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Progress and present status of prostatic surgery

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PROGRESS AND PRESENT STATUS OF PROSTATIC SURGERY

Senior Thesis

Submitted in partial fulfillment of requirements

for Doctor of Medicine

by

Leo H. Hoebet

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SECTION I

HISTORY

The existence of the prostate gland was unknown until the sixteenth century and it is only within the last forty years that its operative surgery has been deemed of sufficient magnitude to require lengthy exposition. Because the distressing symptoms of prostatic hypertrophy so frequently interfere with the pursuit of happiness in later life the physician has always entertained a keen personal, as well as professional, interest in the disease. The subject seems particularly fitting for review this year, as it is the centenary of the first efforts by Guthrie to correct prostatic obstruction through the urethra, and from all indications this year will witness the general abandonment of prostatectomy, either perineal or suprapubic, for some method of transurethral treatment, except in that small percentage of cases where transurethral work is ineffective.

The symptoms of this malady, if we may believe Sir Everard Home, have been recognized since Biblical times. This author surmised that the enlargement of the prostate gland met with so universally in old age is "alluded to in the beautiful description of the natural decay of the body, in the Bible in the book of Ecclesiastes, the 12th chapter, the sixth verse, where it is written, 'or the pitcher be broken at the fountain, or the wheel broken at the cistern'. Ex-

pressive of the two principal effects of the disease - the involuntary passage of urine, and the total stoppage." (1) *

Nicola Massa, a Venetian physician, living in the sixteenth century, generally is accredited as having discovered and described the prostate gland. Reolanus at about the middle of the sixteenth century was the first to suggest that the bladder could be obstructed by a swelling of the prostate.

John Hunter, Sir Everard Home, Brodie, and others both recommended and practiced tunneling of the obstructing body by the catheter, but this method was finally abandoned as dangerous. Chopart states that when Astruc, ten years before his death, which occurred in 1766, was attacked by retention of urine, his attendant, Lafaye, attempted to introduce a catheter but met with an obstruction from tumor in the neck of the bladder. He introduced a stylet through an open end catheter and thus succeeded in forcing the catheter into the bladder and drawing the urine. The catheter was retained for 15 days. This false passage is said to have persisted for the remaining ten years of his life.

Various means of systematic compression to maintain a patulous urethra were used with little success.

*Figures throughout this thesis enclosed in parenthesis (thus) refer to the corresponding numbers in the bibliography.

Special instruments were designed for this purpose, but the remedy was so extremely painful in its application that it met with little general favor. Probably the best known advocate of systematic compression was Dr. Reginald Harrison of London. (2) This surgeon in 1881 devised special olivary bougies, of gum elastic, having an expanded portion an inch from the tip, which was made to enter the bladder. (Fig. I) This instrumentation offered only temporary relief and was never widely advocated.

As is the case of every other department of surgery, operative treatment was at first undertaken only in cases of emergency, where retention of urine existed; or incidentally as part of another operation, such as lithotomy.

Perineal operations came into favor somewhat earlier than those by suprapubic route, owing probably to the greater familiarity of surgeons with operations in the former region, due to widespread practice of perineal lithotomy. Covillard in 1639 successfully operated by perineal cystotomy, and removed a hard mass, not a stone, crushing and destroying it during extraction with the forceps. Sir William Blizard several times before 1806 performed perineal prostatectomy for enlargement without any calculous formation. It has been denied by some writers that Sir William Blizard's operations were anything more than the opening a prostatic abscesses. However, perineal

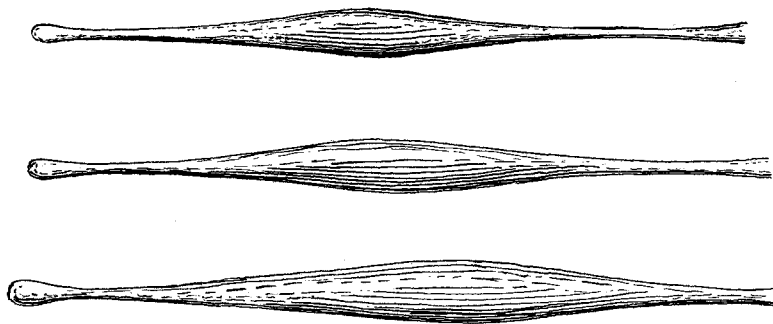


FIG. I - HARRISON'S OLIVARY BOUGIES

prostatectomy combined with lithotomy was by no means infrequent in the early part of the nineteenth century, and was sanctioned by Sir William Ferguson, who employed this procedure before 1848, accepting it as the method of treatment when the catheter failed.

Amussat removed a calculus and a protruding mass of the prostate by suprapubic cystotomy before 1832.

The first regular surgical procedure was established in 1834 by Guthrie, under the name of "division of the bar at the neck of the bladder". This bar being formed by a fold of the mucous membrane stretched taut across the vesicle orifice of the urethra by symmetrical enlargement of the two lateral lobes of the prostate. (3) Alexander Randall of Philadelphia (4) who has carefully studied the pathological changes of the prostate gland, describes the condition as, "Fibrosis which by its inevitable shrinkage stenosis of the bladder orifice produces residual urine and gives all the symptoms of prostatism. Guthrie called the pathological condition 'median bar' formation". His operation was undertaken through the urethra by a catheter carrying a concealed blade.

In 1837 Mercier devised two special instruments called by Gouley "prostatotome" and "prostatectome" (Fig. II) for transurethral correction of prostatic obstruction. The first instrument accomplished the same purpose as Guthrie's, serving merely to divide obstructing bands, and was to all intents and purposes

