end of the wound.

In every patient, it was found at operation that the testis was extensively involved by tuberculosis and complete removal of the organ was necessary. In only two instances was there no obvious involvement of the vas deferens and in these cases the testes were studded by numerous discrete tubercles. Neoplasm was suspected in a further two men but histological examination showed that the condition was tuberculous. Hydrocele of the tunica vaginalis was met with in four instances.

Group 10 - Patients who had Bilateral Orchidectomy.

The reluctance, with which the above procedures were carried out in Robroyston Hospital, is shown by the small number of 5 patients in this group. Three of these men were over the age of 47 years when the operations were performed, while in the other two, aged 22 and 32 years respectively, some attempt was made to avoid double castration by leaving a small part of a testis in each case, but

subsequent spread of the disease caused complete local removal to become necessary.

Fistulae present before operation numbered eight, and details of six of these are shown in table number 84. The other two fistulae were present in the patients who required a revision operation and in each case healing took place within two months of the second operation, the fistulae having been present for three months before the primary operation.

TABLE NO. 84

Details of 6 Fistulae in Relation to Operation.

Duration Time in Months before Operation	Healing time in months after Operation					
	1	2	3	4	5	6
1	1					
2		1				
3						
4						
5						
6						
7		1				
9			1			
10						1
12			1			

Total 6.

Tube drainage was carried out three times, always in association with a scrotal fistula, and in each case the rubber tube was brought through the inguinal wound. All inguinal wounds healed by primary intention. Operative findings showed that caseation was always the predominating change in the epididymes and testes. Deferential disease was obvious in every case and a hydrocele of the tunica vaginalis was encountered four times.

Summary of the Surgical Treatment carried out in Robroyston Hospital.

From the descriptions of the surgical treatment of genital tuberculosis in Robroyston Hospital, it is obvious that the writer and his senior colleague, who were responsible for the great majority of the operations, attempted, when possible to leave at least part of the testis. For many years it was believed that double castration would be attended by a loss secondary sexual characteristics and in the earlier case-records, it was noticed that many patients with bilateral orchitis were dismissed from hospital after a unilateral operation. Later, with the advance of hormone therapy, testosterone propionate was used in several cases with what were believed to be good results. Within recent years, the present writer has found from his examinations of many of the available patients in the present series and

from many patients who received their complete treatment elsewhere and not included in the present study, that the effects of double castration in a patient after puberty are not noticeable. Secondary sexual characteristics do not alter and, as the writer found in the follow-up of some of the present series, even sexual intercourse is possible for many years after the operation, with orgasm present although impaired, virility present but greatly diminished and a definite diminution in the amount of ejaculated fluid. The psychic effects of double castration however, will always remain, and in a young person, the writer is convinced that the end result will be greatly improved if even a small part of one testis remains. Recent literature has recommended double orchidectomy in a patient with prostatic carcinoma and the results found by Jacobs,²²⁷ when the operation is combined with Stilboestrol therapy appear to justify a more favourable prognosis in that condition over a limited time. It must be remembered however that prostatic disease usually occurs in men of advanced years.

The operative mortality of the operations on the superficial genitalia, in Robroyston Hospital, was 6 out of 205, 2.93%. Four patients died of meningitis, one of bronchopneumonia and one of pulmonary embolism. The incidence of meningitis is high, but it must be remembered that the

operation is being carried out in a patient who usually has obvious tuberculosis outwith the genital tract. No radical operations, as described by Young⁵³ and Loughnane,²²⁶ were performed as the writer and his senior colleague are of the opinion that of the surgical procedures epididectomy is the operation of widest application. It is the writer's view that the more radical operation of total extirpation of the seminal tract is based on a correct understanding of the pathology of the disease but it is not without considerable risk, especially in hands not accustomed to perineal prostatectomy. The success of the radical operation depends upon thorough anatomical knowledge combined with dexterity but success for a patient with extra-genital tuberculosis may depend on the time taken for the operative procedure to be carried out. These views have been recently endorsed by Lowsley, Hinman, Smith and Gutierrez.²²⁸

Elsewhere the writer has mentioned that one of the advantages to be gained by surgical intervention, is the more rapid healing of scrotal sinuses. Tables 84 and 84A show the duration and healing times of fistulae, when these details were known, in patients who received conservative treatment alone and in others who had operative treatment in addition. The healing time after operation was definitely less than the duration time before operation in 59 and

greater in 27, these figures approximately representing percentages. The patients with fistulae treated conservatively numbered 26 out of the total of 123, the remaining 34 patients having left the hospital soon after admission. Of the 26 patients with fistulae, only 7 showed healing with conservative treatment and in each case the healing time after admission was much longer than the duration before admission to hospital.

TABLE NO. 84

Duration and Healing Time of 10 Scrotal Fistulae (7 patients) with Conservative Treatment alone.

Number of Fistulae	Duration of Fistulae on Patient's Admission.	Duration of Hospital Stay until Fistulae healed.	Total Duration of Fistulae
1	1 Week	22 months	22 months 1 week
2	3 Months	7 months	10 months
2	1 Month	9 months	10 months
1	1 Month	6 months	7 months
1	1 Month	3 months	4 months
1	1 Month	12 months	13 months
1	3 Months	9 months	12 months
1	Developed in hospital	42 months	42 months

TABLE NO. 84A

Duration of 101 Fistulae Before Operation and Healing Time After Operation (in Months)

Duration Before Operation	Healing Time after Operation												
	1	2	3	4	5	6	7	8	9	10	12	15	18
1	2	5	6										
2	6	7	4	1	1	2							
3	5	4	4	2	2		1						
4	1	1	7	1		1							
5		1	4										
6	2	1	3								1		
7	1	2	2	1									
8	1		1										
9			1	1							1		
10			1			1							
12			4	2	1		1				1		
15		1		1									
18		1	1										

Healing time less than duration in 59

Healing time equal to duration in 15

Healing time longer than duration in 27 Total 101

The use of a small rubber drainage tube for a period of 2 to 3 days after the operation has been found to be beneficial in patients with excess caseation of the

epididymis and testis or where secondary infection was present. In the earlier cases there was a tendency, in the presence of scrotal fistulae, to trim the edges and use the sinus as the exit for the drainage tube. In the later cases the tube was brought through the inguinal wound and it was found that the healing of the wound thereafter was not retarded. When necessary, the writer now prefers to use the inguinal route for drainage in preference to a scrotal sinus. Scrotal haematomata occasionally caused post-operative discomfort but in no case was treatment other than local support necessary. In one patient when the vas deferens was being freed in the inguinal canal damage was caused to the inferior epigastric artery and control of that vessel necessitated further interference. Finally, where secondary infection in any degree is present, there is a tendency for the operation to follow an antiseptic rather than an aseptic technique but this has not yet gone the length of sulphonamide dusting.

