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The Anatomy of the Inguinal Region in Man

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INTRODUCTION

The anatomy of the inguinal region in man is a subject of importance because of its direct relationship to a frequent clinical entity - hernia. There is and has been much controversy concerning the anatomical and clinical phases of this region. No record has been made, in recent literature, of an extensive study of this subject. Studies have been made by different authors but these are not substantiated by a sufficiently extensive number of observations and the conceptions of these investigators vary in certain points. Furthermore, the variations existing in the anatomy of the inguinal region were not properly recognized. The purpose of an operative proceedure in hernia is to restore the anatomy of a defective lower abdominal wall. The fact that the anatomy of the lower anterior abdominal wall is so variable would offer some explanation for the different types of operative proceedures and the number of their modifications.

There may occur functional variations in the anatomy of the inguinal region, that is, pertaining to the degree of development of muscle and fascia in the lower abdominal wall. That the functional anatomy of this region may be varied is well shown by Seaver(24) and also by McKenzie(20) who point out that some hernia are treated satisfactorily by exercise. As is shown by statistics all individuals are not equally prone to hernia. Variations seem to exist in members of the same sex. Also a difference may be expected between the male and the female especially in view of the fact that inguinal hernia occur nine times as frequently in the male as in the female. Racial differences are suggested by some authors but no attempt to show by anatomical study the type and degree of variation has been made. Furthermore, it is the right side that is affected more than the left.

Developmental variations in the anatomy of the inguinal region also exist and may have an important bearing on the predisposition to hernia. Of these, the occurence of the patent processus vaginalis is probably the most important. The urachus and the obliterated hypogastric arteries when associated with mesenteries seem to afford an anatomical predisposition to hernia because of the foveae which they form in the lower inguinal region. In the sub-peritoneal tissue about the internal ring, associated with the vas deferens and the spermatic vessels, are sometimes found bands of tissue which seem to influence the integrity of the internal ring. The adhesions which occur in the region of the internal ring between the ceacum and the abdominal wall on the right side and the sigmoid and the abdominal wall on the left side, also seem to have a developmental background. The presence of adipose tissue in the inguinal region may be regarded to be of an acquired nature. This fat herniating through the abdominal wall or when found in the inguinal canal may become a factor in the production of hernia, especially when the individual undergoes sudden emaciation.

STATEMENT OF PROBLEM

Therefore it is the purpose of this work to attempt to determine a more complete comprehension of the anatomy of the inguinal region by showing, in a series of cadavers, how the anatomy varies, and to what extent, between the right and left side in the male and female, and in the white and colored race.

HISTORY

A careful search of the literature reveals the fact that very few contributions to the anatomy of the inguinal region have been made since 1900. Most of the later work deals primarily with the clinical aspects of this region, such anatomical descriptions as are given in these papers being based, to a great extent, on existing text book presentations. In the literature preceding this century a number of papers are found dealing with the specific anatomy of the inguinal region.

In order to preserve the continuity of the subject, and for the convenience of later applications in this paper, the review of the literature is made in a sequential manner rather than in a chronological order.

In an incision for the repair of hernia, the first important structure to be encountered after separating the skin, subcutaneous tissue, and fascia, is the aponeurosis of the external oblique muscle. This tendinous expansion, as shown by Cooper(3), is to support the inguinal region from the pressure which is placed upon it by man in assuming the erect position. According to Cherner(2), the aponeurosis of the external oblique muscle, because of its early fixation and canalization, plays an important role in resisting intra-abdominal pressure.

The development of the external oblique musculature is not sufficiently discussed anywhere except in Morris(20) and Cunningham(5) Text-Books of Anatomy. Here it is stated that the muscle tissue does not extend to the linea alba medially, and also, that it does not extend below the level of the anterior superior spine. There is little variation in the description of the anatomy of the external ring. Its size, as generally accepted, is 1 inch long and 1/2 inch wide, although a normal ring, according to Macready(18), quoting Gaillard, may be 3 cm. in its long diameter. Spalteholz(25) states, that the average external ring admits the tip of the index finger. The relation of the size of the external ring to the occurence of hernia has not been clearly determined as yet. According to Cherner(2), the size of the external ring cannot be used as an index in determining the possibility of hernia, because tight rings may permit development of hernia while loose rings may not permit development of hernia for a long time or not at all. Hughson(13) points out the fact that in a series of cases in which the inguinal canal was opened on account of a relaxed external ring, and in which no clinical evidence of hernia existed, in every instance a small persistent sac was found. The intercrural fibers, which arch about the lateral boundary of the external ring, are quite uniformly recognised and described by most anatomists.

Cooper(3), Whitherspoon(30), Dickson(6), and Morris(21) Text-Book of Anatomy agree that the internal oblique muscle in the inguinal region takes origin from the lateral 1/2 of the inguinal ligament. Turck(28) in his series of 50 dissections found the muscle taking origin from the lateral 3/4 of the inguinal ligament. The descriptions in Cunningham(5) and Spalteholz(25) Text-Books of Anatomy agree that it is the lateral 2/3 of the inguinal ligament.

As to the transversus muscle, Cooper(3), Whitherspoon(30), and Cunningham(5) and Morris(21) Text-Books of Anatomy agree that it takes origin from the lateral third of the inguinal ligament, although Whitherspoon states that it may attach to the outer one half of the inguinal ligament.

Much controversy has existed and still exists concerning the anatomy of the lowermost fibers of the internal oblique and transversus muscles. According to Knox(15), the lowermost fibers of the internal oblique and transversus muscles, in addition to the usual termination in the conjoined tendon, transmit a series of semicircular or concentric fibers behind the internal portion of the spermatic cord, either to a small extent, which is common enough, or so large and broad as to form a distinct semicircular expansion situated behind all of the lower part of the spermatic cord. He further states that this construction produces the curious appearance of a muscular ring or apperture through which the cord passes, although he proves anatomically that no true sphincter exists. When the internal oblique and transversus muscles contract, their lower fibers become opposed to the upper surface of the inguinal ligament, which Henson(11) describes as a detrussor action. Hammond(10) and Dickson(6) call it a sphincter-like action. Hughson(13) compares it to the shutter of a camera. MacGregor(19) states that the lower fibers of these muscles, not only arch over the cord, but actually course completely around it, forming a complete and grossly definable voluntary muscle sphincter for the canal at its abdominal opening.

The conjoined tendon as described by Watson(29) is triangular in shape with its base inserted into the crest of the pubis and the pectineal line. It is situated immediately behind the inguinal canal and the external abdominal ring. The descriptions of the anatomy of the conjoined tendon agree except that of Whitherspoon(30). He states that the so-called conjoined tendon was in no instance formed by the union of the fibers from the internal oblique and transversus muscles in the subjects he had dissected.

Associated with the transversalis muscle on its posterior aspect, are two ligamentous structures, the ligament of Hesselbach and the ligament of Henle. Douglas(7) offers the following description of these two structures:

"The descending fibers of the outer pillar of the fold (of Douglas) form a tendinous band of varying breadth and strenght.

Braune has called this the ligament of Hesselbach, it having been first noted by that anatomist as part of the fascia transversalis, and named ligamentum inguinale internum"

"Externally the ligament of Hesselbach is joined to the main transversalis tendon, and might then be said to form the edge of an incomplete posterior lamina of that structure. The lower end of this band forms a distinct internal pillar to the deep abdominal ring, and then its fibers divide and pass in different directions. Some are attached to the ligaments covering the horizontal ramus, and the the pectineal fascia, internal to the deep crural ring; others pass to the margin of the deep crural arch and there end for the most part, though some may be traced into the falciform fascia. A large bundle of fibers passes around the deep abdominal ring, constituting its inferior and horizontal pillar, the ligamentum laterale of Henle."

"Braune has noted likewise a second descending limb of the outer pillar, of the fold of Douglas, passing from the upper end of the ligament of Hesselbach, obliquely downwards and inwards to the pubic bone just external to the rectus tendon, to which it is in its whole lenght attached. He named it the ligament of Henle."

Whitherspoon(30) also describes Hesselbach's ligament and states that is plays a most important part in rendering the inner end of the inguinal canal patulous during increased intra-abdominal tension.

Associated with the transversalis muscle on its posterior surface, are also found the pubotransversalis muscle, the interfoveolaris muscle, and a group of fibrous bundles which pass out of the pelvis onto the posterior surface of the transversus muscle in the region of Hesselbach's triangle. Macready(18) states that the pubotransversalis muscle is a small muscular slip attached to the horizontal ramus of the pubes, and passing upwards and outwards behind the transversus to lose itself in the aponeurosis of that muscle. He further states that this muscle is about 3 millimeters broad and that it was described and drawn by Lushka. The interfoveolaris muscle, according to Spalteholz(2[illegible]), arises like a fan behind the transversus muscle (also sometimes from it) and extends downward to the posterior surface of the inguinal ligament and the lacunar ligament. The fibrous bundles passing out of the pelvis onto the posterior of the abdominal wall are described by Whitherspoon(30) as follows:

"External to the pelvic and iliac fascias and extending onto the abdominal wall to become part of the structure known as the conjoined tendon are a series of dense connective tissue fibers, quite ligamentuus in appearance. The lateral half of this structure, lying chiefly under and lateral to the iliac vessels, is known as Cooper's ligament. The fibers are lost below(caudad) under the femoral sheath posterior to the vessels as they go into the thigh. The median half of this ligamentous structure is found beneath the pelvic fascia caudad of the iliopectineal line. It passes out of the pelvis over the iliopectineal line and onto the abdominal wall median to the iliac vessels. In some persons this constitutes the whole of the conjoined tendon, and in all, more or less of the fibers entering into it."

No great difference exists in the description of the peritoneal folds of the lower anterior abdominal wall. As pointed out by Macready(18) and Watson(29) they are of clinical interest in the study of the relation of the parietal peritoneum to the different varieties of hernia. Whether they have a definite relation to the occurence of hernia is a question still undecided.

There is some variation, in early literature, in the description of the anatomy of the internal ring. As pointed out by Liston(16), Cloquet was the first to show that the internal ring was not a true opening, but rather a wide entrance of a funnel shaped canal, which receives the spermatic vessels. Cooper(3) states that the internal ring is not a circumscribed aperture like a ring, but is formed by the separation of two portions of fascia, which have different attachments and distributions at the crural arch. Henson(11), Hill(12), Watson(29), and all authors of recent text-books of anatomy agree that the internal ring consists of a funnel shaped depression in the transversalis fascia where it ensheathes the cord as it leaves the abdomen, and that it is situated midway between the anterior superior spine of the ilium and the symphysis pubis, about ½ inch above and slightly external to the middle of Poupart's ligament.

That the patent processus vaginalis may occur has been and is a generally known and accepted fact, but its relation to hernia has always been a subject of dispute. Quoting Macready(18):

"At the end of the seventeenth and the beginning of the eighteenth centuries it was generally recognized that the tunica vaginalis was closed in man. But when the development of the testis came to be studied, it was soon discovered that the tunica vaginalis may remain open and receive the intestine, but that it may remain open without giving place to a hernia."

"This was observed by several whiters at the end of the last century, and at lenght it was suggested, that the immunity from hernia in such cases was due to the presence of a fold, which partly screens the abdominal opening of the processus vaginalis."

"This fold, which is usually formed of peritoneum and the edge of the infundibuliform fascia, has been given by later writers various degrees of importance. If it has any office in relation to hernia, its effect, unfortunately, is not susceptible to proof."

As pointed out by Hammond(10), the processus vaginalis is present in the fetus, but normally it should become obliterated soon after birth. Occasionally, he further states, it remains patent throughout life, and may retain its connection with the tunica vaginalis or be obliterated at any point between this and the internal ring. Murray(22) has shown that in such cases the bowel may never enter the sac. In observations on post mortem material he found that in 21% of the subjects observed a potential sac existed, but there was no history of the existance of hernia during life. Cowell(4) believes that either an actual or potential oblique peritoneal sac of varying size exists in all subjects. According to Macready(18) the size of the opening is, as a rule, larger on the right side than on the left and oftentimes the size is greater in older than in younger children. Whitherspoon(30) that it is evident from statistics that the procéssus vaginalis of the peritoneum closes in the very large majority of persons during the first four years of life.