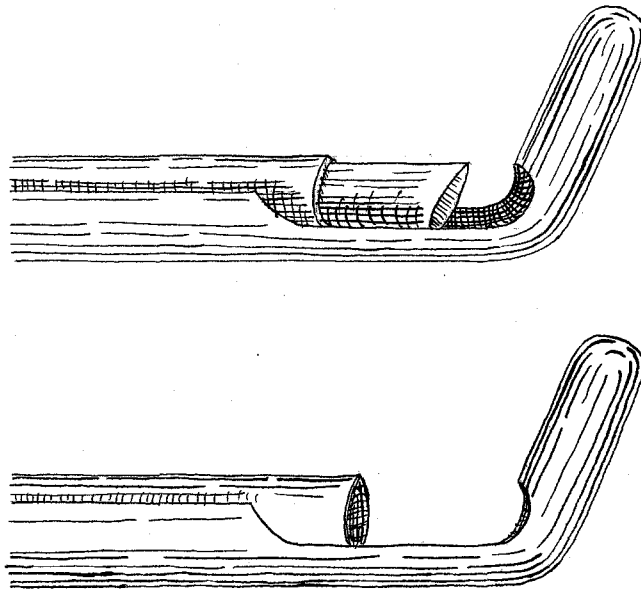


FIG. II - MERCIER'S PROSTATOME &
PROSTATECTOME

a sphincterotome. The second resembled the instrument introduced to the profession by Young in 1911, and since known as a punch. It enabled the operator actually to remove portions of the obstructing tissue, but as it made no provision for either vision or hemostasis, its field of applicability was naturally somewhat limited, although its inventor is credited with having used it with success in several hundred cases. Transurethral surgery produced at once astonishing symptomatic relief. Bottini of Pavia, attempted to expand the application of transurethral methods by use of the galvanocautery. He constructed an instrument resembling a lithotrite, the male blade of which consisted of an electric cautery. A cooling current of water passed through the female blade of the instrument preventing undue heating. Strangely enough Bottini did not popularize his instrument, and it was little known outside of Italy until it was introduced by Freudenberg of Berlin. Freudenberg, becoming an adept in its use, sailed for New York in 1897, where he operated on a number of patients, and persuaded Willy Meyer of its virtues; and Meyer was the first American surgeon to use it. Such an instrument was however of little value outside of median lobe hypertrophy, having little or no value in the hyperplasia of the two lateral lobes.

It was early learned that when glandular hyperplasia is confined to the lateral lobes, urinary ob-

struction occurs from their contact with each other. This type of hypertrophy represents cases in which physical signs from rectal palpation indicate extensive hyperplasia. Any transurethral instrument not manipulated under vision is prone to fall into a groove between lobes and with Bottini's lithotrite-like instrument the resulting destruction of tissue was usually followed by extravasation of urine and fatal sepsis, so that the instrument came into ill repute. Wassidol of Berlin attempted to overcome this lack of vision by adding a system of lenses much as is done in the case of some of the modern instruments. His instrument did not prove successful but it did bestow on its inventor the distinction of being the first to attempt to bring transurethral surgery under vision.

Further modifications of the galvanocautery apparatus were introduced by Dr. H.H. Young in 1902. (5) The greatest advantage of his instrument being that the slipping away of the prostate from the beak of the instrument is rendered nearly impossible, and that thus the risk of burning a hole in the wall of the bladder is minimized.

Sir Henry Thompson, (6) the most eminent authority of 1880, used suprapubic puncture as a temporary measure. Later in 1887 at a meeting of the Clinical Society in London, Thompson recommended permanent suprapubic drainage of the bladder as a method of treatment of enlarged prostate.

Excision of the obstructing parts of the prostate by suprapubic cystotomy was advocated widely by Trendelenburg, Schmidt, and Belfield in 1886. Belfield (7) was the first to report his work in print. Belfield considered himself to be the first surgeon to have performed a suprapubic prostatectomy. In the year of Belfield's report, McGill of Leeds, England, performed his first operation for the removal of obstructing portions of the prostate gland by his approach, and so convincingly persuaded the profession of its advantages that he has been considered by Europeans the father of the suprapubic operation.

At first the suprapubic operation consisted in removing with forceps or by excision that part of the gland which extended visibly into the bladder, but during the next ten years the pioneers in this field became more bold, and it was not long before Fuller, (8) in New York, and Freyer, (9) in England, were each advocating what they both considered complete enucleation of the gland by this route. By their procedures, the obstructing tissue together with a great amount of non-obstructing tissue, was removed, and the functional results were immediately improved; but the mortality was not lowered. As a result, urologic surgeons the world over undertook to institute methods for the reduction of mortality rate.

Goodfellow, (10) Southern Pacific surgeon at Tucson, Arizona performed the first complete perineal

prostatectomy in the St. Mary's Hospital in that city in September of 1891. In 1904 he reported 78 perineal prostatectomies on patients ranging in age from 45 to 84, with only 2 deaths; one from sepsis and one from shock. There were no cases of permanent incontinence or fistulae. His operation was done through a mid-line incision and was used almost universally until about 1905. To gain more room Murphy, Bandit, and Senn used the oblique cut on each side of the anus making the inverted V incision. Somewhat later ZuckerKandl advised a transverse semicircular incision, making a flap toward the rectal aspect.

Combined operations, by the perineal and suprapubic routes, have found a number of supporters. Nicoll removed the gland through the perineum, aiding its extraction by pushing the prostate down by the fingers of one hand introduced into the bladder through the suprapubic wound. Alexander removed it through a suprapubic cystotomy by the aid of the fingers of the other hand in the perineal wound.

A mode of treatment by castration, advocated in 1893 by J. William White, (11) soon met with disfavor. It had been known for many years that in certain animals such as the mole, which have stated periods for sexual intercourse, the prostate is much diminished in size during the intervals, and hence it was inferred that a continuous abeyance of the sexual function would cause atrophy of the prostate in men. Vasectomy

was suggested by Mears as less severe and mutilating operation, and seems likely to continue in use for certain cases for a longer time. The mortality from castration for enlarged prostate was at least 18 per cent and the operation did not relieve the hypertrophy.

Ligation of both internal iliac arteries to induce ischemic atrophy of the prostate was proposed in 1893 by Bier and employed by him in others in 15 cases. Four patients died. Of the eleven who survived eight are said to have gotten more or less relief, while three got no benefit whatever. It was demonstrated that while a primary decrease of the prostate occurred, yet at the end of about eight months it had regained its original volume by virtue of collateral circulation.

Since 1905 great advances have been made in surgical treatment of the prostate, both in actual technique of the operative procedure and in the pre and post operative care. The mortality rate has been lowered markedly. Aschner (12) of the Mount Sinai Hospital, New York reports 277 cases operated in the years 1913-1923 by suprapubic prostatectomy with a mortality rate of 8.3%. Verne C. Hunt (13) of Rochester, Minnesota reports a mortality rate of about 3% on suprapubic prostatectomies performed in 1920-1926.

Hugh H. Young (5) reports a series of 1049 cases in which was carried out a conservative perineal prostatectomy with a death rate of 3.4% on all ages during

a period of years from 1903-1923. Progress is shown by the gradual decrease in mortality rate from 8.4% in 1903 to 2.4% in 1919.

Dr. Edwin Davis (14) of Omaha reports a series of 221 cases operated by perineal route with an enviable mortality rate of only 2.2%. He attributes his conspicuous lowering of mortality rate to three factors. These are 1) proper pre-operative preparation, 2) sacral block anesthesia and 3) complete hemostasis.

While transurethral surgery has been carried out for 100 years, it was following Young's development of his prostate punch in 1911 that much progress was made in this type of prostatic surgery. Young's first punch was a curved posterior urethroscope, with an inner cutting tube, which was later replaced by a tubular cautery in an effort to combat the troublesome hemorrhage. Although the instrument did much to stimulate transurethral work in America, its use in any but median bar formation and obstruction of the contracted neck of the bladder was impossible because of inadequate vision. Braash in 1918 described his median bar excision, which permitted adequate vision but failed to provide for hemostasis, and so failed in wide application.