CHAPTER 10PROGNOSIS AND LATE RESULTS OF TREATMENT IN TUBERCULOUS
EPIDIDYMITIS

In the previous chapter, the writer considered the treatment of tuberculous epididymitis and its early results in 402 cases. He concluded that surgical intervention was advisable in suitable patients and apart from the low operative mortality, it was found that the early results of that form of treatment were good. In these patients who did not undergo any operative treatment, the writer and his senior colleague, in most cases, desisted from proposing surgery as a means of treatment because of some extra-genito-urinary tuberculous condition which rendered operative intervention unduly dangerous. These statements make plain the view of the writer that, a patient with genital tuberculosis should have operative treatment for his condition when his extra-genito-urinary lesions render it possible and in the prognosis of that patient consideration must be given to these extra genital lesions. The writer believes that the outlook in tuberculosis generally is poor and that consequently the future of a patient with epididymal tuberculosis must be equally poor. Apart from the operative mortality, he does not believe however, that the local

genital disease in itself can cause death, except through the fortuitous occurrence of tuberculous meningitis or any further dissemination of the disease. It has been shown that the genital lesion in most cases is secondary to a kidney lesion, the outlook for which is not good, and that the kidney disease is secondary to an extra-genito-urinary focus which may or may not be in an active state. McCrea,³⁷ Miller and Lustock,²⁷ and Greenberger, Greenberger and Alexander,²⁶ state that the prognosis in genital tuberculosis is unfavourable, a statement with which the present writer is in agreement, but only because of the renal and extra-genito-urinary lesions which usually are evident and consequently it is not the true prognosis of genital tuberculosis but the prognosis in a patient with tuberculosis sufficient to cause a spread of the disease to the epididymis.

Support for these views is gained from a study of the 402 patients with tuberculous epididymitis, 88.3% of whom had obvious extra-genital tuberculous lesions. Of that total, 90 or 22.29%, died in hospital and a study of the causes of death, table number 85, shows that, apart from the immediate post-operative complications, the deaths were always due to extra-genital lesions. In all of the 90 patients, tuberculous lesions outwith the genital tract were obvious and often multiple. Herman⁴⁸ and Sjöstrand⁵⁰ both

stress the frequency with which patients with genital tuberculosis develop military tuberculosis and meningitis and in the 90 patients under consideration it can be seen that death was attributable to meningitis in 16 or 17.78%.

TABLE NO. 85

Causes of Death in 90 Patients who suffered from Tuberculous Epididymitis

Cause of Death	No. of Patients	Cause of Death	No. of Patients
Abdominal Tuberculosis	5	Uraemia	25
Pulmonary Tuberculosis	27	Multiple Tuberculosis, amyloid disease	6
Meningitis:		Tuberculous bronchopneumonia (post-operative)	1
(Pulmonary Tuberculosis)	8	Perforated duodenal ulcer	2
(Renal)	4	Pulmonary Embolism	1
(Bone)	3	Cerebral tuberculoma	2
(Abdominal)	1	Exhaustion (spinal tuberculosis)	3
Nephrectomy, operative death	1		
Miliary Tuberculosis	1		
Total	50	Total	40

A study of the age groups of the 90 patients, table number 86, shows that all groups are represented, except the one between 11 and 15 years, but no conclusions can be drawn since the curve of the mortality incidence and the curve of the incidence of epididymitis follow each other closely except that after 40 years the percentage death rate is appreciably higher.

TABLE NO. 86

The Mortality Incidence for 90 Patients in the various Age Groups. The incidence of Epididymitis for the same Age Groups is also given.

Age Groups (Years)	No. of Deaths	%	% Incidence of Tuberculous Epididymitis	Age Groups (Years)	No. of Deaths	%	% Incidence of Tuberculous Epididymitis
- 5	3	3.33	2.98	36-40	8	8.89	8.46
6-10	1	1.11	1.00	41-45	10	11.11	8.7
11-15	0		2.98	46-50	5	5.56	4.48
16-20	11	12.59	11.59	51-55	8	8.89	3.98
21-25	17	18.89	19.10	56-60	4	4.44	3.23
26-30	12	13.33	19.42	61-65	1	1.11	0.67
31-35	10	11.11	12.94				

More information may be obtained from table number 87 where the interval between the onset of the genital tuberculosis and death for each patient is shown. Ten patients, 11.11%, died within a period of three months, 21, 23.33%, within six months and 38, 42.22%, died within one year of the onset of the epididymal lesion. The remaining 52 patients died more than one year after the onset of the genital lesion, 10, 11.11% dying more than 5 years after the development of tuberculous epididymitis. In 14 instances the interval was so long that no exact time of onset of the genital lesion could be ascertained and consequently these records have been omitted from the calculations.

TABLE NO. 87

Interval between the Onset of Epididymitis and Death in 90 Patients.

Month	1	2	3	4	5	6	7	8	9	10	11	12	18	24	30	36	42	48	60	60+	Un- known
Num- ber	3	5	2	5	5	1	3	1	2	1	1	9	8	4	3	7	1	1	4	10	14
Per- cent- age	3.33	5.56	2.22	5.56	5.56	1.11	3.33	1.11	2.22	1.11	1.11	10.	8.89	4.44	3.33	7.78	1.11	1.11	4.44	11.11	15.56
11.11%																					
23.33%																					
42.22%																					

The figures from table number 87 are of necessity incomplete due to the varying period in each case between the onset of the epididymitis and the patient's admission to hospital. What is important in the writer's opinion is that 11.11% of the 90 patients died within three months and 23.33% within six months of the onset of the genital lesion and, as no patient died of the genital lesion of itself, it is evident that, with the exception of the case of pulmonary embolism, the epididymitis was a terminal feature, possibly in a widespread tuberculous condition. A study of this group shows that these patients were already far advanced in a generalised tuberculosis which was the undisputed cause of death. The writer has noticed that a patient about to die of pulmonary tuberculosis particularly, frequently manifests a widespread dissemination of tuberculosis in the months before death, of which dissemination, bacilluria is for the purposes of this research a most interesting feature. It is therefore not surprising to find a high incidence of tuberculous epididymitis in this quite identifiable clinical group.