According to Russel(23) the processus vaginalis has a most important relation to hernia. The saccular theory of Russel, as pointed out by Telford(27), regards the sac of every abdominal inguinal hernia as derived from the funicular process. The sac is the cause of the hernia, and without this preformed sac there can be no hernia.

Stephens(26), in order to explain the more frequent occurence of the processus vaginalis in the male, points out that the gravitated testis exerts a definite drag on the process in an outward direction, while in the female the process is adherent to the round ligaments and subject to backward pull by the weight of the uterus.

Accumulations of fat in the region of the internal ring and its extension through the abdominal wall, or into the inguinal canal, is not a rare occurence. These fatty depositions and fat pedicles are described as lipomas or lipomata. That they may

play an important part in the etiology of some cases of hernia has long been recognized. Maas(17) points out that these accumulations of fat in the lower inguinal region do not cause hernia except in cases where they produce an opening in the abdominal wall. He further states that examples are numerous in which a growth of soft tissue presses aside or even destroys a much harder tissue than its own. Fergusson(8) shows that these hernia on a fatty basis are due primarily to a weakness in the abdominal wall with which is later associated the accumulation of fat. He states that small lipomata form in the openings where hernia are most liable to occur and by intra-abdominal pressure, atrophy of the region of the internal ring occurs; the structures here thin out and weaken and the opening becomes enlarged and the ball of fat urged out by the intra-abdominal pressure protrudes more and more and drags the elastic peritoneum with it. He further states, that if the abdominal wall had no congenital deficiencies in the structures protecting the normal ring, a hernia would be rare, indeed, and an accumulation of fat would rarely take place. These protrusions of fat, as described by Fergusson are veiled over with a thin covering of white fibrous tissue, which must be torn or cut before their connection with the subperitoneal adipose layer can be demonstrated.
Whitherspoon(30) also points out that extraperitoneal fatty tissue continues into the inguinal canal and that it occurs at all ages.

MATERIALS AND METHODS

Observations were made on 177 cadavers, of which 95 were white male, 56 were colored male, 7 were white female, and 19 were colored female. Included in the above are 83 inguinal regions which were removed from the cadavers for detailed study.

Observations were made in the gross anatomy laboratories of Loyola University School of Medicine, University of Illinois College of Medicine, University of Chicago Medical School, and the Chicago Medical School. The 83 specimen used for detail study were removed from cadavers at Loyola University School of Medicine, and with the permission of Dr. McJunkin, from autopsy material at the County Morgue.

Concerning the observations at the medical schools, only such data were collected as were available, that is, depending upon the character and the stage of dissection at the time of observation. Therefore, data were not collected on all points to be observed, in every cadaver of the series.

Grossly, observations were made to determine the variations which existed in the degree of development of muscle and aponeurosis in the inguinal region; the presence of mesenteries associated with the urachus, obliterated hypogastric and inferior epigastric arteries, and the presence of foveae or peritoneal diverticula. Concerning the external oblique muscle, the extent of muscle development medial to the anterior superior spine was measured, the structure of the external oblique aponeurosis and intercrural fibers noted, and the external ring was measured. The extent of attachment on the inguinal ligament of the internal oblique and transversus muscles was measured, and the presence or absence of a conjoined tendon determined. The mesenteries associated with the urachus, obliterated hypogastric arteries, and the inferior epigastric arteries were measured, the distance being taken from the posterior of the anterior abdominal wall to their free margin in the abdominal cavity in the inguinal region. The foveae or peritoneal diverticula were measured as to their width and lenght.

Observations on the presence or abscence of Hesselbach's ligament, Henle's ligament, Pubotransversalis muscle, and the bands of tissue accompanying the vas deferens and the spermatic vessels were made with the aid of a dissecting microscope. In both the gross observations and microscopic dissection, transillumination of the tissues studied helped very materially to make the observations more complete. That is, any thickenings, weaknesses, or the presence of fat in the abdominal wall could be more easily detected by this method. Microscopic preparations were made of some of the subperitoneal bands to determine their histological structure.

DATA CONCERNING THE ANATOMY OF THE INGUINAL CANAL

It is the purpose of the following data to show the variations that occur and the extent to which they occur, between the right and left sides, in both the white male and female, and in the colored male and female.

MEDIAL EXTENT OF THE EXTERNAL OBLIQUE MUSCLE (CHART I)

The medial extent of the external oblique musculature was measured from the anterior superior spine and the following results were obtained. The medial termination of the external oblique muscle occured lateral to the anterior superior spine to the extent of 2.50% on the right and 3.51% on the left side in the white male, this condition not being present in the colored male, white female, or colored female. Medial termination of the muscle at the anterior superior spine to 3 cm. medial to the anterior superior spine occured to the extent of 68.75% on the right and 65.52% on the left in the white male, 59.16% on the right and 60.80% on the left in the colored male, 66.4% on the right and 71.5% on the left in the white female, and 61.05% on the right and left side in the colored female. Medial terminations of 3 cm. and over constituted 28.75% on the right and 30.42% on the left side in the white males, 40.1% on the right and 39.9% on the left side in the colored males, 33.3% on the right and 28.6% on the left in the white females, and 38.85% on both the right and left side in the colored female.

Conclusion:

1. Difference between the right and left side.

   No appreciable difference was found to exist in the medial extent of the external oblique muscle between the right and left side in either the, white or colored races.

2. Sex difference.

   No sex difference is apparent.

3. Race difference.

   The external oblique musculature extends medially to a greater extent in the colored race.

EXTENT OF WEAKNESS LATERAL TO THE EXTERNAL RING IN THE EXTERNAL OBLIQUE APONEUROSIS. (CHART II)

The external ring is formed by the divergence of the lower medial fibers of the aponeurosis of the external oblique. This divergence results in the formation of a superior and an inferior crus. At the lateral boundary of the external ring the two crura come together and are usually strenghtened by the intercrural fibers. In some cases the two crura are separated for a longer distance lateral that usual, but no weak areas exist because well developed intercrural fibers bridge the gap between the two crura. The weak area which sometimes exists is due to the persistant separation of the two crura of the external ring and the lack of intercrural fibers. The lenght of this condition has been found to vary between one and eight centimeters lateral to the external ring. In some cases the intercrural fibers bridge the gap between the separated crura, but this bridging occurs lateral to the lateral boundary of the external ring. As a result, a weak area exists in the aponeurosis of the external oblique extending laterally from the external ring to the point where the intercrural fibers cross the gap in the crura. The interval or weakened area between the two crura consists of loose fibrous connective tissue which is easily destroyed by ordinary dissection.

There was no weakness found to exist in the aponeurosis of the external oblique in 30.11% of the cases on the right and 32.50% on the left side in the white males, 47.84% on the right and 69.8% on the left side in the colored males, 66.4% on the right and 100% on the left side in the white females, and 55.5% and the right and 61.05% on the left side in the colored females. Weakened areas measuring up to two centimeters inclusive were found in 44.45% of the cases on the right and 23.85% on the left side in white males, 35.42% on the right and 18.60% on the left side in the colored males, 16.6% on the right side only in the white females, and 27.75% on both the right and left side in the colored females. Areas of lateral weakness of 2.5 cm. and over occured to the extent of 25.40% on the right and 28.75% on the left side in the white males, 16.64% on the right and 11.63% on the left side in the colored males, 16.6%(1 of 7 cases) on the right side only in the white female, and 11.10% on both sides in the colored females.

Conclusion:

1. Difference between the right and left side.

   The right side in the white male and female and in the colored female showed a definite tendency toward the occurence of these weak areas.

2. Sex difference.

   The male in both the white and colored races shows a greater tendency toward the occurence of these weakened areas that the female.

3. Race difference.

   In the male the white race has a tendency to be weaker. In the female the colored race has a tendency for the more frequent occurence of these weakened areas.

SIZE OF THE EXTERNAL INGUINAL RING (CHART III)

The external inguinal ring was measured to determine the variations occuring in its size. Further, a correlation was made to show the relation of the size of the ring to the degree of muscular development in the inguinal region and to the presence of the foveae or diverticula into the inguinal canal.

A ring admitting the tip of the index finger was regarded as an average sized external ring (1 inch long and ½ inch wide, as is generally accepted). External rings varying in size from the above were classed as small, slightly enlarged, and large. The small external ring, which did not admit the tip of the finger, was present in 6.25% of the cases on the right and 4.8% on the left side in the white males, 1.9% on the right and 2% on the left side in the colored males, and did not occur in the white and colored females. The average sized ring, which admitted the tip of the index finger, occurred in 76.25% of the cases on the right and 74.4% on the left side in white males, 76% on the right and 86% on the left side in the colored males, 83% on the right and 85.8% on the left side in white females, and on both sides in all (100%) of the colored females. Rings larger than the average, with a greater circumference than that of the index finger, occurred to the extent of 17.50% on the right and 21.6% on the left side in white males, 22.8% on the right and 14% on the left side in the colored males, 16.6% on the right and 14.3% on the left side in white females, and did not occur in the colored females.

A fovea or diverticulum was associated with small rings in 2.50% on the right side of white males only. With the average sized ring, it was associated in 28.75% on the right and 22.8% on the left side in the white males, 22.8% on the right and 16% on the left side in colored males, 16.6% on the right and 14.3% on the left side in white females, and 5.26% on the left side only in the colored females. With the larger rings the fovea or diverticulum was associated to the extent of 7.5% on the right and 8.4% on the left side in white males, 10.4% on the right and 4% on the left side in the colored males, and 16.6%(one instance) on the right side in white females.

A correlation was made of the size of the external inguinal ring with the degree of muscular development of the lower anterior abdominal wall. The data discloses that small rings are associated only with the "average" and "better than average" muscular development of the abdominal wall. The average sized external rings were found most frequently associated with the "average" and "better than average" muscular ddvelopment, althoug in some instances they were found in the "less than average" developed lower abdominal walls. The larger rings were found to be about equally associated with the "average" and "better than average" muscular development of the lower anterior abdominal wall.

<u>Conclusion</u>:

1. Difference between the right and left side.

   The right side in the white males and the left side in the colored males and white females shows a tendency toward the presence of external rings of better than average size. The colored females were found to have average rings on both sides.

2. Sex difference.

   There is a slight tendency for rings of better than average size to occur more frequently in the male and more so in the colored male.

3. Racial difference

The racial difference is not very apparent except in the female sex, where the white females show the presence of large rings while no large rings are found in the colored female.

4. A correlation of the size of the external inguinal ring with the occurrence of pits or foveae at the internal inguinal ring showed that pits were associated with small rings in the white male on the right side in two instances and with larger rings they were found to be associated to the extent of 50%.

5. A correlation of the size of the external ring with the degree of muscular development of the anterior abdominal wall shows that various sized rings are associated with abdominalwalls of different degrees of development.

No definite correlation of the size of the external inguinal ring can be made between the right and left side, the sex, and the race of the cases studied. As pointed out by Cherner(2), the size of the external ring cannot be used as an index in determining the possibility of hernia. The anatomical findings, presented in this paper, would tend to support his views and those of some other authors.

INTERCRURAL FIBERS (CHART IV)

Observations were made to determine the frequency of occurrence and the degree of development of the intercrural fibers. If present the intercrural fibers were classified as average, less than average, or better than average in development. No intercrural fibers were present in 18.2% of the cases on the right and 16.8% on the left side in the white males, 28.5% on both sides in the colored males, 33.2% on the right and 57.2% on the left side in the white females, and 31.56% on the right and 41.16% on the left side in the colored females. Intercrural fibers of "less than average" and "average" development were found to be present in 58.5% of the cases on the right and 61.2% on the left side in the white males, 55.1% on the right and 54.1% on the left side in the colored males, 66.4% on the right and 42.9% on the left side in the white females. "Better than average" developed intercrural fibers were found in 23.4% of the cases on the right and 22.8% on the left side in the white males, 17.1% on the right and 19% on the left side in the colored males, and 10.52% on the right side in the white female; no "well developed" fibers being found on both sides in the colored female and on the left side in the white female.