Caulk, (15) in 1920, presented a modified Young punch in which hemostasis was provided by substituting a cautery blade for the tubular knife of the olden instrument. Although Caulk's instrument was faulty in

vision, the control of bleeding was a long step forward, and he must be given credit for keeping the attention of members of the profession on the problem of transurethral resection.

H.C. Bumpus (3) of Rochester noticed that following the use of the cautery blade, an acute fibrile reaction was produced which generally subsided on the fourth or fifth day but which was sometimes unduly prolonged. It appeared that the cauterized area in the neck of the bladder was more prone to infection than a cleanly incised area. This fact led him to use the Braasch cystoscope, in the barrel of which a fenestra similar to the Caulk instrument had been cut. To control bleeding he removed the instrument and replaced it with a flexible electrode, lightly coagulating the bleeding areas and touched each large arteriole seen spurting.

Later the instrument was modified in construction so that a multiple needle electrode could be thrust into the tissue before the knife is passed, and so renders the course of the knife blade through the tissue more or less bloodless and reduced to a minimum the necessity of electrocoagulation of the area after excision.

While these changes were being developed in the direct vision instrument, Stern (16) was perfecting a lens instrument with which the obstructing tissue was resected by a reciprocating wire loop through

which a high frequency current was passed. This instrument was popularized by T.M. Davis of Greenville, South Carolina, who demonstrated the possibilities of this form of resection and to whom much credit is due for the progress of transurethral resection during the last few years.

Following Davis' success, McCarthy produced his panendoscope, which has better vision, and is equipped with a reciprocating loop which reaches out beyond the end of the instrument and resects the tissue as it is drawn back into the instrument. The loop is larger and therefore work can be carried out more rapidly.

Other urologists, including Day, Ceeil, Kerwin, (17) and Foley, have developed instruments which, in the hands of their designers, have proven efficient. They are all modifications of the Stern panendoscope and the work is done by electrocautery and coagulation.

SECTION II**PATHOLOGY**

We are here concerned only with those pathological changes of the bladder neck in which there is an actual change in the tissues. These various forms of obstruction are classified accordingly as they are benign, inflammatory or malignant. The classification is as follows: (18)

I. Benign Prostatic enlargement.

A. Bilateral lobe enlargement.

B. Solitary posterior commissural enlargement (mid-lobe).

C. Solitary subcervical lobe enlargement (pedunculated mid-lobe).

D. Bilateral and posterior commissural enlargement.

E. Bilateral and subcervical lobe enlargement.

F. Bilateral, posterior commissural and subcervical enlargement.

G. Anterior lobe enlargement.

II. Median bar and contracture of the vesical neck.

III. Carcinoma of the prostate (Not considered in this thesis).

Benign Prostatic Enlargement

Benign prostatic enlargement, in one of its various forms, is found in approximately 70 per cent of cases of obstruction. The condition is either an ad-

enomatous or an inflammatory hyperplasia of the prostate, characterized by an arrangement into one or more lobes. Enlargement of the gland may produce lateral lobes, posterior commissural enlargements, subcervical lobes and anterior lobes separately or in combination.

Solitary Forms of Benign Enlargements

Bilateral lobe enlargement is a frequent form of obstruction. In the usual case there are symmetrical intra-urethral enlargements of the two lateral lobes with compression of the prostatic urethra. Greater enlargement may occur in one lobe with displacement of the prostatic urethra toward the opposite side. In one group of cases the enlargement is confined to the prostatic urethra. In another group the internal sphincter dilates allowing upward or intra-vesical enlargement of the lateral lobes. In this group there may be considerable upward projection with elongation of the prostatic urethra. On rectal examination in either group the prostate is enlarged, smooth, of rubbery consistency with a median furrow palpable and a deep sulcus on either side between the periphery of the gland and the pubic arch. Cystoscopically deep clefts are seen in the anterior and posterior positions running well down into the urethra. When intra-vesical enlargement is present, adjacent zones of bladder wall are obscured by the projecting lobes and

there is elongation of the prostatic urethra. This form of obstruction usually is well suited for cystoscopic prostatectomy. The intruding portions of the lateral lobes are resected, beginning above at the base of the gland and continuing down into the urethra as far as the verumontanum. Contraindications to cystoscopic prostatectomy are occasionally found in this form of obstruction. These are present when the intravesical projection of the lateral lobes is so great that it is impossible to see over them with the operating telescope, or when the prostate is spongy and vascular, causing it to bleed briskly on the slightest instrumentation, thus obscuring vision. Very occasionally there is marked compression and deformity of the urethra and it may be impossible to pass the instrument.

Solitary posterior commissural enlargement, often called mid-lobe or glandular bar, is another frequent form of obstruction due to benign enlargement. The enlargement originates in prostatic tissue connecting the lateral lobes in the floor of the urethra immediately under the muscles of the posterior vesical lip. When the growth is small there is merely elevation of the posterior vesical lip. When large there is marked intravesical projection with the trigone almost entirely obscured. The enlargement early resists the action of the trigone muscle and there is great hy-

hypertrophy of this structure. Difficulty in starting the stream is an early and constant complaint in patients with this form of obstruction. Marked hypertrophy of the bladder wall is common and diverticulum formation is not infrequent. Rectal examination is often misleading when no enlargement of the lateral lobes is present. The mid-lobe may not be palpable even though considerably enlarged. On cystoscopy, forward projection and elevation of the posterior vesical lip by a rounded growth is noted. Clefts are found in the right and left posterolateral positions running down into the urethra and merging together in midline. Hypertrophy of the trigone is marked. In advanced cases this structure is often entirely hidden from the view obtained through the right angle vision observing telescope. Cystoscopic prostatectomy is an ideal procedure for this form of obstruction. The obstructing tissue between the two clefts is resected until the trigone is entirely visible.

Obstruction may be due to enlargement of the subcervical or Albarran glands. These glands form a small group in the floor of the prostatic urethra in midline between the posterior vesical lip and the verumontanum. They are just below the mucosa, and enlargement of them results in a rounded nodule with a narrow pedicle - the so-called pedunculated mid-lobe. Growth is always upward through the sphincter with the

formation of a ball valve which closes the internal vesical orifice during voiding. Rectal examination is usually unsatisfactory since an enlarged subeervical lobe is often not palpable. The diagnosis of this form of obstruction is readily made at cystoscopy. View of the pedicle of the subeervical lobe is best obtained by use of a forward vision telescope. The pedicle is severed and the lobe easily removed by cystoscopic prostatectomy.