The writer found it difficult to investigate and assess the end results in those patients out of the whole total of 402 who were available for review. He feels that he cannot with honesty give a considered opinion of the future of men with tuberculous epididymitis, unless at the same time the

extra genital lesions are considered and that entails a different prognosis for each patient. What he would stress is that the vast majority of these men have extra-genital infections and that in most cases the epididymitis follows a renal lesion and consequently the prognosis in tuberculous epididymitis depends on the prognosis of these lesions. If that were generally understood the treatment and outlook of men with renal tuberculosis would be greatly improved as often the tuberculous epididymitis develops when the renal lesion is minimal and within the scope of surgical treatment.

An attempt was made to investigate the present condition of all the available patients who were dismissed from hospital between the years 1921 and 1941. The writer made personal contact with some but he owes most of his limited success to the co-operation of the Tuberculosis Officers of Glasgow Public Health Department. Only those patients who lived in the Glasgow Area were chosen and each patient was asked to attend Robroyston Hospital for examination. When possible, and with the patients' consent, intravenous pyelography and sometimes cystoscopy were undertaken. In addition each patient examined was asked to send a specimen of urine to the hospital for guinea-pig inoculation. Many patients were found who were willing to co-operate but

generally speaking the response was very disappointing. Since the records go as far back as 1921 it was not surprising to the writer that information of many patients was impossible to obtain. In all, communications by letter or by hand were sent to the addresses of over 200 patients but only 82 became available for further study. The maximum number of years which had passed between the original admission and the writer's review was 20 years and the minimum period was 1 year. The 82 patients included 15 who, for some reason or another were re-admitted within the period of the writer's tenure of office in Robroyston Hospital. Of the remaining patients, 29 were known to have died after leaving hospital, 8 were reported as being very well but were unable to attend for re-examination because of service commitments and 15 were found to be totally untraceable. The remaining patients refused to come to hospital and equally were unwilling to interview the writer in their own homes. It was fully appreciated that many of these men had war commitments which made the granting of such facilities difficult.

A superficial genital examination of the 82 patients showed that no abnormality other than those attributable to operative intervention, was present in 38 men, 1 to 13 years after a bilateral genital operation had been performed. The

mean period between the operation and the examination in these 38 cases was 6.34 years. In 16 men after a unilateral operation 2 to 20 years previously, mean 7.44 years, tuberculous involvement of the remaining epididymis was found; in none of these cases had vasectomy of the healthy vas deferens been carried out. Nineteen men between 2 and 11 years after a unilateral operation did not show any abnormality of the other epididymis. The mean duration of these cases since operation was 5.68 years and in 6 instances vasectomy of the healthy vas deferens had been performed. Nine patients attended hospital for examination with a history of epididymitis which had been treated conservatively 1 to 7 years previously, mean 5.2 years. Local extension of the disease was found in 7 of the 9 patients with scrotal fistulae in 2, slight improvement in 1 and no change was obvious in the remaining case. In these men who had a previous bilateral genital operation, bilateral epididymectomy was carried out 20 times, epididymectomy and orchidectomy in 10 instances and bilateral orchidectomy 3 times. The unilateral operation was one of epididymectomy in 23 and orchidectomy in 12 men.

Table number 88 shows the results of rectal examination in 82 men. No disease of the pelvic genitalia was palpated in each of 13 men whose epididymes had been removed, while

the prostate and seminal vesicles were still abnormal in 17 men who had undergone a bilateral genital operation. The remaining 8 men in that group of patients who had submitted themselves to a bilateral operation, showed an abnormality of some of the pelvic genitalia. The writer prefers to describe the pelvic lesion as an abnormality rather than a diseased focus as, in 9 instances the prostate and seminal vesicles were so hard that it was thought that calcification had occurred. Kretschmer^{112,113} reported that calcification of these organs does occur and he looked upon the condition as a favourable result of tuberculous prostatitis and seminal vesiculitis. Of the 35 men who had previously undergone a unilateral operation, 21 showed bilateral disease of the pelvic genitalia and of these 21 men, 14 had tuberculosis of the remaining epididymis. Seven men had no palpable deep genital disease after a unilateral operation while the remaining 7 men showed palpable evidence of prostatitis or seminal vesiculitis or both. The 9 men who had purely conservative treatment for their epididymitis all showed bilateral disease of the deep genitalia, the epididymal lesion being bilateral in 8 and unilateral in one man.

TABLE NO. 88

Results of Rectal Examination in 82 Patients on their re-examination

	Previous Bilateral Operation	Previous Unilateral Operation	Previous Con- servative Treatment
P + Bi.SV	17	21	8 (7 bilateral epididymitis)
RP + RSV	1	3	
LP + LSV	1	3	
P	6	1	1 (bilateral)
No abnormality	13	7	
Total	38	35	9

P = bilateral prostatitis

Bi.SV = bilateral seminal
vesiculitis

RP = right lobe prostatitis

LP = left lobe prostatitis

RSV = right seminal vesicu-
culitis

LSV = left seminal vesicu-
culitis

Unfortunately in only 32 patients was a rectal examination carried out while the patient was undergoing treatment in hospital. In 17 instances, no abnormality could be palpated rectally on the patient's re-examination, when it was known that disease had been present during their stay in hospital.

TABLE NO. 89

The Localisation of the Pelvic Genital Disease during hospital treatment and on re-examination, in 32 Patients. The interval between the two examinations is shown in years.