<u>Conclusion</u>:

1. Difference between the right and left side.

   The intercrural fibers are about equally developed on both sides in the white and colored males. The degree of development is much more pronounced on the right side in the white and colored female.

2. Sex difference.

   The degree of development of the intercrural fibers in the male seems to be greater than in the female.

3. Racial difference.

The development of the intercrural fibers in thw white male is about twice of that found in the colored male. There is also a greater degree of development of intercrural fibers in the white female than in the colored female.

EXTENT OF ATTACHMENT OF THE INTERNAL OBLIQUE MUSCLE ON THE INGUINAL LIGAMENT (CHART V)

The attachment of the internal oblique muscle on the inguinal ligament was measured for the purpose of determining the extent of variation in the origin of this muscle from the inguinal ligament. The internal oblique muscle was found to take origin from the lateral 1/3 of the inguinal ligament in 5% of the cases on the right and 8.4% on the left side in the white males, and 3.7% on the right side in the colored males. It originated from the lateral 1/2 of the inguinal ligament in 56.25% of the cases on the right and 51.6% on the left side in the white males, 46.25% on the right and 51.3% on the left side in the colored males, 16.6% on the right and 14.3% on the left side in the white females, and 10.52% on the right and 11.1% on the left side in the colored females. Attachment on the lateral 2/3 of the inguinal ligament was present in 31.25% on the right and 31.2% on the left side in the white males, 29.60% on the right and 30.40% on the left side in the colored males, 16.6% on the right and 14.3% on the left side in the white females, and 36.82% on the right and 33.30% on on the left side in the colored females. Attachments of the internal oblique muscle extending for more than the lateral 2/3 of the inguinal ligament were found to be present in 6.25% on the right and 9.6% on the left side in the white males, 20.35% on the right and 19% on the left side in the colored males, 49.9% on the right and 57.2% on the left side in the white females, and 52.60% on the right and 55.5% on the left side in the colored females.

Conclusion:

1. Difference between the right and left side.

   The left side seems to be slightly better developed than the right side in the white and colored males, while in the white and colored females the two sides are about equally developed.

2. Sex difference.

   The internal oblique musculature in the white and colored females is decidedly better developed than in the white and colored males.

3. Racial difference.

   The colored race shows a much better development of the internal oblique musculature than the white race.

According to Cooper(3), Whitherspoon(30), Dickson(6), and Morris Text-Book of Anatomy(21) the internal oblique musculature takes origin from the lateral one-half of the inguinal ligament, according to Cunningham(5) and Spalteholz(25) anatomies, from the lateral 2/3 of the inguinal ligament, and according to Turck(28) from the lateral 3/4 of the inguinal ligament. In the present series of observations the origin was found to vary from the lateral 1/4 of the inguinal ligament to the whole lenght of the inguinal ligament. The most frequent occurrence being the lateral 1/2 of the inguinal ligament in the white and colored males, in about 50% of the cases observed; and, the lateral 3/4 of the inguinal ligament in the white and colored females, being found in 42% of the females observed.

ANATOMY OF THE LOWER FIBERS OF THE INTERNAL OBLIQUE AND TRANSVERSUS MUSCLES (CHART VI, figure 4.) V

Observations were made to determine the variations in the anatomy of the lower fibers of the internal oblique and transversus muscles. The following variations in the disposition of the lower fibers of the internal oblique were noted.

1. The lower fibers of the internal oblique and transversus muscles do not form a conjoined tendon but go straight and insert into the sheath of the rectus above the pubes (Fig. 4a). Andrews and Bissel(1) recognized this condition and contended that it predisposed to direct hernia. This variation was found in 8.32% of the cases on the right and 15.75% on the left side in the white males, 12.50% on the right side only in the colored males, 33.3% on the right and 20% on the left side in the white females, and 16.6% on the right side only in the colored females.

2. The lower fibers of the internal oblique and transversus muscles course medially and downward to insert into the lower

portion of the sheath of the rectus and the pubic tubercle, but do not insert into the inguinal ligament or iliopectineal line. This condition was found in 29.72% of the cases on the right and 31.50% on the left side in the white males, 50% on the right side only in the colored males, 66.6% on the right and 60% on the left side in the white females, and 49.8% on the right and 57.2% on the left side in the colored females.

These variations in the lower fibers of the internal oblique and transversus muscles are most frequently associated with the "average" developed abdominal wall in the males, with a "less than average" developed abominal wall in the white females, and with the "average" developed abdominal wall in the colored females. It was associated with the oblique peritoneal sac (pit) in 1/3 of the cases in the white males, in 1/3 of the cases, on the left side only, of the white females, in one-fourth of the cases, on the left side only, of the colored females, and was not associated with pits in the colored males or on the right side in the white and colored females.

3. The lower fibers of the internal oblique and transversus muscles form the conjoined tendon and insert into the iliopectineal line and the inguinal ligament in the region of the medial 1/3 of the posterior wall of the inguinal canal (Fig. 4b.). This variation was found in 8.32% of the cases on the right and 10.50% on the left side in the white males, 12.50% on the right side only in the colored males, and was not found in any of the

other specimen.

This variation is associated with the "average" developed abdominal wall on the right side in the white and colored males, and with the "well developed" musculature of the abdominal wall on the left in the white males. It is associated with diverticula in 50% of the white male specimens; and not at all in the colored males.

4. The lower fibers of the internal oblique and transversus muscles curve downwards to be inserted into the inguinal ligament in the middle as well as the medial third of the inguinal canal (Fig. 4c). That is, the conjoined tendon and the lower fibers of the internal oblique and transversus muscles are found in the medial 2/3 of the posterior wall of the inguinal canal. This variation was found in 24.96% of the cases on the right and 21.00% on the left side in the white males, 12.50% on the right and 25% on the left in the colored males, 16.6% on the right and 43.9% on the left side in the colored females, and not at all in the white females.

This variation is associated most frequently with the "average" developed musculature of the lower anterior abdominal wall in all of the cases observed. It is associated with diverticula in 50% of the cases of the white males, on both sides in the one cases of the colored male, and is not associated with diverticula in the white or colored female.

5. Here the lower fibers of the internal oblique and transver-

sus muscles have a definite structural relation to the internal abdominal ring. The fibers were found to be curving above the internal abdominal ring medially and downward to form the conjoined tendon, and the part of them directly associated with the internal inguinal ring attached to the inguinal ligament in the lateral third of the inguinal canal (Fig. 4d). In some cases the lowermost fibers coursed medially and downward over the internal ring and then laterally and downward under the internal abdominal ring to attach to the inguinal ligament. In these instances there was formed a structure which appeared, at first, as a sphincter at the internal ring. This variation was found in 29.12% of the cases on the right and 21% on the left side in the white males, 12.5% on the right and 75% on the left side in the colored males, 20% on the left side only in the white females, and 16.6% on the right side only in the colored females.

In no instance was it possible to demonstrate the "inguinal sphincter" which was described by MacGregor(19), since in no case did the lower fibers of the internal oblique muscle course completely around the cord at the internal inguinal ring.

This condition is most frequently associated with the "well" developed and "average" developed musculature of the lower anterior abdominal wall. It is associated with diverticula in about one-third of the cases of the white males, in two out of three instances on the left side of the colored males, and is not associated with pits in the female.

6. Occasionally there is found a band of muscle fibers which take origin from the most medial portion of the attachment of the internal oblique to the inguinal ligament and course obliquely downward and medially under the spermatic cord, parallel to the inguinal ligament, to gain attachment on the pubic tubercle (Fig. 4e). This band of muscle was found in 13.42% of the cases on the right and 11.63% on the left side in the white males, 5.76% on the right and 11.52% on the left side in the colored males, and 16.6% on the right and 14.3% on the left side in the white females, and was not found to occur in the colored females.

This muscle band under the spermatic cord was associated with the "average" developed abdominal wall on the right side in the white males and the right and left side in the white females, and to a slightly greater extent with the "well developed" musculature of the anterior abdominal wall on the left side in the white males and the right and left side in the colored males.

7. Occasionally the lowest fibers of the internal oblique muscle form a structure which gives the curious appearance of a ring likened to the external ring (Fig. 4f). This structure consists of a loop of muscular fibers about the spermatic cord as it passes through the internal oblique muscle. Taking origin from the inguinal ligament, the lowest fibers of the internal oblique instead of coursing obliquely upward and medially and then medially and downward, go first obliquely upward and laterally, then curve upward medially, and finally medially and down-

ward to become inserted into the iliopectineal line. In this series of observations the structure was found to be present to the extent of 3.66% on the right and 6.98% on the left side in the white males, and 11.52% on both sides in the colored males. It was not found to be present in the white or colored females.

This ring appearance in the internal oblique muscle was associated with the "average" developed musculature of the anterior abdominal wall on the right side in the white male, and to a greater extent with the "well" developed abdominal wall on the left side in the white male and the right and left side in the colored male.

Conclusion:

In the first five variations presented above, no definite significant correlation can be made as to the difference between the two sides, the sex, the race, because of the limited number of observations. In general the following correlation exists.

1. Difference between the right and left side.

Variations (1 and 2) presenting a more deficient development of the internal oblique muscle were found more frequently on the left side in the white male and on the right side in the colored male, white female, and colored female.

Variations (4 and 5) presenting a stronger development of the internal oblique muscle and having a definite relation to the internal inguinal ring were found on the right side in the white males and on the left side in the colored males, white females and colored females.

The muscle band under the spermatic cord was found to occur more frequently on the right side in the white males, more on the left side in the colored males, occurring equally on both sides in the white females, and not occuring at all in the colored females.

The ring appearance in the internal oblique muscle was found more frequently on the left side in the white males and was equally distributed on both sides in the colored males.

2. Sex difference.

The male sex presents a greater variation in the anatomy of the lower fibers of the internal oblique (variations 1 to 5), and also the lower fibers are more frequently related to the internal inguinal ring in the male than in the female.

The muscle band under the spermatic cord occurs more frequently in the male.

The ring appearance in the internal oblique was found to be present only in the male sex.

3. Racial difference.

The semicircular formation, about the internal ring, of the lower fibers of the internal oblique and transversus muscles occurs more frequently in the colored male than in the white male, and similarly in the colored female than in the white female.

The muscle band under the spermatic cord is more apparent in the white race.

The ring appearance in the internal oblique muscle was much more frequently seen in the colored male. It was not found in the female sex.

EXTENT OF ATTACHMENT OF THE TRANSVERSUS MUSCLE ON THE INGUINAL LIGAMENT (CHART VIII and Fig. 5.)

The extent of origin of the transversus muscle from the inguinal ligament was measured and the variations and their extent recorded. The transversus muscle did not take any part of its origin from the inguinal ligament in 5.88% of the cases on the right and 4.05% on the left side in the white males, 6.24% on the right and 4.34% on the left side in the colored males, 16.6% on both sides in the white females, and the condition was not found to exist in the colored females. This muscle has an attachment to the lateral one-fourth of the inguinal ligament in 36.75% on the right and 36.45% on the left side in the white males, 35.36% on the right and 32.55% on the left in the colored males, 16.6% on both the right and left side in the white females, and 31.56% on the right and 35.28% on the left in the colored females. The attachment was from the lateral one-third of the inguinal ligament in 36.75% on the right and 37.80% on the left in the white males, 29.12% on the right and 32.55% on the left in the colored males, 16.6% (one case) on the left side only in the white females, and 26.30% on the right and 17.64% on the left in the colored females. Instances in which the attachment was greater than the lateral one-third of the inguinal ligament were found in 20.58% on the right and 21.60% on the left side in the white males, 29.12% on the right and 30.38% on the left side in the colored males, 66.6% on the right and 50% on the left side in the white females, and 42.08% on the right and 47.04% on the left side in the colored females.

Conclusion:

1. Difference between the right and the left side.

   The transversus muscle was found to have a more extensive attachment to the inguinal ligament on the left side than on the right in the white males, colored males, and colored females, but more on the right side than on the left in white females.