Combined Forms of Benign Enlargement

Each of these forms of benign prostatic enlargement may occur in combination with another form. Combined forms of enlargement commonly found are bilateral lobe and mid-lobe, bilateral lobe and pedunculated mid-lobe and occasionally bilateral lobe, mid-lobe and pedunculated mid-lobe.

In obstructions due to the combined enlargement of the lateral lobes and the posterior commissure, enlargement in the posterior commissure leads to dilation of the internal vesical sphincter and permits upward growth of the lateral lobes. In advanced cases there is marked intravesical projection with elongation of the prostatic urethra. At rectal examination the upward direction of the enlargement is apparent, differing in this respect from the downward and backward growth commonly found in pure bilobar enlargement. At

cystoscopic examination a deep cleft separating the lateral lobes is found in mid-position anteriorly, and clefts are found in the right and left posterolateral positions between the median and lateral lobes. The degree of elongation of the prostatic urethra varies with the stage of the growth. At cystoscopic prostatectomy the posterior commissure is resected first, followed by resection of sufficient portions of the lateral lobes to provide a wide funnel-shaped opening. Marked intravesical projection of the lateral lobes and a spongy vascular gland may be encountered in this type of obstruction and prove to be contraindications for cystoscopic prostatectomy.

In combined bilateral lobe and subcervical lobe enlargement pathologically there is the usual bilateral lobe enlargement plus a pedunculated mid-lobe. Here again upward growth of the subcervical lobe causes dilation of the internal sphincter with marked intravesical enlargement of the lateral lobes in advanced cases. On rectal examination the upward enlargement of the laterals is suggested. Cystoscopically there is the usual anterior cleft and deep clefts in right and left posterolateral positions. With the foroblique and retrospective telescope the pedunculated mid-lobe is seen projecting into the bladder. Removal of the obstruction by cystoscopic prostatectomy is accomplished by complete resection of the pedun-

culated mid-lobe and obstructing portions of the lateral lobes.

When obstruction is due to the combination of bilateral lobe, posterior commissural and sub-cervical lobe enlargement, there is intra-urethral and intravesical enlargement of the lateral lobes and upward growth of the posterior commissure with the trigone obscured to some degree. Added to this there is a pedunculated mid-lobe projecting upward through the internal vesical orifice. The presence of this form of obstruction is recognized at cystoscopy in the manner described above. The obstruction usually is readily removed by cystoscopic prostatectomy, except in occasional cases exhibiting contraindications to the method mentioned above. The pedunculated mid-lobe and posterior commissure are resected first, followed by removal of sufficient tissue from the lateral lobes to provide a wide open vesical neck and prostatic urethra.

Anterior lobe enlargement is the rarest form of prostatic enlargement, and is an infrequent cause of obstruction. Hyperplasia in this location is uncommon because glandular tissue of the anterior commissure is rarely present past puberty. The hypertrophy is usually small and may be found in combination with lateral lobes. Its presence is recognized at cystoscopy by the finding of clefts in the right left anterior oblique positions. The growth should be easily removed by cystoscopic prostatectomy.

Median Bar and Contracture

Obstructions may be due to inflammatory changes in the prostate and tissues of the vesical neck, the result of long continued infection. These changes are characterized by replacement of the glandular and muscular structures with fibrous tissue. In the usual case the process is most marked in the tissues beneath the posterior quadrant of the vesical neck with the formation of a median bar. In advanced cases the changes occur throughout the prostate with general contraction of the gland, narrowing of the entire prostatic urethra, and fixation of the vesical neck. When the condition has reached this stage it is called contracture of the bladder neck. Median bar and contracture often occur in very young individuals but are more commonly found in men over forty. In many of the cases a history is obtained of a previous gonorrhoeal urethritis and extension of the infection to the posterior urethra and prostate. A study of the gross pathology of the obstructions due to the formation of a median bar shows a dense inelastic mass of forward projecting tissue forming the posterior quadrant of the vesical neck. The bar causes elevation of the posterior quadrant and the forepart of the trigone. Immediately below the bar the urethra falls away sharply and the verumontanum is drawn upward by the sclerotic process. On cut section the bar is composed of fibrous tissue and a small amount of muscular tissue with glandular

tissue absent. Marked hypertrophy of the bladder wall and trigone are usually present and bladder stone and diverticulum formation are occasionally found associated. On rectal examination the prostate is usually of normal size but of firm consistency. With a sound in the urethra an increased thickness and firmness of the tissues at the bladder neck may be evident on rectal palpation. Diagnosis of obstruction due to median bar or contracture is made only on cystoscopic examination. Since there is no enlargement of the lateral lobes no clefts are seen on examination of the bladder neck. The sharp forward projection of the posterior vesical lip and elevation of the forepart of the trigone are visible. Except in advanced cases with general contracture the prostate urethra falls away immediately below the bar and is quite roomy. Upward displacement of the verumontanum may be noted. This condition is ideally suited for cystoscopic prostatectomy. The forward projecting mass is resected, restoring the normal curve between the trigone and the verumontanum. Relief of the obstruction may also be accomplished by use of one of the punch instruments.

Randall did 800 autopsies on male patients and found prostatic hypertrophies which he has classified as follows: (4)

	<u>Number</u>	<u>Per-cent</u>
Lateral lobe hypertrophies alone	29	18.4
Median lobe hypertrophies alone (subcervical)	42	26.7
General trilobar hypertrophy	22	14.0
Anterior lobe	3	1.9
Carcinoma	8	5.0
Sarcoma	1	0.6
Median bar - fibrous	8	5.0
Median bar - glandular	13	8.2
Median bar - not classified	18	11.4
Median bar - small and non-obstructive	<u>14</u>	8.9
Total	157	

SECTION III**PRESENT STATUS OF PROSTATIC SURGERY**

A - PREOPERATIVE TREATMENT

Preoperative treatment of patients suffering benign hypertrophy of the prostate should aim at control of infection and discovery of lesions in the urinary tract or in other organs which from an internist's point of view might be a factor in increasing morbidity or mortality. Care in evaluation of these factors will materially reduce morbidity or mortality, particularly in that large group of patients who die before prostatectomy is undertaken.

It is generally accepted now that the high mortality rate of twenty years ago has been transferred to a present day preoperative mortality when about 40 per cent of the deaths occur preoperatively. A careful physical survey of the patient should become a rule before any preoperative treatment is started. This should be done because it is known that in many instances our preoperative treatment would either not have been started, or would have been changed, had the findings of a complete physical examination been known. Except in emergencies, a patient with hypertrophy of the prostate should not have more of a urologic examination than the finger palpation of the rectum, urinalysis and x-ray before the results of a complete physical survey, together with blood chemistry and electrocardiogram, are known. Internists know the difficulties that the sufferer with prostatic disease may

have during his preoperative and operative treatment, and of the importance of discovering lesions before preoperative treatment is begun. Having such cooperation it is agreed that preoperative treatment should be delayed until the internist has assured himself that the patient has no condition that may give rise to complications or contribute to morbidity or mortality. Internists have taught the surgeon that patient with any cardiovascular lesion should have more careful and possibly more prolonged preoperative treatment than a patient with normal findings. (19)

Aschner (12) believes that cystostomy for drainage is indicated without question in following conditions: a) Those in which previous attempts to pass a catheter have failed and have resulted in injury to or bleeding from the urethra; b) those in which intravesicle bleeding has occurred so that the bladder cannot be satisfactorily evacuated by catheter and irrigation; c) those in which there is an epididymo-orchitis; d) those in which active renal infection is manifest; e) those complicated by vesical calculi.