	Localisation of Pelvic Genital disease during hospital treatment	Type of operation performed (if any)	Localisation of pelvic genital disease on re-examination	Interval in years between hospital treatment and re-examination	Difference in pelvic genital disease on re-examination
1	P + Bi.SV	Bilateral	P	8	Improved
2	P + Bi.SV	B	None	7	Well
3	RP + RSV	U	None	4	Well
4	P + Bi.SV	B	P	3	Improved
5	P + Bi.SV	B	None	6	Well
6	P + Bi.SV	B	P (slight)	8	Improved
7	LP + LSV	U	None	10	Well
8	P + Bi.SV	No operation	P + Bi.SV	6	No change
9	RSV + RP	B	P	10	No change
10	RSV + BP	B	None	5	Well
11	RSV +	U	P (very hard)	11	Improved
12	P + Bi.SV	B	P (slight)	8	Improved
13	P + Bi.SV	B	P + Bi.SV	4	No change
14	RSV	U	RP (slight)	2	Improved
15	None	B	RSV + RP	5	Worse
16	P + Bi.SV	U	P + Bi.SV	5	No change
17	P + Bi.SV	B	P + Bi.SV	4	No change
18	P + Bi.SV	B	P	7	Improved
19	P + Bi.SV	U	P	5	Improved
20	P + Bi.SV	B	None	12	Well
21	P + Bi.SV	U	P + Bi.SV	7	No change
22	P + Bi.SV	B	P+Bi.SV. calcified	4	Improved
23	P + Bi.SV	B	P+Bi.SV (very hard)	5	Improved
24	P + Bi.SV	B	None	5	Well
25	P + Bi.SV	B	P (calcified)	13	Improved
26	P + Bi.SV	B	P + Bi.SV	11	No change
27	P + Bi.SV	B	P + Bi.SV	2	No change
28	LSV + LP	U+Vasectomy	LSV+LP (very hard)	6	Improved
29	RSV + RP	U+Vasectomy	RSV+RP (hard)	2	Improved
30	P + Bi.SV	B	LSV (hard)	8	Improved
31	Bi.SV	U	P+Bi.SV (hard)	9	Worse
32	P + Bi.SV	B	P (very hard)	3	Improved

P. = bilateral prostatitis Bi.SV = Bilateral seminal vesiculitis
 RSV = right seminal vesiculitis LSV = left seminal vesiculitis
 RP = right lobe prostatitis LP = left lobe prostatitis
 B = bilateral U = unilateral

Table number 89 shows that, in most of the patients, there was an improvement in the pelvic genital disease between the time of the hospital and operative treatment and the time of the re-examination. The table also shows for each patient the pelvic genital disease before treatment, the type of treatment carried out and the interval between the hospital stay and the re-examination. The result of each rectal examination, on the patient's review, is also shown, and a study of the whole table clarifies the position which might otherwise entail a very complicated and involved description. It can be seen that the re-examination showed no pelvic genital disease in 7, an improvement in the pelvic disease in 15, no change in 8 and a worsening in 2 men.

In the discussion on the pathogenesis of genital tuberculosis, the writer concluded that, in the majority of cases, epididymal tuberculosis follows renal and pelvic genital tuberculosis. From the experimental and clinical results of other workers in addition to his own findings, he was convinced that the commonest route of infection to the epididymis was by way of the vas deferens from the posterior urethra, the vehicle being the infected urine. In Chapter 7 (Associated Renal Lesions) it was found that at least 59.96% of the 402 patients with epididymitis, also suffered from renal tuberculosis and the writer emphasised that the

investigation of the urinary tract in many was not carried out thoroughly and in point of fact was not attempted in 161 patients. When the 82 patients presented themselves for re-examination particular interest was taken in 67 men who had not been previously investigated for renal disease, the other 15 men having received treatment for definite renal tuberculosis. The first step taken in the review of these 67 men was the examination of the urine by the microscope and guinea-pig inoculation for tubercle bacilli, followed by intravenous pyelography and sometimes cystoscopy, catheterisation of the ureters and retrograde pyelography. Unfortunately, several patients were unwilling to co-operate fully, in that several specimens of urine never reached the hospital and some objected to pyelography and cystoscopy. Other difficulties which arose included undue delay in the delivery of the urinary specimens from the Corporation dispensaries and the untimely death of several guinea-pigs from intercurrent disease. In spite of these difficulties the writer was interested and not at all surprised to find that 37 of the 67 men, 55.22%, had definite renal tuberculosis (bilateral 16, unilateral 21). It must be stressed again that these 37 patients did not undergo any previous renal investigation and in consequence, that number should be added to the previous total of 241 men with associated renal and

genital tuberculosis (Chapter 7) to give the combined total of 278, 69.15% of the 402 cases. It may be argued that the renal disease in these 37 patients developed some time after the epididymal disease, a viewpoint which the present writer cannot disprove, but it suggests the contrary, that in each of 2 cases the intravenous pyelograms showed complete calcification of one kidney which pointed to old-standing disease and in 2 other cases the radiologist reported areas of calcification in one kidney region. Further, the two patients with complete calcification of one kidney had, at the time of re-examination, no urological symptoms and the urine was free of albumen and tubercle bacilli, each constituting a "closed" renal lesion. Ten of the remaining patients who were diagnosed as having renal tuberculosis, had no urinary symptoms while in a further 4 men, the only abnormality which was admitted, was the fact that micturition was necessary on one occasion each night. Before leaving the present section the writer wishes to state that in his opinion, these cases of silent renal tuberculosis are further proof that renal tuberculosis may be present without causing symptoms and that no case of tuberculous epididymitis should be under treatment without at the same time undergoing a full renal investigation whether or no the urine contains tubercle bacilli.

In the 30 of the 67 patients, who were not diagnosed as definitely suffering from renal tuberculosis, it is unfortunate that in these men a complete investigation was not carried out in any one case, due to the difficulties which have been mentioned previously. The writer prefers to state that renal tuberculosis was not diagnosed as in no case was the investigation sufficient to rule out the possibility of renal disease. Five of the 30 men suffered from nocturnal frequency of unknown cause, 7 had a tuberculous bacilluria without pyelography being carried out, and a further 3 patients whose urinary specimens were negative for tubercle bacilli showed abnormal pyelograms. An additional 10 men refused to allow pyelography to be undertaken and 3 patients neglected to send specimens of urine to the hospital.

The review of the 82 patients 1 to 20 years after their hospital treatment has given the writer the definite impression that the superficial genital operation was beneficial to the patient, as of the 9 patients who did not have surgical treatment 7 showed deterioration several years later. The results locally of bilateral operative procedures were good, but when a unilateral operation was carried out there was a distinct tendency for recurrence of the disease on the other side. That recurrence appears to be preventable

when vasectomy of the healthy vas deferens is carried out, as in 6 patients reviewed several years after vasectomy no instance of involvement of the remaining epididymis was found. The fact that vasectomy appears to prevent spread of the disease to the healthy side is further proof in the writer's opinion that tubercle bacilli reach the epididymis by way of the vas deferens. After local surgical treatment it was found that the pelvic genital disease improved in the majority of patients who were known to have pelvic disease prior to the operation. In the one case reviewed with known pelvic genital disease before treatment, in which conservative treatment only was employed, the rectal examination 6 years later showed no alteration in the disease of the prostate and seminal vesicles. As the writer fully expected, his attempt to investigate the urinary tract in those patients who did not have such an examination previously, resulted in renal tuberculosis being diagnosed in all the patients who had a complete investigation. He considers it important that many of the patients who suffered from renal tuberculosis did not have any signs or symptoms of renal disease.