2. Sex difference.

   The transversus muscle has a greater extent of attachment to the inguinal ligament in the females than in the males.

3. Racial difference.

   Colored males have a much more extensive attachment of the transversus muscle to the inguinal ligament than the white males, but, conversely, white males more than colored females.

According to Cooper(3), Whitherspoon(30), and the Cunningham(5) and Morris(21) Text-Books of Anatomy the transversus muscle takes origin from the lateral 1/3 of the inguinal ligament, although

Whitherspoon states that it may extend to the outer half of the inguinal ligament. In the series of observations reported herein, the origin of the transversus muscle from the inguinal ligament varied from a point on the anterior superior spine to the lateral two-thirds of the inguinal ligament.

THE ANATOMY OF HESSELBACH'S TRIANGLE

In the repair of direct or indirect inguinal hernia the tissues utilized in the reconstruction of the lower abdominal wall are the ones found within Hesselbach's triangle. That is, the transversus muscle, internal oblique muscle, and the conjoined tendon. Observations were made to determine the extent of development of the internal oblique and transversus muscles within Hesselbach's triangle, and also to determine the presence or absence of the conjoined tendon.

DEVELOPMENT OF THE INTERNAL OBLIQUE MUSCLE IN HESSELBACH'S TRIANGLE (CHART IX)

This data will serve as a criterion of the development of the abdominal wall in the inguinal region and thus give a significant anatomical background for the possibility of occurrence of hernia. By means of transillumination it was made possible to show the variations in the development of anterior abdominal wall musculature in Hesselbach's triangle (Figures 6-14).

The internal oblique was muscular throughout the area of the triangle of Hesselbach in 48.75% on the right side and 50% on the left in white males, 62.7% on the right and 68% on the left side in colored males, 66.6% on the right and 57.2% on the left side in white females, and 89.42% on both sides in colored females. Instances in which the internal oblique was not all muscular throughout Hesselbach's triangle were found in 40% on the right and 39.6% on the left side in white males, 36.1% on the right and 34% on the left side in colored males, 14.3% on the left side only in white females, and 10.52% on both sides in colored females. The internal oblique presenting no muscular development in Hesselbach's triangle was found in 3.75% on the right and 2.4% on the left side in whitemales, and 33.3% on the right and 28.6% on the left side in the white females; this undeveloped condition not being found in the colored male or female.

<u>Conclusion</u>:

1. Difference between the right and left side.

   The right side has a weaker muscular development within Hesselbach's triangle in white and colored males. No apparent difference can be demonstrated between the two sides in white and colored females.

2. Sex difference.

   Generally speaking, there is better muscular development within Hesselbach's triangle in females than in males.

3. Racial difference.

   The colored male has a better development of muscle than the white male, and the colored female has a better development than the white female.

DEVELOPMENT OF THE TRANSVERSUS IN HESSELBACH'S TRIANGLE (CHART X)

As in the case of the internal oblique muscle, observations were made to determine the extent of development of the transversus muscle in Hesselbach's triangle.

The transversus muscle was wholly aponeurotic in Hesselbach's triangle in 58.05% on the right and 57.15% on the left side in white males, 63.24 on the right and 62.40% on the left side in colored males, 40% on the right and 33.2% on the left side in white females, and 66.6% on the right and 64.68% on the left side in colored females, A few scattered muscle fibers of the transversus were found to be present in Hesselbach's triangle in 12.15% on the right and 13.97% on the left side in white males, 8.16% on the right and 8.32% on the left side in colored males, 16.55% on the right and 17.64% on the left side in colored females. Such a condition was not found in the white females. The transversus muscle was fairly well developed in some portion of Hesselbach's triangle in 24.20% on the right and 25.40% on the left side in white males, 26.52% on the right and 27.04% on the left in colored males, 60% on the right and 49.8% on the left in white females, and 11.10% on the right and 11.76% on the left side in colored females. The transversus muscle was well developed throughout the area of Hesselbach's triangle in only one case, that of a colored male(2.04% on the right and 2.08% on the left).

Conclusion:

1. Difference between the right and left side.

No marked difference between the two sides was found to exist in the development of the transversus muscle in Hesselbach's triangle.

2. Sex difference.

The white female has a greater tendency toward the development of the transversus muscle in Hesselbach's triangle than the white male; the colored female slightly more than the colored male.

3. Racial difference.

The white male and female have a slightly greater development of the transversus muscle in Hesselbach's triangle than the colored male and female.

THE CONJOINED TENDON (CHART XI)

The conjoined tendon is a triangular structure formed by the fussion of the aponeurosis of the internal oblique and transversus muscles largely within the limits of Hesselbach's trianle. The base of this structure is insdrted into the crest of the pubes and the iliopectineal line. Observations were made to determine how often the conjoined tendon, as described, was present. It was present in 50.66% on the right and 42.50% on the left in the white males, 29.71% on the right and 34.68% on the left in colored males, 66.6% on the right and 57.2% on the left in white females, and 38.85% on both sides in colored females. In the remainder of the caes the following conditions presented themselves; the lower muscular fibers of the internal oblique and transversus muscles continued directly to insert into the crest of the pubis and the iliopectineal line without fusin to form a conjoined tendon; in others, the lower muscular fibers of the internal oblique and transversus muscles passed directly to their insertion into the linea semilunaris just above the pubes; and in some instances only the internal oblique had muscular fibers present in this region. Therefore, the conjoined tendon, as described, was not present in 49.33% on the right and 57.50% on the left side in white males, 70.29% on the right and 65.28% on the left side in colored males, 33.30% on the right and 42.90% on the left side in white females, and 61.15% on the right and left sides in colored females.

<u>Conclusion</u>:

1. Difference between the right and left side.

   The conjoined tendon was found to be present more frequently on the right side in the white male and female, on the left side in the colored male, and equally present on both sides in the colored female.

2. Sex. difference.

   The conjoined tendon was present much more frequently in the female.

3. Racial difference.

   The conjoined tendon is found much more frequently in the white race.

ANATOMY OF ASSOCIATED STRUCTURES IN HESSELBACH'S TRIANGLE.

Posterior to the transversus muscle and its aponeurosis, within the region of Hesselbach's triangle are found a number of muscular and fibrous structures. Not much mention of them is made in recent literature, but still their structure and their relation to the anatomy of the inguinal region indicates that they are the results of a development in response to special stress and strain in this region. These structures are Hesselbach's ligament, Henle's ligament, Pubotransversalis muscle, Interfoveolaris muscle, and a group of fibrous bundles which pass out of the true pelvis onto the posterior surface of the anterior abdominal wall within the region of Heselbach's triangle.

HESSELBACH'S AND HENLE'S LIGAMENTS (CHART XII, Figures 15 and 16)

Hesselbach's ligament consits of a band of tendinous fibers of varying breadth and strenght, extending from the outer edge of the fold of Douglas downward and laterally to come into direct relation with the medial and inferior margins of the internal ring. Henle's ligament as described by Douglas(7) descends from the upper limit of the ligament of Hesselbach, abliquely downwards and inwards to the pubic bone, lying lateral to the rectus tendon. In the greater number of cases one or the other of these ligaments was found to be present alone, but in other cases both were found in the same specimen. Since only a very limited number of specimen were observed for these structures, no significant correlations can be made from the actual precentages presented. Hesselbach's ligament, existing alone, was found to be present in 20% on the right and 30% on the left side in the white males, 25% on the right and 50% on the left in colored males, 100% on both sides in white females (only 3 right and 4 left observed), and 16.6% on the right and 28.6% on the left side in the colored females. Henle's ligament was found in 24% on the right and 5% on the left side in the white males, and 66.6% on the right and 14.3% on the left side in colored females. It was not found in the colored males or white females. Hesselbach's and Henle's ligaments were both present in 24% on the right and 15% on the left side in white males, 25% on the right side only in the colored males, and 14.3% on the left side only in colored females.

These two ligaments were found to be most frequently associated with the "average" and to some extent with the "well developed" lower anterior abdominal walls in the white and colored males and the colored females, and more with the "poorly developed" lower anterior abdmoinal walls in the white females.

Diverticula or foveae were found to be associated with these ligaments to the extent of 25% of the white male specimens, 30% of the colored males, and 27% of the white and colored female specimens.

<u>Conclusion</u>:

1. Difference between the right and left side.

The ligaments of Hesselbach and Henle were found more frequently on the right side in the white and colored males and on the left side in the white and colored females.

2. Sex difference.

These ligaments occurred more frequently in the male.

3. Racial difference.

The ligaments of Hesselbach and Henle are found to occur more frequently in the white male and female than in the colored male and female.

THE PUBOTRANSVERSALIS AND INTERFOVEOLARIS MUSCLES (CHART XIII)

The pubotransversalis muscle, as described by Macready(18) is a small muscular slip attached to the horizontal ramus of the pubes, passing upwards and outwards behind the transversus to lose itself in the aponeurosis of that muscle. It was found to be present only in the white males to the extent of 8.32% on the right and 5% on the left side. The interfoveolaris muscle arises from behind the transversus muscle (also sometimes from it) and extends downwards to the posterior surface of the inguinal and lacunar ligaments. It was found in 8.32% on the right side only in the white males, 12.5% on the right side only in the colored males, and 14.3% on the left side only in the colored females.

These muscles were associated with a "well developed" anterior abdominal wall in 43% of the cases and with a "poorly developed" abdominal wall in 43% of the cases.

Conclusion:

The pubotransversalis and interfoveolaris muscles were found more frequently on the right side, in the male, and in the white race.

LIGAMENTOUS FIBERS EXTENDING FROM THE PELVIS ONTO THE POSTERIOR OF THE CONJOINED TENDON (ON POSTERIOR OF TRANSVERSUS MUSCLE APONEUROSIS) CHART XIV AND FIGURES 15 and 17.

"External to the pelvic and iliac fasciae and extending onto the abdominal wall to become a part of the structure known as the conjoined tendon are a series of dense connective tissue fibers, quite ligamentous in appearance. The lateral half of the structure lying chiefly under and lateral to the iliac vessels is known as Cooper's ligament. The fibers are lost below (caudad) under the femoral sheath posterior to the vessels as they pass into the thigh. The median half of this ligamentous structure is found beneath the pelvic fascia caudad of the iliopectineal line. Its passes out of the pelvis over the iliopectineal line and onto the abdominal wall median to the iliac vessels. In some persons this structure constitues the whole of the conjoined tendon, and in some more or less of the fibers enter it." Whitherspoon(30)

No observations were made to determine the relation of these fibers within the pelvis, but their presence and development on the posterior surface of the anterior abdominal wall was noted. These fibers are ligamentous and extend onto the abdominal wall as quite definite bundles. Their lenght onto the posterior surface of the anterior abdominal wall is variable, being as much as 2.5 cm. in some cases; their width also varies, being 2 to 2.5 cm. in some of the well developed specimen. These ligamentous fibers were found to be present in 49.92% on the right side and 48% on the left side in the white males, 47.34% on the right and 47.04% on the left side in colored males, 100% on the right and 75% on the left side in the white females, and 87.5% on the right and 50% on the left side in the colored females.

As shown by the data, these ligamentous fibers on the posterior surface of the transversus aponeurosis are most frequently associated with the "average" and the "better than average" muscular development of the lower anterior abdominal wall.

<u>Conclusion:</u>

1. Difference between the right and left side.

   In both the white and colored males these fibers appear to be equally developed on both the right and the left side, although there is a slight tendency to better development on the right side. In the white and colored females, the fibers were found to occur more frequently on the right side.

2. Sex difference.

   These fibers are more frequently present in the female.

3. Racial difference.

   These fibers are more frequently found in the white than in the colored race, although the difference between the white and colored males is very slight.

DEVELOPMENTAL VARIATIONS IN THE ANATOMY OF THE INGUINAL REGION.