Patients who present themselves with complete or almost complete retention should not have an immediate cystostomy performed in the absence of the above indications. These cases should be catheterized and the bladder emptied gradually and intermittently at regular intervals. It has been the practice of Aschner to perform suprapubic cystostomy in all cases of marked

retention after the gradual emptying of the bladder by catheter has been accomplished and some improvement in renal function has been attained.

The statement has at times been made that cystostomy drainage favors improvement in renal function to a greater degree and in less time than does catheter drainage. While clinical impressions on this question may be valuable, they are more subject to personal views and interpretations. Only cases coming to the hospital with large residual urines and laboratory evidence of deficient renal function as judged by phenol-sulphthalein test and blood chemistry were considered. Cases in which catheter drainage yielded definite and substantial improvement by these criteria showed a temporary setback after cystostomy. Others remained stationary, showing no further improvement.

Cases on the other hand which showed slight and very gradual improvement with the catheter, gave evidence of very marked and rapid betterment after cystostomy. Others in which no betterment was made under the catheter regime, also improved rapidly after cystostomy. On the basis of these results, it would seem that those patients failing to improve sufficiently with catheter drainage should be given the possible benefit of cystostomy.

Cystostomy has been preferred to catheter preparation because it puts the prostate and posterior urethra at rest, free from irritation, with an opportunity

for hyperemia and swelling to subside. When there is infection of the bladder, it has been felt that to open up the prostatic bed to absorption at the same time as the suprapubic wound is created and opened up to absorption, is to place added burden upon the kidneys and other vital organs. (20)

The one great undeniable advantage of the catheter is that it permits of gradual or intermittent emptying of the distended bladder. Its possible disadvantages are: (12) a) The infection of the urethra; b) the failure to reduce the congestion and inflammation of the posterior urethra and vesical neck; c) the risk of inducing epididymitis.

According to Aschner it is doubtful if many cases of epididymitis can be laid to the use of an indwelling catheter. In H.H. Young's large series of perineal prostatectomies, (5) prepared by catheter the incidence of epididymitis was 20 per cent. Aschner's incidence of epididymitis following the two stage operation was also about 20 per cent. This would seem to indicate that urethral infection was not an important factor in epididymitis. However, E. Davis (14) of Omaha in 221 cases of perineal prostatectomy had a postoperative epididymitis develop in 28 cases, or about 13 per cent. He considered this to be too high a rate and so adopted a preliminary bilateral vasectomy as a routine prophylactic measure, with a subsequent drop in epididymitis incidence almost to zero.

During the period of drainage the bladder may be irrigated to combat co-existing cystitis. Drainage allows recovery of renal function and stabilization of the cardio-vascular-renal reserve. The length of time that preliminary treatment is necessary depends on the general condition of the patient; such treatment should be continued until the tests of renal function have become stabilized within normal limits. Only under unusual circumstances should prostatectomy be contemplated when the phenolsulphonephthalein return is less than 20 per cent or the urea content of the blood more than 50 milligrams for each 100 cubic centimeters. In many instances a period of from 10 days to 3 weeks of preliminary treatment assures the relative safety of prostatectomy; however, if renal insufficiency is marked and the patient is in poor general condition, it is necessary to drain the bladder for months before prostatectomy may be undertaken with any degree of safety. Experience of V. C. Hunt of Rochester, Minn. (13) has led him to adopt a minimum of 10 days.

B - SUPRAPUBIC PROSTATECTOMY

Usually suprapubic prostatectomy is performed in one stage. However, associated lesion of the bladder such as vesical calculi (12 percent), diverticuli (5 to 7 per cent), severe cystitis and marked renal insufficiency required prolonged drainage, and senility forbid the uniform adoption of the one-stage operation. Nevertheless, in carefully selected cases drainage of the bladder may be adequately carried out by urethral catheter, thus facilitating in 75 per cent of the cases the one-stage visible operation which permits the application of the general principles of surgery; that is, exposure, accuracy of conduct, and complete hemostasis. (13)

The one-step operation deserves consideration in patients with clear urine, good functional tests and less than 250 c.c. residual. The large proportion of postoperative hemorrhages was one of the factors that placed the one-step procedure in disfavor with those who practiced papatory enucleation of the gland. The choice between catheter drainage and cystostomy will determine in some measure the choice between one-stage and two-stage prostatectomy. (12)

The occasional low reflection of the peritoneum anterior to the bladder, even when the bladder is greatly distended, presents a hazard to the trocar method, except when the instrument is introduced after

the wall of the bladder has been exposed. Primary cystostomy for drainage is most readily accomplished by distention of the bladder with water or an irrigating solution. It is important in the performance of preliminary cystostomy that the trocar be introduced high into the bladder and the catheter brought out at the upper angle of the wound rather than at the lower, or just above the pubes. This allows enlargement of the incision downward at subsequent prostatectomy and obviates the accidental opening and contamination of the peritoneum which is difficult to avoid if the incision must be enlarged upward.

While visible conduct of the operation of prostatectomy is desirable and insures greater accuracy, the two-stage operation necessary in about 25 per cent of cases does not readily allow the exposure of the one-stage operation by virtue of the rigidity of the tissues and the presence of a urinary sinus, and it is usually not advisable to attempt obtaining it, as the chances of opening the peritoneum would be increased.

(13)

The technique of suprapubic prostatectomy is very simple. The bladder is approached through the preperitoneal space, opened and held apart by retractors. The prostate will at once come into view, particularly if its hypertrophy is more pronounced in the median lobe. With a pair of curved scissors the bladder membrane around the base is cut through and not torn through as

was formerly done. The prostate is delivered and removed. A Pilcher bag is placed into the bed of the removed prostate to stop immediate and delayed hemorrhage. This is removed in twenty-four hours. Before removal it is best to leave it in situ for a few hours and observe the wound carefully to detect delayed bleeding. A reinflation of the bag is necessary in only a low percentage of cases. A urethral catheter is placed and maintained for from twelve to fifteen days.