CHAPTER 11OPERATIONS FOR GENITAL TUBERCULOSIS

1. Epididymotomy.
2. Epididymectomy.
3. Orchidectomy.
4. Vasectomy.
5. Vasostomy.
6. Radical Operation (Young)

1. Epididymotomy.

An incision is made through the skin over the point of juncture between the swollen epididymis and testis, 6 to 10 centimetres in length, and includes skin, fascia and tunica vaginalis which is opened longitudinally at the juncture of the testis and epididymis. The epididymis is found, examined and multiple punctures made through its fibrous covering with a small tenotome. The knife is continued deep enough to penetrate the thickened fibrous capsule and pus, if present, is evacuated and if caseation is found it may be curetted and 10% iodoform and glycerine injected.

Thomson-Walker⁴⁴ and Keyes⁵¹ report favourably on this procedure, the latter splitting the epididymis in its whole length and using a curette to remove all the tuberculous foci.

He then leaves the whole area open with the edges sutured to the skin.

2. Epididymectomy.

Miles and Wilkie²²⁹ state that, owing to the rugose nature of the skin of the scrotum and to the fact that it is peculiarly sensitive to the irritant action of antiseptics, it is difficult to obtain a sufficient degree of asepsis to ensure primary union. It is therefore advisable in their opinion to avoid carrying incisions into the scrotal tissues if the purpose of the operation can be attained without doing so.

The skin incision is made in the line of the inguinal canal about a finger's breadth above the medial portion of the inguinal ligament, exposing the aponeurosis of the external abdominal oblique muscle and the external abdominal ring. The coverings of the spermatic bundle are divided and the spermatic cord exposed. Traction on the cord and blunt dissection separating it from its scrotal coverings are used to deliver the testis enclosed in its coverings, through the wound.

The next step in the procedure is to open the tunica vaginalis in the median line and the testis and epididymis lie free. Blunt dissection is used if possible, to free the globus minor from the testis but if the structures are

very adherent, careful sharp dissection with scalpel or scissors may be necessary, care being taken to avoid opening the tuberculous epididymis or the body of the testis. As the dissection proceeds particular care should be taken not to injure the arterial supply to the testis which passes into the testis at its upper and medial aspect. When the globus major is reached several large veins must be carefully avoided.

If there is any tuberculous involvement of the coverings, the affected areas may be removed en bloc with the epididymis, a procedure calling for patience and careful blunt dissection. When the coverings are free from disease the testis should be enclosed in them at the end of the operation, interrupted cat-gut sutures being used. When the epididymis is free, the vas deferens is followed up and freed to the external abdominal ring where it is ligated and divided. The testis is then examined carefully and if necessary incised to find out if there is any disease present, these affected areas being removed. Where the testis is extensively involved it must be sacrificed but up to 50% of it may be removed without interfering with its viability. The inguinal wound is then closed, with or without drainage.

Picque and Worms²³⁰ showed that, in every case, there is an anastomosis between the three arteries, the spermatic,

the deferential and the cremasteric. Theoretically, sufficient blood supply to the testis ought to be maintained if any two of these vessels are sacrificed but practically, it seems unlikely that the spermatic and deferential can be sacrificed without grave risk of resultant atrophy of the testis.

Alternative Technique of Epididymectomy (Cecil)^{214,215}

An elliptical incision is made in the scrotum over the testis and epididymis and these structures extruded. Separation of the epididymis from the testis is undertaken by means of the diathermy knife and both structures wrapped in gauze. A haemostat is passed through the scrotal wound and its point is made to protrude beneath the skin over the external abdominal ring. A small nick is made over the tip of the haemostat and another haemostat is pushed along the same path. The latter is used to clamp the vas deferens near the epididymis. With the diathermy knife the duct is severed distal to the clamp freeing the epididymis which is cast aside. The clamp and the vas are then withdrawn upwards bringing the latter on to the groin. It is then wrapped in gauze and strapped to the abdomen. The testis is replaced in the scrotum and the scrotal wound closed. At the end of a week the vas deferens separates at the level of the skin like the umbilical cord.

Alternative Technique of Epididymectomy (Cabot)²³¹

Cabot prefers to describe this operation as epididymo-vasectomy and he carries it out by making his incision over the epididymis circumscribing sinuses if present. The epididymis is then separated from the testis and concerning the following steps of the operation the writer quotes Cabot, "when it (the epididymis) is free, the lower inch or two of the vas should be stripped up by blunt dissection from the structures of the cord. A curved clamp is then applied to the vas and the epididymis, and the lower inch or two of the vas cut away. The vas is then stripped up by blunt dissection with the fingers so as to free it from the structures of the cord up to the external abdominal ring. Guided by the finger, the clamp on the lower end of the vas is then passed up to the external ring and carefully inserted into the canal, care being taken to avoid pushing it in front of the canal between the fascia and the fat. The clamp is then pushed upward and outward following the line of the inguinal canal until its tip lies directly beneath the fascia at the level of the internal abdominal ring. The handle of the clamp is then strongly depressed, bringing the point snugly against the skin. An incision, not over $\frac{1}{2}$ inch in length is then made on the point of the clamp, which is then pushed out through the incision carrying with

it the distal end of the vas. The vas is then picked up and traction is made so as to pull out the portion lying in the canal so that the remaining portion dives vertically into the wound and over the brim of the pelvis. The finger is then inserted into the little wound and the vas is freed as far as the finger can reach, making steady traction during this process. A right-angled clamp is then applied to the vas at its lowest accessible point. It is divided, cauterized with phenol (carbolic acid) ligated and dropped back. The wound in the groin is closed with one catgut suture in the fascia, with a silk-worm stitch in the skin."

Cabot then advises curetting any apparent foci in the testis and closing the wound with a silk-worm stitch, leaving a protective-tissue drain at the lower angle. He finds that the drain shortens the convalescence by giving free exit to the serum which necessarily oozes from the raw surface and removes it in 48 hours.

3. Orchidectomy.

The incision is similar to that used for epididymectomy by the inguinal route. When the testis is delivered the spermatic cord may be ligated en masse and transfixed at the external abdominal ring and removed. Alternatively, the vas deferens may be separated from the other constituents of the cord and divided, the vessels secured with forceps and

tied separately and the testis removed.