Of the developmental variations in the anatomy of the inguinal region, the occurrence of a fovea or diverticulum into the inguinal canal is of primary importance. The urachus and the obliterated hypogastric arteries when associated with a mesentery form foveae in the lower inguinal region, and these foveae seem to afford an anatomical predisposition to hernia. In the sub-peritoneal tissue, associated with the internal ring, the vas deferens, and the spermatic vessels, are sometimes found bands of tissue which because of their anatomical relation seem to influence the integrity of the internal inguinal ring. The adhesions which occur in the region of the internal ring between the ceaeum and the anterior abdominal wall on the right side and the sigmoid colon and the anterior abdominal wall on the left side, also seem to have a developmental background.

OBLIQUE PERITONEAL SAC (FOVEAE OR DIVERTICULA) CHART XV, Fig. 18.

The oblique peritoneal sac, grossly, is an evagination into the inguinal canal through the internal inguinal ring of the parietal peritoneum of the anterior abdominal wall. This peritoneal sac and its relation to hernia has been and still is a subject of controversy. Observations were made to determine how often this peritoneal process is found to exist in the average cadaver and a correlation was made of these data with the muscular development of the inguinal region. No attempt was made to differentiate between a congenital peritoneal sac (processus vaginalis) and an acquired peritoneal sac. A dimpling of the peritoneum was found at the internal inguinal ring in 16.51% on the right and 20.4% on the left side in white males, 12% on the right and 12.24% on the left side in colored males, 14.3% on both sides in the white females, and not at all found in the colored female. Peritoneal diverticula .5 cm. to 1 cm. in lenght were found in 16.51% on the right and 7.2% on the left side in the white males, 18% on the right and 4.08% on the left side in the colored males, and were not found in the white or colored females. Peritoneal diverticula 1.5 cm. in lenght were found in 3.81% on the right and 4.8% on the left side in the white males, 4% on the right and 2.04% on the left side in colored males, 16.6%(one case) on the right side only in the white females, and 5.55% on both sides in the colored females. Peritoneal diverticula measuring from 2 to 4 cm. in lenght were found in 7.62% on the right and 2.4% on the left side in the white males, 2% on the right side only in the colored males, and not found in the white or colored females.

Correlation of the foveae or diverticula with muscular development.

In white males, diverticula ranging from a dimple to 1 cm. in size were found most frequently associated with the "average" muscular walls, although a few cases were associated with the "less and the better than average" developed muscular walls. In the specimens with diverticula ranging in lenght from 1.5 cm. to

4 cm. it was found that half of them were associated with "less than average developed" abdominal walls, while the other half was associated with "average" and "better than average" muscular development.

In colored males, the specimens presenting a slight dimple of the peritoneum were associated mostly with "better than average" muscular development, and those having diverticula of 1 cm. and more were variously associated with "less and better than average" muscular development.

In general, large diverticula were associated to the extent of 50% with the "less than average" muscular development of the lower anterior abdominal wall. Small diverticula were associated with "less than average" muscular development in 13.3% of the cases (10 out of 75 pits).

Conclusion:

1. Difference between the right and left side.

In the white and colored males and the white female, diverticula were found to occur more frequently on the right side and also were of greater lenght on the right than on the left side. These findings are in accordance with the ideas of Macready(18) who states that the size of the opening is as a rule larger on the right side than on the left and oftentimes the size is greater in older than in younger individuals.

2. Sex difference.

The peritoneal diverticula are much more common in the males.

3. Racial difference.

The peritoneal diverticula are much more frequently found in the white male and female than in the colored male and female.

THE URACHUS (CHART XVI)

In some instances the urachus posseses a mesentery which forms a fovea on each side of the mid-line of the anterior abdominal wall, jest above the pubic crest. These foveaemay be a factor in the formation of a hernia. Observations were made with the purpose of determining how often such mesenteries occur and how prominent they were. This condition was also correlated with the degree of development of the muscles of the anterior abdominal wall, and with the presence of diverticula at the internal inguinal ring.

From observations it was found that the urachus did not posses a mesentery in 63.75% of the white males, 68% of the colored males, 100% of the white females, and 88.8% of the colored females. A mesentery .5 cm. long was found in 16.25% of the white males, 10% of the colored males, and 5.55% of the colored females. A meeentery 1 cm. wide was found in white males in 5% of the specimens, and in the colored males in 12%. None of this width were found in white and colored females. A mesentery 1.5cm. wide was found in 6.25% of the white males only. A mesentery 2 cm. wide was found in 2.5% of the white males, 2% of the colored males, and in 5.56% of the colored females. A mesentery of 3.5 cm. width was found in one white male, one of 4 cm. width was found in two white males(2.50%),and in one colored male(2%), and one measuring 4.5 cm. and another 5 cm. were found in white males.

Correlation of the mesentery of the urachus with the degree of muscular development of the abdominal wall.

In the white male and colored female the mesentery of the urachus is most frequently associated with "average developed" muscular walls. In the colored male it is most frequently associated with "better than average" development of the muscle.

Correlation of the mesentery of the urachus with the occurrence of diverticula at the internal ring.

Diverticula at the internal ring were found to be associated with a mesentery of the urachus in 20% of the white males or in slightly more than half of the cases in which such a mesentery occurred. The same is also true for those cases, in the white male, in which there is no associated mesentery of the urachus. In the colored male, diverticula were associated in 12% of the 32% cases having a mesentery, and in 28 of the 68% of cases having no mesentery. Therefore, it seems, that the presence of the urachus with a mesentery has little, if any, correlation with the occurrence of pits or diverticula at the internal ring.

Conclusions:

1. Sex.difference.

The mesentery associated with the urachus occurs principally in the males. It was not found in the white female, and only in two instances in colored females.

2. Racial difference.

The mesentery was found to occur more frequently in the white male. Also greatest widths of the mesentery were found in the white male. In the female it was found to be present to a slight degree in the colored and not at all in the white female.

<u>OBLITERATED HYPOGASTRIC ARTERIES</u> (CHART XVII)
Measurement of the associated mesenteries.

Observations were made with the purpose of determining how often the obliterated hypogastric arteries were associated with a mesentery in the cadaver and what the lenght of the mesentery was. This may help to determine the relation of the foveae or pouches formed by these mesenteries to the variations occurring in the anatomy of the inguinal region. Therefore, correlations were made between the presence of obliterated hypogastric mesenteries, and the degree of muscular development of the anterior abdominal wall, and the occurerence of diverticula at the internal ring.

The obliterated hypogastric arteries did not posses a mesentery in 25.2% on the right and 35.10% on the left side in the white males, 17.28% on the right and 20% on the left side in the colored males, 83% on the right and 57.2% on the left side in the in the white females, and 52.6% on the right and 55.5% on the left side in the colored females. Mesenteries of .5 cm. width were found in 21.6% on the right and 19.9% on the left side in t the white males, 13.44% on the right and 26% on the left side in the colored males, 16.6% on the right and 14.3% on the left side in the white females, and 26.3% on the right and 16.65% on the left side in the colored females. Mesenteries varying from 1 to 2 cm. inclusive were found in 32.4% on the right and 32.76% on the left side in the white males, 38.40% on the right and 42% on the left side in the colored males, 16.6% on the right and 28.6% on the left side in the white females, and 21.04% on the right and 27.75% on the left side in the colored females. Mesenteries of the obliterated hypogastric arteries measuring 2.5 cm., 3 cm., and 3.5 cm. were found 13.2% on the right and 7.55% on the left side in the white males, 23.04% on the right and 16% on the left side in colored males, but were not found in the white or colored females. Mesenteries of 4 and 5 cm. in width were found in 7.2% of the instances on the right and 3.51% on the left side in the white males, 6.96% on the right side only in colored males, and not at all in the white or colored females. In one case in the white male the obliterated hypogastric artery mesentery measured 7 cm. on the right and 6 cm. on the left. In this case diverticual were present in both internal inguinal rings and the abdominal wall of both sides was poorly developed.

Correlation of the urachus mesentery with the obliterated hypogastric artery mesentery.

In the white male, the mesentery of the urachus was found to the extent of 36.25% and the obliterated hypogastric arteries were associated with this mesentery to the extent of 31.25%. In the colored male, the mesentery of the urachus was present in 32% and the obliterated hypogastric arteries were associated in 32% of the cases. In the two cases of occurrence of the mesentery in the colored female, one was associated with the obliterated hypogastric artery mesentery.

Correlation of the obliterated hypogastric artery mesentery with the degree of muscular development of the abdominal wall.

In the white male, on both the right and left side, the mesenteries seem to be generally associated with the "average" and the "better than average" developed muscular walls. In the colored male the mesenteries are found associated most frequently with the "better than average" developed and the "average" developed muscular walls of the abdomen. In the white female they are mostly associated with the "better than average" development of musculature of the inguinal region. In the colored female they are most frequently associated with the "average" developed muscular wall.

Correlation of the obliterated hypogastric mesentery with the occurrence of diverticula at the internal ring.

Diverticula into the internal inguinal ring are more frequently present in cases in which obliterated hypogastric artery mesenteries are present.

Conclusion:

1. Difference between the right and left side.

   In the white and colored male the obliterated hypogastric mesenteries occur much more frequently on the right side, and mesenteries of greater width are more frequent on the right side. In the white female they are more frequent on the left and in the colored female they are more frequent on the right side.

2. Sex difference.

   Mesenteries associated with the obliterated hypogastric arteries occur much more frequently in the male s.

3. Racial difference.

   These mesenteries occur more frequently in the white race.

INFERIOR EPIGASTRIC ARTERY MESENTERY (CHART XVIII)

In a few cases it was noticed that the inferior epigastric artery was raised away from the posterior surface of the anterior abdominal wall thus producing a mesentery associated with this artery.

Observations were made to determine how frequently this occurred and what relation it had to the muscular development of the anterior abdominal wall. The inferior epigastric artery was raised away from the anterior abdominal wall the distance of its thickness in 4.68% on the right and 5.55% on the left side in white males, 6% on both sides in the colored males, but was not found in the females. In the white male, the mesentery was associated with "average" muscular development of the anterior abdominal wall and in the colored male with "better than average" muscular development. A mesentery of .5 cm. width was found to be associated with the inferior epigastric artery in 1.17%(1 case) on the right side only in the white males, and 5.26% (one case) on the left side only in the colored females, In the white male it was associated with a "better than average" development of the abdominal wall and in the colored female with a "less than average" developed muscular wall. A mesentery of 1 cm. was found on the left side only in the white male and was associated withaan "average" developed muscular wall. A mesentery of 1.5 cm. also found on the left side only in the white male, was associated with a "less than average" muscular development of the anterior abdominal wall.

Conclusion:

As can be seen from the data, no definite correlation of the findings can be made as to the fifference between the right and left side or as to the race. Further, no valuable correlation of the occurrence of this mesentery can be made with the degree of muscular development.

LIGAMENTUM DUCTUS DEFERENS (VAS BAND) (CHART XIX and FIG. 19)

During the course of making observations on the different anatomical structures in the inguinal region, a subperitoneal thickening was noticed which was related to the internal abdominal rings and the vasa deferentia. This subperitoneal thickening was found medial to the vas deferens and extended from the internal ring backwards, downward and medially, separating from the vas deferens in a more medial curve, to become indistinguishable over the region of the lateral superior portion of the urinary bladder. Upon later dissection it was discovered that this subperitoneal thickening was the superior free margin of a definite structure, which because of its anatomical relation, has been called the intervasa deferential fascia (Fig. 19), and which will be discussed subsequently. An arbitrary criterion, as to the development of these thickenings, was established for the purpose of classification, into "average" and "well developed" types. From observations it was found that the "average" condition was present in 40.61% on the right and 48.60% on the left side in the white males, 59.02% on the right and 50% on the left side in colored males. The "well developed" conditions were found in 36.68% on the right and 17.55% on the left side in the white males, and 20.43% on the right and 7.89% on the left side in the colored males.

CORRELATION OF THE LIGAMENTUM DUCTUS DEFERENS WITH MUSCULAR DEVELOPMENT.