It is the general consensus of opinion that epidural anesthesia is the best form of anesthesia to use in any type of prostatectomy now and it can be used in nearly all cases. Regional anesthesia cannot be given to all patients, however. Extremely nervous or apprehensive patients or those who insist upon a general are unsuitable for a regional anesthesia. An unfavorable mental attitude on the part of the patient constitutes the chief contraindication. Extradural anesthesia is advantageous in that: a) It produces complete relaxation of the muscles of the perineum. This facilitates the operation and allows a more complete exposure. b) The congestion and bleeding frequently observed as a result of increased blood pressure associated with a general anesthesia is absent. c) The patient is spared postoperative nausea and vomiting. d) A full diet may be resumed shortly after operation. e) Postoperative gastrointestinal complications as abdominal distension, practically never occur. f) The

incidence of cardiorespiratory complications is materially reduced. (21)

In the suprapubic operation local infiltration of the abdominal wall is of course essential in addition to the sacral block.

The various points of advantage in the suprapubic approach are: a) The approach is practically bloodless. b) Enucleation may be done by the aid of sight or touch alone. c) Stone or other diseases of the bladder are most easily dealt with. d) If there is a large hypertrophy, particularly of the median lobe, it is easier of access. e) The prostate is more accessible and by digital pressure in the rectum can be brought still closer, without the aid of instruments. (21)

C - PERINEAL PROSTATECTOMY

Prostatectomy by the perineal route is an older procedure than is that by either suprapubic or transurethral route and therefore is probably more perfected. It is the type more commonly used by urologists; few general surgeons are well enough acquainted with the perineum to use this approach. Early in the history of prostatic surgery lowest mortality rates were the result of perineal prostatectomy and even today with the advent of transurethral work it still bears that distinction.

Young reports 1049 cases in which was carried out a conservative perineal prostatectomy with a death rate of 3.4% on all ages during a period of years from 1902-1923. Fig. III. (5)

A glance at this table shows that, with negligible variations, the mortality rate per cent increases gradually in each decade of life, but up to seventy-five years of age the mortality remains very low, 2.8 per cent. After seventy-five years the operation is definitely more dangerous, but it is interesting to note that, during the last series of 198 cases without a death, there were 18 patients over seventy-five years of age (6 over eighty) all of whom went home well. One of his patients who had reached the age of ninety-three died two weeks after operation, of cerebral thrombosis, apparently not associated with the operation.

FIG. III

SHOWING RELATIONSHIP BETWEEN AGE AND MORTALITY AFTER
PROSTATECTOMY

Age, years	Cases	Deaths	Percentage
30 to 34	1		
35 to 39	3		
40 to 44	2		
45 to 49	10		
50 to 54	52	2	3.8
55 to 59	140	1	0.7
60 to 64	217	6	2.7
65 to 69	264	10	3.7
70 to 74	213	6	2.8
75 to 79	113	6	5.3
80 to 84	28	2	7.1
85 to 89	2	2	
90 to 94	1	1	
Not given	3		
Total	1049	36	3.4

Age as a causative factor of mortality if graphically shown in above table.

E. Davis and C.A. Owens of Omaha (22) report 479 consecutive cases of perineal prostatectomy under sacral block anesthesia with 12 deaths, or 2.5% mortality rate, with 98.8% of these patients classifying themselves, upon questionnaire blanks, as well or improved. See table below.

Results in Perineal Prostatectomy

Total consecutive cases	479
Average age	70
Mortality rate	2.5%
Late Functional results	82.3%
Well	16.5%
Improved	1.2%
Unimproved	
Deaths	12
Incontinence	
Complete	0
Moderate but definite	4
Slight or doubtful	5
Perineal urinary fistula	
Requiring secondary closure	7

The classification of late functional results as to well, improved, or unimproved as shown in the above table, is based upon the patients' own voluntary opinion as expressed upon questionnaire blanks sent out at an interval of not less than four months following the operation.

Technic of the perineal operation is quite simple. Through an inverted V incision the prostate is reached by blunt dissection on each side of the central tendon, opening up the space behind the transversus perinei muscle and triangular ligament. After division of the central tendon and rectourethralis muscle the posterior surface of the fascia of Danonvilliers is exposed. Division of the posterior layer of this fascia gives entrance into space between the two, which in fetal life was peritoneum, and opens up a ready access to the prostate, seminal vesicles and vasa deferentia. By means of the prostatic tractor, introduced through the posterior part of the membranous urethra, the hypertrophied mass can be drawn into the field. (21)

The urethra is opened by means of an inverted V incision, which makes it possible to enucleate in one piece the entire adenomatous hypertrophy, including the anterior commissure, if it is involved. With the tractor held vertically, beak directed downward, the lateral lobes having been freed, the mucous membrane in front of the middle lobe is being divided transversely with the scalpel, exposing the ejaculatory ducts, covered by index finger which pushes them back. This procedure preserves the ejaculatory ducts and allows the removal of every vestige of the hypertrophied tissue without injury to the neck of the bladder and internal sphincter. A four-pronged dilating instrument is then introduced into the bladder through the wound

and the hemostatic bag - resembling that of Pilcher's but through the perineal wound. This is inflated and direct traction is applied for three to six hours when traction is released; after about two hours following release of traction the air is released but left in situ to provide subsequent renewal of traction should hemorrhage develop. It is customary to wait for 48 hours postoperative before removing the bag, and to postpone still further unless the urine has cleared, that is, to wait until it is yellow rather than pinkish. The hazard of delayed hemorrhage is thus reduced to a minimum.

The advantages of the perineal operation over the suprapubic are: a) Abdominal distension from obstipation or intestinal obstruction or undue gas formation is not so common. b) The subtrigonal lobe can be brought into view and be separated from the sphincter. c) By making an inverted V incision into the urethra the entire adenomatous hypertrophy, including the anterior commissure and every vestige of hypertrophied tissue can be removed. d) The drainage being downward, is much more effective and the care-taking of the wound is very simple. e) Micturition is more perfect. f) The cutting or tearing into the perineum has a mortality all its own. g) Sterility is caused less often by the perineal operation, a matter of great importance, particularly in the younger class of patients by reason of its psychic effect. h) There is an easy access to

all bleeding points and hemorrhage can be more thoroughly controlled.