4. Vasectomy.

This operative procedure may be performed under local anaesthesia unless a more major operation is being performed on the other side at the same time. The cord is grasped through the skin between finger and thumb, the duct defined and a small incision made down upon the cord. The duct is withdrawn and 1 to 2 inches resected and the ends ligated and allowed to slip back into the wound, which is then sutured.

5. Vasostomy.

This operation consists in exposing the vas deferens through a small incision and injecting solution through the lumen of the vas. The procedure may be carried out as an adjunct to epididymo-vasectomy.

6. Radical Operation (Young)⁵³

The following details are taken from a description of the operation by Young. His plan is (1) complete excision of the lateral lobes of the prostate, seminal vesicles, ampullae and lower portions of the vasa deferentia through the perineum, without opening the urinary tract and (2) excision of the remainder of the vas deferens, epididymis (and testis if diseased) through the groin or scrotum. The exaggerated perineal prostatectomy position is used and when

the patient is in position Young's long urethral tractor is inserted until the beak reaches the apex of the prostate.

The skin incision is the inverted U perineal incision used in prostatectomy, with its centre about 3 centimetres in front of the anus, just behind the bulb in the perineum and extending obliquely backward and outward and around the anus on each side for a distance of 8 centimetres. Blunt dissection is carried out on each side of the central tendon, and division of the tendon and recto-urethralis muscle follows, with resulting exposure of the membranous urethra at the apex of the prostate.

At this stage, the convexity of the tractor (closed) can be felt in the membranous urethra. The instrument is then gently pushed into the bladder and opened out and fixed in this position by means of a screw near the outer end. Young then divides the posterior layer of Denonvilliers fascia which covers the apex of the prostate and access is gained to the anterior layer of Denonvilliers fascia. By blunt dissection the fascial layers are rapidly opened up and the whole posterior surface of the prostate and the adjacent portions of the seminal vesicles exposed, traction at the same time being made with the long retractor in the urethra to draw down the seminal vesicles. For a wider exposure it is generally advisable to incise slightly the

levator ani muscles and retract at each inferior angle of the wound.

Incisions are now made on each side of the urethra about $1\frac{1}{2}$ centimetres apart, and going deeply into the prostatic substance and, as soon as the region immediately above the prostate is brought into view an inverted U incision is made through the anterior layer of Denonvilliers fascia over the lower portion of each vesicle. By blunt dissection the fascia is stripped up from the posterior surface of the vesicles and ampullae as well as from the lateral lobes of the prostate and adjacent lower portions of the vesicles in front.

Isolation of the seminal vesicles and vasa deferentia is carried out by blunt dissection, care being taken in the separation of the vesicles from the bladder wall. The vesicle may then be separated from the vas and a tape placed round each for purposes of traction. A clamp should then be placed across the fibro-vascular pedicle at the upper end of the seminal vesicle and this should be very carefully ligated with heavy cat-gut using transfixion sutures if necessary. The vas deferens should be isolated by blunt dissection as high up as possible and clamped doubly and divided. The upper clamp is left in situ for subsequent traction, to liberate the remaining vas previous to its

removal through the groin. The opposite seminal vesicle and vas deferens are similarly isolated, clamped and ligated and the operator then proceeds to complete the separation of the anterior portions of the seminal vesicles and vasa from the bladder.

The attention of the operator is then given to the lateral lobes of the prostate, the capsule of which has already been dissected off. With a knife a deep incision parallel and near to the urethra is made and by means of a long sharp curette almost all of each lateral lobe is gouged out, carried backward, and removed in continuity with the seminal vesicle to which it is adherent. Sharp dissection is necessary at the vesico-prostatic juncture, and on each side of the median line it is necessary to cut across the ejaculatory ducts at the upper end of the prostate. The specimen consisting of the lateral lobes of the prostate, portions of the ejaculatory ducts, ampullae, and seminal vesicles, may then be removed in one piece.

Second Stage of Operation: Epididymectomy and Extraction of the remainder of Vas through the groin.

Young carries out this procedure using a high scrotal incision, the technique of epididymectomy being the same as described previously. When the epididymis with the vas attached is free from the testis he carries out a to-and-fro

traction on the vas by means of the clamp attached to its deeper portion (stage 1) and the vas grasped with gauze between the thumb and finger externally. The vas is liberated in this way and on removing the clamp from the deeper end, no difficulty is usually experienced in withdrawing the entire remaining vas out through the inguinal canal.

If the opposite epididymis is involved complete epididymovasectomy is carried out on that side also. Where no operation is done upon the opposite side of the scrotum the retrovesical portion of the vas may be forcibly divulsed and as much removed as will come away with the ampulla.

CHAPTER 12 - SUMMARY AND CONCLUSIONSUMMARY.

Four hundred and two cases of tuberculous epididymitis were reviewed in detail to establish what is known or suspected of that condition. Special attention was paid to the wider aspects of the disease and a pathogenesis of tuberculous epididymitis has been presented which is at variance with much of the generally accepted conception.

CONCLUSIONS.

1. The incidence of tuberculous epididymitis in tuberculous men is about 5%. The figure reached in the cases reviewed was 7.34%, but in the writer's opinion that represented an incidence in a selected population owing to the formation of a genito-urinary department in Robroyston Hospital in 1934. The mean percentage incidence for the years prior to the establishment of the special department was 4.52%, a figure which corresponds closely to 4.7% and 5% respectively found by other workers (Chapter 3.a.).
2. Tuberculous epididymitis may occur in males at any age from infancy to old age, but the disease is essentially one of the period of greatest sexual activity. Of the 402 cases of tuberculous epididymitis 71% occurred in men between the years of 16 and 40 and 60% between 21 and 40 years

(Chapter 3.b.).

3. Tuberculous epididymitis is, in the great majority of cases, secondary to extra-genital tuberculous disease, other foci of disease being obvious in 88.32% of the series reviewed (Chapter 3.c.). A single extra-genital focus of tuberculosis was obvious in 263 men or 65.42% while more than one lesion was found in 92 or 22.89%. In 47 patients, 11.69%, no extra-genital tuberculosis was discovered (Chapter 3.c.).
4. Injury does not play an important part in the production or localisation of the genital disease. Eighteen patients, 4.48%, attributed their genital lesion to injury (Chapter 3.d.) but, accepting the statement of Girdlestone that local injury can be excluded from causal relationship with a lesion unless it occurred more than one month and less than six months before the development of the first symptom, in only 3 or 16.67% of the 18 patients, 0.75% of the total 402 cases, would that condition be fulfilled. The type of injury varied but in the writer's opinion, injury would be more liable to damage the testis and not the epididymis, since the latter lies posterior to the testis (chapter 3.d.).
5. There was no evidence to support the view that, in a tuberculous patient, with a history of previous gonococcal

epididymitis, tuberculous epididymitis was a likely occurrence. Only 10 case records, 2.44% of the total, showed that there had been a previous infection of the epididymis by the gonococcus, and in only 3 of these was the interval between the infections known (Chapter 3.e.).