In the white male, ligaments of "average" development were associated on the right side most frequently with an "average" muscular development of the abdominal wall, while on the left side, slightly more frequently with a "better than average" developed muscular wall; in the colored male, on the right side more frequently with a "better than average" muscular development and on the left equally associated with "average" and "better than average" muscular development. Ligaments of the "well type were most frequently associated with an "average" developed muscular wall in both the white and colored males.

Correlation of the ligamentum ductus deferens with the presence of diverticula.

From the data it is evident that diverticula into the inguinal canal are to some extent associated with the presence of these ligaments. In specimen with no evident ligaments, diverticula into the inguinal canal were found in 2.62% of 22.27% cases (specimen with no evident ligaments) on the right and 2.70% of 33.75% on the left side in the white males, and 2.27% of 20.43% cases on the right in the colored male, no diverticula occurring on the left. In specimen in which ligaments existed, diverticula into the inguinal canal were found in 41.96% of 77.29% cases on the right side and 32.50% of 66.15% cases on the left side in white males, and 36.32% of 79.45% cases on the right and 18.41% of 57.88% cases on the left in the colored males.

Conclusion:

1. As to correlation with the degree of muscular development.

These ligamenta ducti deferentia in general, were associated with the "average" and the "better than average" development of the musculature in the inguinal region in both the white and colored males.

2. As to correlation with diverticula.

It is evident from the data, that the ligamentum ductus deferens has a definite relation to the occurrence of diverticula at the internal abdominal ring.

3. Difference between the right and left side.

In both the white and colored males, the ligaments were present more frequently and were better developed on the right side.

4. Racial difference.

In general, the ligamenta ducti deferentia occurred to a greater extent in the white male than in the colored male, although the well developed ligaments were much more frequently present in the white male than in the colored male.

THE SPERMATIC LIGAMENTS (CHART XX)

In some cases there were found subperitoneal thickenings associated with the spermatic vessels, extending from the region of the internal inguinal ring and coursing for a short distance with the spermatic vessels. On microscopic dissection of the peritoneum and subperitoneal tissue of this area, it was found that these subperitoneal thickenings, when present, were due to bands of tissue which accompanied the abdominal portion of the spermatic vessels for a short distance before they entered the internal inguinal ring. Microscopic sections were made of these ligaments. There was found to be present connective tissue and some smooth muscle. These bands, for the sake of convenience of discussion, were colled the spermatic ligaments because of their association with the spermatic vessels. These ligaments, as in the case of the ligamenta ducti deferentia, were arbitrarily divided into "average" and "well developed" cases.

"Average" spermatic ligaments were found to be present in 32.5% on the right and 29.19% on the left side in white males, and 43.92% on the right and 27.8% on the left side in the colored males. The "well developed" spermatic ligaments were found in 20.8% on the right and 11.12% on the left side in the white males, and in 12.20% on the right and 2.74% on the left in the colored males.

Correlation of the presence of the spermatic ligaments with the degree of muscular development of the lower anterior abdominal wall.

The spermatic ligaments of "average" development were found to be associated most frequently, in the white male on the right side, with "better than average" muscular development; on the left side "average" muscular development; in the colored male on the right side, with "average" muscular development and on the left side with "better than average" muscular development. The well developed spermatic ligaments were found most frequently associated with the "average" developed muscular wall in both the white and colored males.

Correlation of the spermatic ligaments with diverticula.

Those specimen in which a spermatic ligament could not be demonstrated, diverticula were found in 13% of 46.8% cases on the right and 11.12% of 59.77% cases on the left side in the white male, and 4.88% of 43.92% cases on the right and 2.78% of 69.50% on the left side in the colored males. In cases in which spermatic ligaments were present, diverticula were found associated in 31.2% of 53.3% cases on the right and 25.02% of 40.31% on the left side in the white males, and 31.72% of 56.12% cases on the right and 16.68% of 30.58% cases on the left side in the colored males.

Conclusion:

1. As to correlation with the degree of muscular development of the anterior abdominal wall.

   The spermatic ligaments are most frequently associated with "average" and to some extent with the "better than average" muscular development of the lower anterior abdominal wall.

2. As to correlation with diverticula.

   Diverticula were found in 14% of the cases having no demonstrable spermatic ligaments and in 57% of the cases with spermatic ligaments.

3. Difference between the right and left side.

   Spermatic ligaments were found to occur much more frequently on the right side.

4. Racial difference.

The spermatic ligaments were found more frequently in the colored male on the right side and in the white male on the left side, although spermatic ligaments of the well developed type were found more frequently in the white male.

ADHESIONS OF THE CEACUM AND SIGMOID AT THE INTERNAL RING.

Adhesions Of The Ceacum At The Internal Ring.

Total number of specimen observed:

White male	95
Colored male	56
White female	7
Colored female	19

Occurrence:

None occurred in the colored male, white female, or colored female.

White male - right side.

1. At the internal ring ---- 1 case (1.005%)
2. Below internal ring ---- 1 case (1.005%)
3. 3 cm. from int. ring ---- 1 case (1.005%)

TOTAL - 3 cases (3.015%)

Adhesions Of The Sigmoid Colon At The Internal Ring.

None occurred in the white female and colored female.

	White male Left side.		Colored male Left side
1. Over internal ring --	4 cases(4.02%)	--	3 cases(5.23%)
2. Inferior to int. ring-	11 cases(11.05%)	--	4 cases(7.12%)
TOTAL	15 cases(15.07%)	--	7 cases(12.46%)

The ceacum which usually lies in the right iliac fossa on the iliopsoas muscle was found in the three cases herein reported to be placed more caudally and anteriorly. In the first case the apex of the ceacum was found to be adherent directly over the internal ring. In the second case the apex of the ceacum was not quite up to the internal ring and therefore was below the internal ring. In the third case the apex of the ceacum was found to adhere 3 cm. postero-laterally from the internal ring.

The sigmoid colon, according to the description in Morris(21), begins over the region of the psoas muscle about midway between the lumbosacral promontory and the inguinal ligament, and then descends along the left pelvic wall. In the course of making observations it was found in 15.075% of the cases in the white males and 12.46% in the colored males that the sigmoid colon was directly related by adhesion to the internal abdominal ring. It was found adherent directly over the left internal ring in 4.02% cases in the white males and 5.34% in the colored males.

No data have been found in the literature which deals with adhesions of the ceacum and sigmoid colon at the internal ring, although some information exists in Macready's book on Ruptures(18) which explain the formation of congenital hernia of the ceacum and sigmoid flexure, which may help in explaining these adhesions. Quoting Macready:

"Two theories may here be referred to by which Wrisberg sought to account for the production of hernia in the tunica vaginalis. According to the first, the intestine or omentum may adhere, during fetal life, to the testis, and the descent of the testis may determine the descent of the viscera. The second theory is founded on the fact that the peritoneal fold, which encloses the spermatic vessels in embryonic life, sends a short suplicature to the nearest part of the ceacum or end of the ileum on the right side, and the sigmoid flexure on the left, and Wrisberg supposed that sometimes the testis drew down with it one or the other of these viscera. This last theory has been considerably modified by Lockwood, its latest exponent; and as it leaves his hands, affords the only adequate explanation of the congenital hernia of ceacum and sigmoid flexure. Loestein described the peritoneal folds connecting the testis and ceacum on one side and the testis and sigmoid on the other."

Therefore, since there is evidence that such peritoneal folds exist between the testis and the ceacum on one side and the testis and sigmoid on the other, it seems reasonable to conclude that the presence of the ceacum and sigmoid at the internal ring is due to these folds which only partially succeeded, in early development, in displacing these organs from their normal position in the abdominal cavity.

<u>Conclusion:</u>

1. Difference between the right and left side.

    Adhesions of the sigmoid colon in the region of the left internal inguinal ring are more frequent than adhesions of the ceacum on the right side.

2. Sex difference.

The adhesions were found to occur only in the males.

3. Racial difference.

These adhesions are most frequent in the white race. Adhesions of the ceacum are found only in the white male, and the adhesions of the sigmoid colon are twice as frequent in the white males.

LIPOMATA IN THE INGUINAL REGION(CHART XXI)

General deposition of fat and fat pedicles in the inguinal region are described as lipomas or lipomata. That they are not rare and that they may play an important part in the etiology of some cases of hernia has long been recognized. The nature, size, and location of these deposits of fat is variable. The fat may be present in the inguinal canal, infiltrating the spermatic cord, or it may be present as a definite circumscribed extension through the internal abdominal ring from the subperitoneal tissue. It may be present as a circumscribed extension of subperitoneal tissue which herniates through the muscles of the abdominal wall in the inguinal region. As pointed out by Fergusson(8) these extensions of fat or fatty pedicles are veiled with a thin covering of white fibrous tissue, which must be torn or cut, before their connection with the subperitoneal adipose layer is demonstrated. From the observations herein reported it was found that fat pedicles and fatty accumulations were present in the inguinal canal in 13.65% on the right and 11.55% on the left side in the white males, 12.6% on the right and 5.4% on the left side in the colored males, 14.3%(one case) on the right side only in the white female, and 10.52% on both sides in the colored females. Fatty extensions and fatty accumulations accurring in the inguinal region exclusive of the inguinal canal were found to be present in 4.20% on the right and 9.45% on the left of the white males, 3.6% on both sides in the colored males, 14.3%(one case) on the left side only in the white female, and 15.78% on the right and 5.26% on the left side in the colored females. In the white female (one case) on both sides, fatty infiltration of the lower inguinal region was so extensive that the inguinal canal throughout its extent was enclosed in fat. The musculature of the internal oblique and transversus muscles was completely replaced by fat, but the aponeuroses were present and very strong.

Correlation of fat pedicles with muscular development of the abdominal wall.

In general, fatty pedicles are most frequently associated with the "average" and "well developed" lower abdominal walls.

Conclusion:

1. Difference between the right and left side.

   Fatty pedicles which are found in the inguinal canal appear more frequently on the right side. Fatty pedicles occuring outside the inguinal canal, elsewhere in the inguinal region, were found to be present more frequently on the left side in the white male and female, equally distributed in the colored male, and more frequent on the right side in the colored female.

2. Sex difference.

Fatty pedicles were found to be more frequently present in the female than in the male.

3. Racial difference.

In general, fat deposits in the inguinal region occur more frequently in the white race.

DISCUSSION

As a result of this statistical study, based upon 177 cadavers, some very important facts regarding the anatomy of the inguinal region can be presented. The economic status of the individuals studied was not determined, and their occupational habits were not known. Therefore, it was not possible to make a classification of the individuals based upon the physical stress they had been subject to, or to determine whether the anatomical variations, found existing, were the result of this physical stress, or had developed irrespective of it. Irregardless of these factors, the anatomical findings, after a careful correlation, show that a wide degree of variation exists in the anatomy of the inguinal region between the right and left side, in the two sexes, and in the white and colored race.

A study of the muscular development of the anterior abdominal wall shows that there is a definitely better development in the female sex and also a better development in the colored race. Variations in the development of the lower fibers of the internal oblique and transversus muscles were found to be present most frequently on the right side and in white males. The data point out the fact that the white male has a weaker abdominal musculature and the right side is slightly weaker than the left. Therefore, this development of the lower fibers of the internal oblique muscle my be a functional response, a functional response, a functional hypertrophy, of the muscle tissue to strenghten a weak abdominal wall. Fort(9) points out that the predominance of right over left sided hernia has been variously explained by different authors as being due to the larger lobe of the liver being on the right side, the inclination of the mesentery being to the right side, and the predominance of those who are right handed. He further considers the most important factors to be, a congenital weakness of the inguinal region which is usually on the right side, the oblique direction of the mesentery to the right, the peristaltic wave ranging from left to right, the concentration of intra-abdominal pressure in the right iliac fossa with the contraction of the diaphgram, and the fact that the right side of the pelvis is larger than the left. He also points out that the left testicle reaches the scrotum first because of the pressure of the sigmoid colon and also the left internal ring closes first due to this same pressure. From data presented herewith it can be added, that the muscles of the lower anterior abdominal wall show a weaker development on the right side.