D - TRANSURETHRAL PROSTATECTOMY

The rationale of transurethral prostatectomy is based upon important clinical observations concerning changes in the obstructing prostate, the result of constant drainage of the bladder by suprapubic cystostomy or urethral catheter. It has long been known that a shrinkage and decrease in size of the gland often followed a period of drainage. On rectal examination a markedly enlarged, swollen, spongy prostate was often transformed into a slightly enlarged firm structure. Cystoscopic examination of the vesicle orifice before drainage showed marked intravesical projection and urethral intrusion of bulging lobes whose surfaces exhibited greatly increased vascularity. On examination of the same patient after bladder drainage the intruding lobes had receded and their increased vascularity was no longer apparent. These regressive changes in the prostate were most marked when the drainage was by suprapubic cystostomy. In some cases prolonged drainage was followed by sufficient shrinkage of the prostate to permit healing of the suprapubic wound and temporary return of normal urination. (18)

These observations raised the question, "Would not removal of only the obstructing portion of the gland be followed by these same regressive changes in the unremoved portion and thus permanently restore bladder function?" This question was partially answered by Young from his experience with his punch op-

eration in cases of median bar and contracture. (5) He, and later Caulk, (15) was so impressed by his results that he extended the use of his cautery punch to obstruction due to hypertrophy of the prostate. He demonstrated that in the cases where a small proportion of the total growth could be thus removed there was usually relief of the obstruction and with it shrinking of the remaining part of the gland. This work of Caulk established the fact that relief of all types of obstruction could be obtained by transurethral resection when removal of the obstructing tissue by means of his punch was technically feasible.

As a result of this experience and histological studies of the changes referred to, Caulk believes that benign prostatic enlargement is a form of inflammatory hyperplasia and is not neoplastic. Among others who subscribe to this belief are Ewing, Green, and Brooks. If the enlargement is not neoplastic, recurrence need not be expected when the obstructing tissue has been removed and relief probably will be permanent if an adequate resection has been made.

Cystoscopic prostatectomy is rapidly replacing major surgical removal in the treatment of bladder neck obstruction. Of a large series of reported cases, this method was found suitable in 90 per cent of cases. It is preferable to major surgery because of important advantages to the patient. These are, according to Donohue, (18) a) a smaller risk to life than can be

be assured by the most satisfactory conducted perineal or suprapubic operation; b) the assurance of as good functional results; c) a shorter period of convalescence without the distress imposed by prolonged drainage of urine and slow healing of the wound; d) and a substantial saving to the patient's finances.

It must be remembered, however, that transurethral prostatectomy is a gross surgical problem and should not be performed by men who have no special training in the field. A high percentage of deaths and poor results that have occurred may be attributed to indiscriminate work in the hands of inexperienced men. It is a highly technical procedure and its proper performance depends upon accurate knowledge of the precise form and position of the obstructing lobes. It is not enough to merely establish the presence of residual urine and enlarged prostate, often the extent of the investigation when suprapubic prostatectomy is performed. When transurethral methods are to be employed a thorough understanding of the gross morphological character of the obstruction and proficiency with cystoscopic instruments are essential. The precise form that the prostate has taken and the portion of it responsible for the obstruction must be recognized through interpretation of the cystoscopic views. With this information, adequate and safe resection of the obstructing tissue may be undertaken. (18)

The requirements for transurethral surgery are:

(23) a) Same preparation as for prostatectomy; b) a sincere respect for the urethra and an aim to protect it from unnecessary trauma; c) the selection of the best physical agent for the removal of the obstruction and the proper administration of this agent; d) vigilant postoperative care.

The general interest which the profession has recently shown in this subject is due in a large measure to the work of T.M. Davis, (24) who improved the instrument devised by Stern (resectoscope) and has used it in several hundred cases, with excellent success.

The most recent type of instrument which has added impetus to this work is the instrument devised by McCarthy of New York, which he calls the Stern-McCarthy electrotome. This instrument, like the Stern resectoscope, requires for its operation a cutting and a coagulating current either of which can be applied through the same loop. The former type of current is used for excision of the obstructing prostatic tissue and the latter for the control of the hemorrhage.

There are at least four types of electro-surgical operations employed for relieving prostatic obstruction. (25).

1) The method originally used by Collins in which the obstructing portions of the gland are destroyed by means of the coagulating current, tissue so destroyed being allowed to slough away. Successful results usually require repeated fulgurations by the fractional

plan. This method is not generally recommended for enlargements of the lateral lobe.

2) The method described by Kerwin of New York. It is performed by means of a bladder-neck resection, the principle of which is preliminary coagulation of the obstructing lobe followed by immediate excision of the charred tissue. Its practical usefulness has not yet been convincingly demonstrated.

3) The method first used by J.R. Caulk of St. Louis, in which the cautery punch is employed to accomplish the same objective. It is used by Caulk in more than 90 per cent of his cases, including all types of enlargement.

4) The method which involves the use of the cutting and coagulating current as are used with the Stern and the Stern-McCarthy instruments.

Kerwin's instrument, (Fig. IV), consists of an outer steel sheath equipped with a fenestra on one side and a curved beak. An inner tubular structure replaces the usual obturation, which carries the McCarthy lens system, a high frequency needle, and irrigating cocks. A tubular knife between the two sheaths acts as an obturation, rotating between the two parts previously described. Especially important is this knife which rotates to the operator's right, and thus opens the fenestra. Because its edges are well rounded, the tooth usually found on prostatic punches is unnecessary and has to be omitted. This eliminates trauma to the