6. In the diagnosis of tuberculous epididymitis, neoplasm and septic infection are the most important conditions to be excluded, the former taking first place owing to the dangers of mis-diagnosis. In a young male, with an obvious extra-genital tuberculous lesion, and with the local condition as laid down in chapter 4 the diagnosis is probably tuberculosis.
7. About half of the cases examined with tuberculous epididymitis are bilateral when first seen, 46.27% of the total being bilateral when admitted to Robroyston Hospital and 56.47% being the total of bilateral cases soon after (chapter 5.a.).
8. Since tuberculous epididymitis tends to be a bilateral disease it is unlikely that injury would have any influence on its localisation and certainly it appears that a local cause should be sought in the pathogenesis of tuberculous epididymitis.

9. From his study of a selected 63 patients with bilateral epididymitis (chapter 5.a.) it appears that involvement of the second side is an early event in most cases. Of the 63 cases, the second side was diseased within six months of the onset of the primary epididymal lesion in 58.73%, within one year in 74.60% and within two years in 87.3%.
10. In 8 cases, 12.7%, the time interval between the onset of disease of the two sides was more than two years, the intervals in 3 cases being 6, 8 and 9 years respectively, and so it appears that the danger to the second side cannot be entirely eliminated until after a lapse of 9 years (chapter 5.a.).
11. The writer considers it possible to classify tuberculous lesions of the epididymis as acute, subacute and chronic, and has given his criteria for each type in chapter 5.b. Subacute and chronic tuberculous epididymitis, in most cases, occur in patients with active tuberculous lesions elsewhere in the body and the number of genital lesions developing in patients with inactive tuberculosis is small (chapter 5.b.1). The acute form of tuberculous epididymitis is always associated with an active extra-genital tuberculous focus.

12. Genital tuberculosis commences acutely sufficiently often to render the tubercle bacillus being considered a possible causative agent in those cases of acute epididymo-orchitis, where the nature of the infection is not immediately apparent. In the series reviewed, 6.21% of cases commenced acutely (chapter 6.b.2.)
13. Acute tuberculous epididymo-orchitis usually occurs in young patients, the great majority being present in men under 40 years of age (chapter 5.b.2.)
14. Acute tuberculous epididymo-orchitis may be divided into two types, in one of which the epididymo-orchitis occurs during a generalised tuberculosis from which the patient soon dies, and in the second type, the acute lesion becomes subacute or chronic and behaves as such. Out of 25 cases, only 3 or 12% conformed to the first type and therefore the writer considers that most cases of acute tuberculous epididymo-orchitis soon settle and become subacute or chronic (chapter 5.b.2.)
15. It is possible for a patient with subacute or chronic unilateral epididymitis to develop an acute lesion on the other side and it is also possible for the initial epididymal lesion to be an acute unilateral or bilateral one.

16. Sudden pain and swelling associated with general symptoms is the sequence of events in all patients with acute tuberculous epididymitis (chapter 5.b.2.).
17. The slightest abnormality of the male genitalia is generally sufficient to cause a patient to seek medical advice. No fewer than 55.76% of the 402 cases reviewed were in hospital for treatment within three months and 79.89% within six months of the onset of the epididymal disease (chapter 5.b.).
18. Tuberculous epididymitis usually starts in the globus minor, as out of 88 cases admitted to hospital within two months of the onset of the epididymitis, 33, or 37.5%, showed disease localised to the globus minor, 5 or 5.68% showed disease localised to the globus major and 50 or 56.8% showed disease of the whole organ (chapter 5.b.1.).
19. It is rare for tuberculous disease to begin in the globus major as in 92 tuberculous epididymes commencing in hospital, 62% showed a lesion localised to the globus minor and no case was observed in which the globus major was the only part involved (chapter 5.b.1.).
20. It is uncommon for the tuberculous process to remain localised to the epididymis for a period of more than seven months (chapter 5.b.1.).

21. If the testis becomes involved by a spread of the disease from the epididymis, other complications are likely. Only 13 of the cases admitted to hospital with genital tuberculosis, 3.49%, showed disease localised to the epididymis and testis, and the duration of the disease was always less than one year (chapter 5.b.1.). Of the 92 tuberculous epididymes developing in hospital only 2 or 2.17% showed the same condition and the duration of both cases was two months.
22. Apart from an uncomplicated epididymitis, the commonest lesion is one which involves the epididymis, the testis and the vas deferens with an associated fistula (chapter 5.b.1.).
23. About half of the patients with tuberculous epididymitis will develop scrotal fistula, the percentage in the series reviewed being 41.04, (chapter 5.c.), but the writer is convinced that the above figure would be higher in patients treated on purely conservative lines. Early operation, when possible, is favoured in Robroyston Hospital, a factor which contributes to a diminished incidence of scrotal fistula formation.
24. The age of the patient does not influence the formation of a scrotal fistula (chapter 5.e.).

25. Sinus formation is not more common in those patients with a major active extra-genital tuberculous lesion; it appears that it is the state of the epididymal lesion which determines the presence or absence of scrotal fistulae (chapter 5.e.).
26. Scrotal fistula formation, when it occurs, is an early feature of tuberculous epididymitis in the great majority of cases. Out of 176 tuberculous epididymes with associated scrotal fistulae, the fistulae developed in 45.45% within two months, in 63.64% within three months, in 75% within four months, in 84.66% within six months and in 94.88% within one year of the onset of the epididymal lesion.
27. A scrotal fistula is unlikely to develop in association with a tuberculous epididymis of more than one year's duration, but the danger cannot be entirely eliminated until after the lapse of 6 years. In the series reviewed, 5.11% of the scrotal fistulae developed within sixteen months and six years from the onset of the epididymal lesion (chapter 5.e.).
28. Inguinal adenitis, in association with tuberculous epididymitis, is due to involvement of the scrotum with or without fistula formation (chapter 5.g.).