The fact that the female has a greater development of the internal oblique in the inguinal region may be explained if the theory of cremaseteric origin from the internal oblique be accepted. No definite reason for the greater development of muscle in the colored race can be forwarded. It is true that they are of the working class, but it is also known that the white male will stand under long sustained physical exertion as long as, and in many cases longer than the colored male. The literature is very meager in regards to this subject. Only one mention of it was made by Knox(14) in 1836, who observed that no hernia were found to occur in the colored races, provided they were unmixed.

Foveae and diverticula into the inguinal canal were most frequently found on the right side, in the white male. It is shown from statistics that indirect inguinal hernia is more frequent in the male sex and also on the right side. Since a peritoneal sac precedes the formation of practically all indirect inguinal hernia, a consideration of some factors thought responsible for the occurrence of hernia will apply also to the occurrence of foveae or diverticula. It is evident from the data that in cases where there is a beginning formation of a sac, the abdominal walls show "average" or "better than average" development. It may be supposed in these cases that the musculature of the anterior abdominal wall has been sufficiently developed and is withstanding the strain placed upon it, and the sac cannot progress in size; or it may be assumed that the sac has not developed to a greater size because the muscular wall, as a result of the stress and strain placed upon it, has become better developed to oppose this pressure. This has been well sbstantiated by Seaver(24) and McKenzie(20) who have reported good results in the treatment of some cases of hernia with proper exercise to produce hypertrophy of muscle in the inguinal region. The fact that sacs of greater lenght are associated mostly with poorly developed walls might lead one to conclude that the stresses and strains have overcome the resisting power of the muscles of the lower anterior abdominal wall, and have weakened them sufficiently so that a sac has bulged partially through them; or one might also conclude that because the muscular wall was weak or deficient and under increased stress gave away to the formation of a sac into the inguinal canal. The existance of sacs in cases with well developed muscular walls, without the occurrence of hernia, is explained by the protective action of the well developed internal oblique muscle which is placed in front of the internal inguinal ring. This is well substantiated by Murray(22), who in his examination of post-mortem cases found that 21% of the cases had potential peritoneal sacs, but there was no evidence of hernia during life. The occurrence of hernia, in these cases, may be explained by the fact that increased stress and strain, especially in the squatting position, overcomes the muscular protection to such an extent, that the muscles, which under ordinary conditions were able safely to quard the patent opening are suddenly overtaxed and the bowel escapes. Henson(11) points out that usually when hernia occurs, without a preexisting sac, it is due to atrophy and relaxation of the internal oblique muscle and relaxation of the transversalis fascia with enlargement of the internal ring and loss of normal relation between the ring and the muscle, with consequent loss of the valve-like protection that the internal oblique affords the ring. That the muscles of the anterior abdominal wall can atrophy when subject to constant and continuous stress or pressure is best illustrated by a lipoma in the inguinal region. Maas(17) points out that a small fatty tumor located in the parieties of the abdomen dialates the opening as it begins to grow; and, that examples are numerous in which a growth of soft tissue presses aside or even destroys a much harder tissue than its own.

Therefore, the occurrence of hernia would depend primarily upon the size of the opening at the internal abdominal ring and the strenght of the muscle that guards it.

The relation of the ligamenta ducti deferentia and the spermatic ligaments to the internal inguinal ring, and the high percentage of pits or diverticula associated with them, tends to raise a question as to what role they might have in the production of a sac at the internal ring. The relation of the ligamentum ductus deferens to the internal abdominal ring is such that a pull in the direction of its course would tend to pull the medial lip of the internal ring medially. A contraction of the smooth muscle in the spermatic ligaments would tend to produce a pull away from the internal ring in the direction of the course of the spermatic vessels and therefore tend to hold the lateral lip of the internal ring in place. A number of these bands were sectioned and it was found that in many there was present smooth muscle. Therefore, it is possible to conclude that under certain physical or physiological stress the muscle in these ligaments could contract with the result that the internal ring would gap so that intra-abdominal pressure would tend to push the peritoneum into this opening.

CONCLUSION

This research claims significance because of the relatively large series of specimens studied in an attempt to determine the variations in the anatomy of the inguinal region. Special attention was given to the differences between the right and left sides, the differences in the sexes, and the racial differences. The main effort has been to make a correlation of the variations found with the degree of muscular development of the lower anterior abdominal wall.

The muscles of the lower anterior abdominal wall were found to be much better developed on the left side, especially in the colored males, in the females, and in the colored race. Variations in the development of the lower fibers of the internal oblique and transversus muscles were found to be present most frequently on the right side and in the white males.

Hesselbach's and Henle's ligaments were found more frequently on the right side in the white and colored males and on the left side in the white and colored females. They were most frequentl found in the males, and in the white race. They were associated with "average" and to some extent with the "better than average" developed musculature of the lower anterior abdominal wall.

Diverticula were associated in more than one-fourth of the cases having these ligaments.

The pubotransversalis and interfoveolaris muscles were found more frequently on the right side, in males, and in the white race. These muscles were associated with a "well developed" musculature of the anterior abdominal wall in 43% of the cases and with a "poorly developed" abdominal wall in 43% of the cases.

Diverticula (oblique peritoneal sacs) were found to occur most frequently on the right side, in males, and in the white race. Large diverticula were found to be associated with "less than average" muscular development of the lower anterior abdominal wall in 50% of the cases, while small diverticula were associated with "less than average" muscular development in 13.3% of the cases.

A mesentery associated with the urachus was found most frequently in males, and in the white race.

Mesenteries associated with the obliterated hypogastric arteries were found most frequently on the right side, in males, and in the white race. These developments of the mesentery were associated most frequently with "average" and "better than average" muscular development.

The ligamentum ductus deferens (vas band), a bundle of musculo-fibrous tissue associated with the vas deferens, and which was not found to be recorded in the literature, was found to be present most frequently on the right side, and more frequently in the white than in the colored race. It was associated most frequently with "average" and "better than average" muscular development of the lower anterior abdominal wall, and was found to have a definite relation to the occurrence of diverticula at the internal inguinal ring.

The spermatic ligament, consisting of bundles of musculo-fibrous tissue and which also was not found to be recorded in the literature, was found to be present most frequently on the right side, and in the white race. Like the ligamentum ductus deferens, it was most frequently associated with "average" and "better than average" muscular development of the lower anterior abdominal wall. Diverticula were associated with 57% of the cases possessing spermatic ligaments.

Adhesions of the sigmoid colon over the internal abdominal ring on the left side were found to occur much more frequently than adhesions of the ceacum over the internal ring on the right side. Both were more frequent in males, and in the white race.

Lipomata (fatty pedicles) in the inguinal region were found in about 13% of the cases and occurred more frequently in females, and more frequently in the white than in the colored race.

SUMMARY

1. The size of the external inguinal ring has no relation to the degree of muscular development of the anterior abdominal wall or to the occurrence of diverticula at the internal ring.

2. Weakened areas in the aponeurosis of the external oblique muscle occur more frequently on the right side, in the males, and in the white race.

3. Intercrural fibers are most frequently found in the females, and in the white race.

4. The musculature of the anterior abdominal wall in the inguinal region shows a weaker development on the right side; is not as well developed in the males as in females; and is better developed in the colored than in the white race.

5. Special developments of the lower fibers of the internal oblique and transversus muscles, tending to strenghten the internal ring, are more frequent on the right side in the white male.

6. The conjoined tendon occured most frequently on the right side in the white race and on the left in the colored race. It was more frequent in the female s, and in the white race.

7. Ligaments of Hesselbach and Henle occurred most frequently in the males, and in the white race.

8. The pubotransversalis and interfoveolaris muscles occurred more frequently on the right side, in the males, and in the white race.

9. Ligamentous fibers extending from the true pelvis onto the posterior of the transversus muscle aponeurosis tend to occur more frequently on the right side, in the females, and in both the white and colored race.

10. Diverticula at the internal inguinal ring are found most frequently on the right side, in males, and in the white race.

11. The urachus mesentery occurs most in the white male.

12. The obliterated hypogastric artery mesenteries occur most frequently on the right side, in males, and in the white race.

13. The inferior epigastric artery mesentery is infrequent and variable as to occurrence.

14. The spermatic and ductus deferens ligaments are more frequently found on the right side and in males. Because of their relation to the occurrence of diverticula they play some part in the production of pits at the internal ring.

15. Adhesions of the sigmoid colon on the left side, over the internal ring, are more frequent than adhesions of the ceacum over the internal ring on the right side.

16. Lipomata were found in 13% of the cases, especially on the right side, in males, and in the white race.

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CHARTS AND FIGURES

CHART I.

MEDIAL EXTENT OF THE EXTERNAL OBLIQUE MUSCLE.

Number of specimen observed:

	R.		L.
White male	80	-	85
Colored male	53	-	53
White female	6	-	7
Colored female	18	-	18

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Lateral to ant. sup. spine.	2	2.50	3	3.51	66	66----	--	-----	--	-----	--	-----	--	-----	--	-----
At anterior sup. spine	25	31.25	26	30.42	11	20.90	14	26.60	1	16.60	1	14.30	4	22.20	4	22.20
1 to 3 cm. med. to a. s. s.	30	37.50	30	35.10	21	39.90	18	34.20	3	49.80	4	57.20	7	38.85	7	38.85
3 cm. med. to A. s. s.	7	8.75	11	12.87	4	7.70	5	9.50	1	16.60	1	14.30	1	5.55	--	-----
4 cm. med. to A. s. s.	6	7.50	6	7.02	2	3.80	1	1.90	1	16.60	1	14.30	3	16.65	4	22.20
5 cm. med. to A. s. s.	6	7.50	4	4.68	11	20.90	10	19.00	--	-----	--	-----	2	11.10	2	11.10
6 cm. med. to A. s. s.	3	3.75	3	3.51	4	7.70	5	9.50	--	-----	--	-----	1	5.55	1	5.55
7 cm. med. to A. s. s.	1	1.25	1	1.17	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----
8 cm. med. to A. s. s.	--	-----	1	1.17	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----

CHART II.

EXTENT OF WEAKNESS LATERAL TO THE EXTERNAL RING IN THE EXTERNAL OBLIQUE APONEUROSIS.

Number of specimen observed:

	R.	L.
White male	79	80
Colored male	48	43
White female	6	7
Colored female	18	18

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Aponeurosis all weak	5	6.35	3	3.75	--	-----	1	2.32	1	16.60	--	-----	--	-----	--	-----
.5 cm. lateral weakness	1	1.27	3	3.75	--	-----	--	-----	--	-----	--	-----	1	5.55	1	5.55
1 cm. lateral weakness	12	15.24	8	10.00	9	18.78	4	9.30	--	-----	--	-----	4	22.20	2	11.10
1.5 cm. lateral weakness	5	6.35	6	7.50	4	8.32	1	2.32	--	-----	--	-----	--	-----	--	-----
2 cm. lateral weakness	12	15.24	11	13.75	4	8.32	2	4.65	--	-----	--	-----	--	-----	2	11.10
2.5 cm. lateral weakness	5	6.35	8	10.00	2	4.16	3	6.98	--	-----	--	-----	--	-----	--	-----
3 cm. lateral weakness	7	8.89	11	13.75	1	2.08	--	-----	--	-----	--	-----	1	5.55	2	11.10
3.5 cm. lateral weakness	2	2.54	--	-----	--	-----	1	2.32	--	-----	--	-----	--	-----	--	-----
4 cm. lateral weakness	4	5.08	2	2.50	3	6.24	1	2.32	1	16.60	--	-----	1	5.55	--	-----
4.5 cm. lateral weakness	1	1.27	1	1.25	1	2.08	--	-----	--	-----	--	-----	--	-----	--	-----
5 cm. lateral weakness	--	-----	1	1.25	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----
8 cm. lateral weakness	1	1.27	--	-----	1	2.08	--	-----	--	-----	--	-----	--	-----	--	-----
No weakness	23	30.11	26	32.50	23	47.84	30	69.80	4	66.40	7	100.	11	61.05	11	61.05

CHART III.