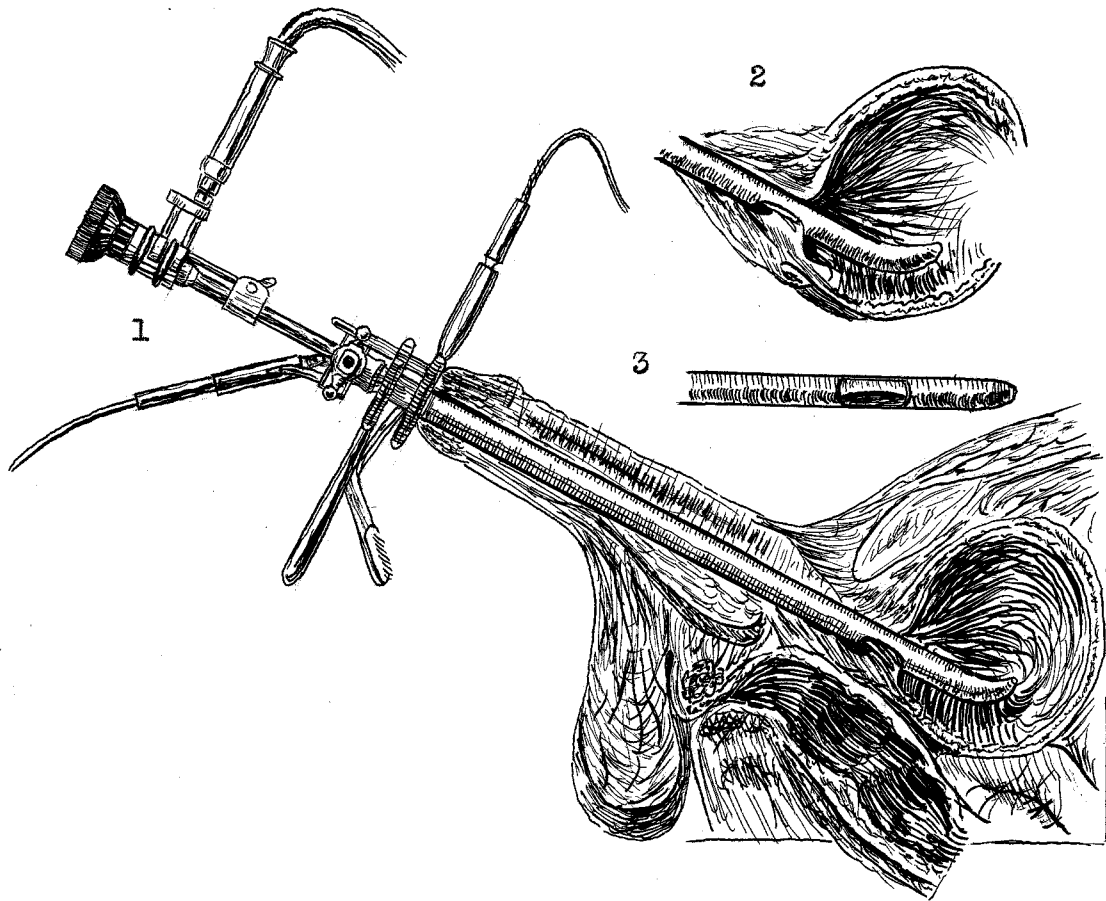


FIG. IV - KERWIN'S INSTRUMENT IN POSITION FOR
VESICAL NECK RESECTION

- 1, Sheath passed through urethra into bladder.
Cautery needle point fixes tissue to be removed.
- 2, Tissue has been desiccated (indicated by whitening) and is about to be cut off by
- 3, the inner rotary cutting tube.

bladder neck while searching for the obstruction. Completely independent of sheath, telescope, illuminator, needle, and irrigating system, the knife can be rotated at will without disturbing or twisting irrigating tubes or cords. At the same time the main instrument has the freedom of motion necessary for exact location of the tissues to be excised, the site of which the preceding cystoscopic examination has determined.

Fixation of any protruding mass is accomplished by means of a strong electric needle, which at the same time renders the piece bloodless before it is removed. A sharp-edged knife is provided to cut off the piece after hemostasis has been attained by the cautery. This makes it possible to repeat the resecting process as often as the operator wishes, so that everything can be cleared away at a single session. By turning or irrigation the field can be kept clear for work.

The Stern-McCarthy instrument varies from the Kerwin instrument in having a movable loop electrode capable of cutting under water. This loop is operated in the confines of the sheath. Protruding prostatic lobes or the elevated sphincter can be engaged in the fenestra and resected in a straight line, the cut surface remaining under perfect control at all times. The direction of the cutting thrust or sweep of the loop can be moved towards the operator from a distal

position through the engaged tissues or the loop may be moved away from the operator, opening up a visible furrow as it advances. Bleeding here is controlled by coagulation which is performed with the view of destroying the least amount of tissue possible. The loop is activated with a mild coagulating current incapable of quick, deep penetration and should be kept in motion over the bleeding area without actually coming in contact with the tissues. It should not be allowed to come to rest while the current flows. In this way bleeding is controlled without deep destruction of tissue and slough. (16)

It is the opinion of Stern, Kerwin, and T.M. Davis that transurethral resection offers many advantages and wide usage, its contraindication being mainly in long lateral lobe hypertrophy where the spongy tissue infringes upon the urethra even after resection of large quantity of it. The mortality rate is believed by these men to be below that of perineal or the suprapubic type. Davis has lost only three cases in 515 cases operated, or a mortality rate of about .6 of one per cent.

Transurethral surgery is a new field and will probably show many changes in the next few years.

E - POSTOPERATIVE TREATMENT

It is a rare thing to see a prostatectomy die of a single unfortunate accident or complication. A patient who, but for the enlargement of the prostate, is healthy rarely dies after prostatectomy. He will survive a good deal of hemorrhage, or a wound infection, or any of the usual complications. On the other hand, the patient who, in addition to the enlargement of the prostate, has various other impairments, is naturally prone to develop complications and more readily to succumb to them. Any good surgeon can handle the former cases, while the latter frequently require all the knowledge and skill of a surgeon experienced in urological technique. Many serious complications can develop in these patients; careful attention to prevent the development of these ranks first in importance in the prevention of mortality. The chief causes of death after prostatectomy are: a) shock, b) renal failure, c) hemorrhage, d) cardiac failure, e) infection of the wound, f) pyelonephritis, g) Pneumonia, h) cerebral hemorrhage, i) dilatation of the stomach, j) and intestinal paresis. There is much that can be done for the prevention of all of them, and in these patients it is important that everything necessary be done at the first indication that preventive measures are needed, for serious complications so often develop rapidly and are only stopped or avoided by the immediate institution of measure for their relief. (20)

In postoperative treatment our first attention is given to shock since most patients are old and feeble. They must be given water in large quantities. Careful watchfulness and control of hemorrhage is always essential.

Next in order are pulmonary complications, primarily pneumonia. Since the use of sacral and local anesthesia, however, this complication is met with much less frequently and this has tended in a remarkable degree to lessen the percentage of mortality. Pneumonia may develop, however, two or three weeks after operation. A prevention of this disease, while very difficult, can best be accomplished if the patient is up and out of bed, in a few days in a wheel chair.

If there is considerable impairment of the kidneys, due to back pressure or infection ascending before or after operation, it most always results in uremia and very often in death. Practically the only prevention of this complication is a thorough preparation of the patient before operation through prolonged catheter drainage and by giving him large amounts of water, increasing the phthalein output and by bringing down blood urea. It is imperative that the water cure be continued after the operation, either by mouth, proctoclysis, subcutaneously or intravenously, more particularly if fever or localized symptoms should indicate an oncoming pyelitis.

Of all cardiovascular complications, pulmonary

embolism is by far the most prevalent. While it may be caused by some cardiac disease, yet it appears to be brought on most often from some cause in the operative field. In advanced arterio-sclerosis we must think of a possible cerebral hemorrhage. Therefore it behooves the operator to bring the high blood pressure down as far as possible before operation.

Aside from shock it seems infection is to be most dreaded and therefore everything must be done to prevent it, or if present to combat it, before operation is undertaken. While a urethral or suprapubic drainage will almost invariably have infection as a sequence, yet we must take every possible care to prevent it.

It must be remembered that by reason of the condition prevailing before operation, as a rule the bladder had become contracted and that for this reason micturition may be more frequent than normal, that the loss of tonicity of the internal or external sphincter may be responsible for a leakage of urine upon coughing or sneezing. This loss of tonicity will lessen rapidly and micturition will become normal in a very short while. Permanent incontinence of urine seldom occurs. (21)

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