29. Tuberculosis of the testis, in the great majority of cases, follows epididymal tuberculosis. The writer has never seen a case of isolated tuberculosis of the testis and no record of such exists in Robroyston Hospital (chapter 5.c.).
30. In about one third of the men with epididymal tuberculosis, the testis becomes involved. Out of 383 men with genital tuberculosis, 35.51% had disease of the testis (chapter 5.c.).
31. Involvement of the testis from the epididymis is an early feature, as 39.52% of the cases admitted to hospital with tuberculous epididymo-orchitis were found within three months, 73.39% within six months and 87.1% within one year of the onset of the epididymitis (chapter 5.c.). Out of 17 men who developed their genital disease in hospital, the testis became diseased within one month in 5.88%, within two months in 58.82%, within four months in 76.47% and within seven months of the onset of the epididymal lesion in 100% (chapter 5.c.).
32. The testis in the great majority of cases becomes diseased by a spread of the tuberculous process from the globus major and body of the epididymis. Exceptionally,

discrete tubercles may be found throughout the substance of the organ (chapter 5.c.)

33. Hydrocele of the tunica vaginalis occurs in from 10 to 20% of all cases of tuberculous epididymitis. It may be the only sign of tuberculosis of the superficial genitalia and should be viewed with suspicion in a man with a history of past or present tuberculosis (chapter 5.f.).
34. Tuberculosis of the vas deferens is due to an extension of the disease from the seminal vesicles, the prostate and the epididymis, as, in the series reviewed (chapter 5.d.) 10 cases were present which showed involvement of the proximal and distal thirds with the middle third of the vas deferens free from disease.
35. Tuberculous vasitis is present in over half of the patients with tuberculous epididymitis, the percentage being 53.79 in the cases reviewed (chapter 5.d.).
36. Tuberculosis of the vas deferens appears as an early feature of genital tuberculosis, as 53.69% of the patients with vasitis were found within four months and 80.78% within eight months from the start of the epididymitis (chapter 5.d.).
37. The writer has seen one case in which there was disease

of the prostate and seminal vesicles with an ascending infection of the vas deferens without epididymal involvement and so he concludes that epididymitis is not an essential precursor to tuberculous vasitis.

38. The writer believes that there is a pre-existence of seminal vesicular or prostatic tuberculosis or a co-existence of both, for a considerable period before clinical tuberculous epididymitis becomes apparent. That conclusion is based upon a study of 195 patients who were admitted to hospital with pelvic genital disease and epididymitis (page 144), 23 patients who had unilateral epididymitis and pelvic genital disease on admission to hospital but who later developed involvement of the second epididymis (page 159) and 12 patients in whom disease of the pelvic genitalia was found before the onset of epididymitis (page 161).
39. Renal tuberculosis in the great majority of cases, is associated with epididymal tuberculosis. In the 402 cases of tuberculous epididymitis studied, the association of these two lesions was found in 59.95%, the remaining 40.05% of the patients not being investigated for renal tuberculosis (chapter 7.).
40. Renal tuberculosis in the great majority of cases precedes genital tuberculosis (page 234) and the writer does

not consider that anyone has demonstrated that the spread of tuberculosis may be from the epididymis to the kidney.

41. Renal tuberculosis, pelvic genital tuberculosis and tuberculous epididymitis constitute a clinical unity, with the prostate and seminal vesicles the link between the kidney and the epididymis (chapter 8.).
42. With an established renal tuberculosis, the infected urine carries tubercle bacilli to the prostate and seminal vesicles and the epididymis becomes diseased by the tubercle bacilli passing down the vas deferens (chapter 8.).
43. It is possible for the testis to become tuberculous by means of a blood spread of the infection to the organ, but in these cases small discrete tubercles are found throughout its substance (chapter 5.c.).
44. Since the writer has found 4 cases in which there was a blood spread of tuberculosis to the testis (page 115) he cannot accept the view held by many, that the same route accounts for infection of the epididymis. With the same blood supply to both organs, it appears to be very unlikely that the organisms, in the vast majority of cases, would settle in the epididymis. Furthermore epididymitis is essentially a bilateral disease, and if local spread suffices

for infection of the second epididymis, it should suffice for infection of the first epididymis.

45. In the writer's opinion, no satisfactory evidence has been advanced to support the lymphatic spread of the disease from the prostate and seminal vesicles to the epididymis.
46. The treatment of tuberculosis, including genital tuberculosis, consists basically of general constitutional treatment, with perhaps ultra-violet light and tuberculin in suitable patients as useful adjuvants.
47. Operative intervention in genital tuberculosis, in suitable patients, is beneficial. Among the contra-indications to operation are, advanced extra-genital lesions or the existence of a degree of illness which would make the risk of operation unjustifiable. Among the benefits are (1) the more rapid healing of scrotal fistulae (chapter 9b.), (2) the prevention of spread from one epididymis to the other by means of epididymectomy on one side and vasectomy of the healthy vas deferens on the other (chapters 9 and 10), (3) the prevention of spread from the epididymis to the adjoining structures (chapters 9 and 10), (4) the tendency for the prostate and seminal vesicles to heal after a local genital operation (chapter 10), and (5) the eradication of one focus of tuberculosis which may aid the patient to

overcome other lesions.

48. Age has little influence except at the extremes of life in the decision to operate in genital tuberculosis.
49. The operation of choice for tuberculous epididymitis is epididymectomy (chapter 10). In unilateral cases epididymectomy on one side and vasectomy of the healthy vas deferens on the other, will remove the local disease and prevent spread to the second epididymis (chapter 10).
50. As most patients with unilateral epididymitis are sterile, vasectomy of the healthy vas deferens will have little influence on the patient (chapter 10).
51. Orchidectomy should be avoided when possible. Even a small part of the testis may retain its blood supply (chapter 9).
52. If it be necessary to carry out bilateral orchidectomy, provided the patient is past puberty, no physical changes are likely to occur.
53. The radical operation appears to subject the patient to an unnecessary risk especially in hands not accustomed to perineal prostatectomy.
54. The prognosis of genital tuberculosis is the prognosis

in a man with renal tuberculosis and possibly extra-genito-urinary tuberculous lesions; consequently the prognosis depends on the state of the extra-genital lesions as tuberculous epididymitis by itself does not cause death.

55. From the follow-up of all the available patients 2 to 20 years after their hospital treatment, added support was obtained for the view that renal tuberculosis usually precedes genital tuberculosis, that prostatitis and seminal vesiculitis improve and heal after epididymectomy, that operation when possible is advisable and that the outlook in patients with genital tuberculosis is poor due to their extra-genital lesions.
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