SIZE OF THE EXTERNAL INGUINAL RING

Number of specimen observed:

	R.	L.
White male	80	84
Colored male	53	51
White female	6	7
Colored female	19	19

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
SMALL EXT. RING	5	6.25	4	4.80	1	1.90	1	2.00	--	-----	--	-----	--	-----	--	-----
Development LTA	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----
" average	3	3.75	3	3.60	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----
Development BTA	2	2.50	1	1.20	1	1.90	1	2.00	--	-----	--	-----	--	-----	--	-----
C. with F of D	2	2.50	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----
AVERAGE E. RING	61	76.25	62	74.40	40	76.00	43	86.00	5	83.00	6	85.80	19	100.	19	100.
Development LTA	8	10.00	6	7.20	4	7.60	6	12.00	2	33.20	2	28.60	2	10.52	2	10.52
" average	30	37.50	32	38.40	17	32.30	19	38.00	2	33.20	3	42.90	16	84.16	15	78.90
Development BTA	23	28.75	24	28.80	19	36.10	18	36.00	1	16.60	1	14.30	1	5.26	2	10.52
C. with F or D	23	28.75	19	22.80	12	22.80	8	16.00	1	16.60	1	14.30	--	-----	1	5.26
ENLARGED E. R.	6	7.50	9	10.80	4	7.60	3	6.00	--	-----	--	-----	--	-----	--	-----
Development LTA	--	-----	1	1.20	1	1.90	--	-----	--	-----	--	-----	--	-----	--	-----
" average	5	6.25	6	7.20	2	3.80	2	4.00	--	-----	--	-----	--	-----	--	-----
Development BTA	1	1.25	2	2.40	1	1.90	1	2.00	--	-----	--	-----	--	-----	--	-----
C. with F or D	1	1.25	3	3.60	1	1.90	1	2.00	--	-----	--	-----	--	-----	--	-----
LARGE EXT. RING	8	10.00	9	10.80	8	15.20	4	8.00	1	16.60	1	14.30	--	-----	--	-----
Development LTA	1	1.25	1	1.20	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----
" average	4	5.00	4	4.80	4	7.60	1	2.00	--	-----	--	-----	--	-----	--	-----
Development BTA	3	3.75	4	4.80	4	7.60	3	6.00	1	16.60	1	14.30	--	-----	--	-----
C. with F or D	5	6.25	4	4.80	5	9.50	1	2.00	1	16.60	--	-----	--	-----	--	-----

Development LTA - associated with abdominal wall of less than average muscular development.

Development BTA - associated with abdominal wall of better than average develop.

C. with F or D - correlation with foveae or diverticula.

Chart IV

INTERCRURAL FIBERS

Number of specimen observed:

	R.	L.
White male	77	84
Colored male	53	53
White female	6	7
Colored female	16	17

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Not present	14	18.20	14	16.80	15	28.50	15	28.50	2	33.30	4	57.20	6	31.56	7	41.16
Less than ave. developed.	20	26.00	16	19.20	11	20.90	9	17.10	2	33.30	1	14.30	8	42.08	4	23.52
Averagely developed	25	32.50	35	42.00	18	34.20	19	37.00	2	33.30	2	28.60	3	15.78	6	35.28
Better than ave. developed	16	20.80	17	20.40	9	17.10	10	19.00	--	-----	--	-----	2	10.52	--	-----
Very well developed	2	2.60	2	2.40	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----

CHART V.

EXTENT OF ATTACHMENT OF THE INTERNAL OBLIQUE MUSCLE ON THE INGUINAL LIGAMENT.

Number of specimen observed:

	R.		L.
White male	80	-	84
Colored male	54	-	53
White female	6	-	7
Colored female	19	-	18

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Lateral 1/4	1	1.25	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----
Lateral 1/3	4	5.00	7	8.40	2	3.70	--	-----	--	-----	--	-----	--	-----	--	-----
Minus Lat. 1/2	8	10.00	4	4.80	3	5.55	4	7.60	--	-----	--	-----	--	-----	--	-----
Lateral 1/2	24	30.00	27	32.40	17	31.45	15	28.50	--	-----	--	-----	--	-----	--	-----
Plus Lat. 1/2	13	16.25	12	14.40	5	9.25	8	15.20	1	16.60	1	14.30	2	10.52	2	11.10
TOTAL Lat. 1/2	45	56.25	43	51.60	25	46.25	17	51.30	1	16.60	1	14.30	2	10.52	2	11.10
Lateral 2/3	25	31.25	26	31.20	16	29.60	16	30.40	1	16.60	1	14.30	7	36.82	6	33.30
Lateral 3/4	3	3.75	6	7.20	9	16.65	8	15.20	2	33.30	3	42.90	9	47.34	8	44.40
Lateral 4/5	1	1.25	1	1.20	--	-----	--	-----	1	16.60	1	14.30	1	5.26	2	11.10
Whole lenght	1	1.25	1	1.20	2	3.70	2	3.80	--	-----	--	-----	--	-----	--	-----
TOTAL Lat. 3/4 and over	5	6.25	8	9.60	11	20.35	10	19.00	3	49.90	4	57.20	10	52.60	10	55.50
No attachment on Ing. Lig.	--	-----	--	-----	--	-----	--	-----	1	16.60	1	14.30	--	-----	--	-----

CHART VI

ANATOMY OF THE LOWER FIBERS OF THE INTERNAL OBLIQUE AND TRANSVERSUS MUSCLES.

Number of specimen observed:

White male	24 - 19
Colored male	8 - 4
Colored female	6 - 7
White female	3 - 5

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
1. STR. ACROSS	2	8.32	3	15.75	1	12.50	--	-----	1	33.30	1	20.00	1	16.60	--	-----
C. with F or D	2	8.32	2	10.50	1	12.50	--	-----	1	33.30	--	-----	1	16.60	--	-----
Development LTA	--	-----	--	-----	--	-----	--	-----	1	33.30	1	20.00	--	-----	--	-----
" average	1	4.16	2	10.52	1	12.50	--	-----	--	-----	--	-----	--	-----	--	-----
Development BTA	1	4.16	1	5.25	--	-----	--	-----	--	-----	--	-----	1	16.60	--	-----
2. TO PUB. TUB.	7	29.12	6	31.50	4	50.00	--	-----	2	66.60	3	60.00	3	49.80	4	57.20
C. with F or D	3	12.48	2	10.50	--	-----	--	-----	--	-----	1	20.00	--	-----	1	14.30
Development LTA	2	8.32	--	-----	--	-----	--	-----	2	66.60	2	40.00	--	-----	--	-----
" average	4	16.64	4	21.00	3	37.50	--	-----	--	-----	1	20.00	3	49.80	2	28.60
Development BTA	1	4.16	2	10.50	1	12.50	--	-----	--	-----	--	-----	--	-----	2	28.60
3.MED 1/3 CANAL	2	8.32	2	10.50	1	12.50	--	-----	--	-----	--	-----	--	-----	--	-----
C. with F or D	1	4.16	1	5.25	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----
Development LTA	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----
" average	2	8.32	--	-----	1	12.50	--	-----	--	-----	--	-----	--	-----	--	-----
Development BTA	--	-----	2	10.50	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----
4.MID 1/3 CANAL	6	24.96	4	21.00	1	12.50	1	25.00	--	-----	--	-----	1	16.60	3	43.90
C. with F or D	2	4.16	3	15.75	1	12.50	1	25.00	--	-----	--	-----	--	-----	--	-----
Development LTA	1	4.16	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----
" a verage	5	20.80	2	10.50	1	12.50	1	25.00	--	-----	--	-----	1	16.60	2	28.60
Development BTA	--	-----	2	10.50	--	-----	--	-----	--	-----	--	-----	--	-----	1	14.30
5.LAT 1/3 CANAL	7	29.12	4	21.00	1	12.50	3	75.00	--	-----	1	20.00	1	16.60	--	-----
C. with F or D	2	8.32	1	5.25	--	-----	2	50.00	--	-----	--	-----	--	-----	--	-----
Development LTA	--	-----	1	5.25	--	-----	2	50.00	--	-----	--	-----	--	-----	--	-----
" average	5	20.80	1	5.25	--	-----	1	25.00	--	-----	--	-----	1	16.60	--	-----
Development BTA	2	8.32	2	10.50	1	12.50	--	-----	--	-----	1	20.00	--	-----	--	-----

Development LTA - associated with less than average muscular development.
Development BTA - associated with better than average muscular development.
C. with F or D - correlation with fovea or diverticula.

CHART VII
ANATOMY OF THE LOWER FIBERS OF THE INTERNAL OBLIQUE AND TRANSVERSUS MUSCLES (Continued)

6. MUSCLE BAND UNDER THE SPERMATIC CORD.

Number of specimen observed:

	R.		L.
White male	82	-	86
Colored male	52	-	52
White female	6	-	7
Colored female	19	-	19

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Present	11	13.42	10	11.63	3	5.76	6	11.52	1	16.60	1	14.30	--	-----	--	-----
Development LTA	1	1.22	1	1.16	--	-----	1	1.92	--	-----	--	-----				
" average	6	7.32	4	4.65	1	1.92	2	4.84	1	16.60	1	14.30				
Development BTA	4	4.88	5	5.81	2	4.84	3	5.76								

7. INCOMPLETE SPHINCTER OF THE INTERNAL OBLIQUE MUSCLE.

Number of specimen observed: (Same as for above)

Present	3	3.66	6	6.98	6	11.52	6	11.52								
Development LTA	--	-----	--	-----	--	-----	--	-----								
" average	2	2.44	1	1.16	2	4.84	2	4.84								
Development BTA	1	1.22	5	5.81	4	7.68	4	7.68								

Development LTA - associated with less than average development of the lower abdominal wall.

Development BTA - associated with better than average muscular development of the lower abdominal wall.

CHART VIII

EXTENT OF ATTACHMENT OF THE TRANSVERSUS MUSCLE ON THE INGUINAL LIGAMENT.

Number of specimen observed:

	R.	L.
White male	68	74
Colored male	48	46
White female	6	6
Colored female	19	17

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
ANT. SUP. SPINE	4	5.88	3	4.05	3	6.24	2	4.34	1	16.60	1	16.60	--	-----	--	-----
LATERAL 1/5	10	14.70	11	14.85	5	10.40	4	8.68	1	16.60	1	16.60	--	-----	1	5.88
LATERAL 1/4	15	22.05	16	21.60	12	24.96	11	23.87	--	-----	--	-----	6	31.56	5	29.40
Total of Lat. 1/5 and 1/4.	25	36.75	27	36.45	17	35.36	15	32.55	1	16.60	1	16.60	6	31.56	6	35.28
LATERAL 1/3	25	36.75	28	37.80	14	29.12	15	32.55	--	-----	1	16.60	5	26.30	3	17.64
LATERAL 1/2	14	20.58	16	21.60	14	29.12	13	28.21	4	66.60	3	50.00	6	31.56	7	41.16
LATERAL 2/3	--	-----	--	-----	--	-----	1	2.17	--	-----	--	-----	2	10.52	1	5.88
Total of Lat. 1/2 and 2/3	14	20.58	16	21.60	14	29.12	14	30.38	4	66.60	3	50.00	8	42.08	8	47.04

CHART IX

MUSCULAR DEVELOPMENT OF THE INTERNAL OBLIQUE IN HESSELBACH'S TRIANGLE.

Number of specimen observed:

	R.	L.
White male	80	84
Colored male	52	51
White female	6	7
Colored female	19	19

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
ALL APONEUROSIS	3	3.75	2	2.40	--	-----	--	-----	2	33.30	2	28.60	--	-----	--	-----
MUSC. IN LOWER 1/2 HESS. TR.	5	7.50	7	8.40	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----
MUSC. IN UPPER 1/4 HESS. TR.	3	3.75	6	7.20	1	1.90	1	2.00	--	-----	--	-----	--	-----	--	-----
MUSC. IN UPPER 1/3 HESS. TR.	7	10.00	8	9.60	5	9.50	6	12.00	--	-----	--	-----	2	10.52	1	5.26
MUSC. IN UPPER 1/2 HESS. TR.	17	21.25	16	19.20	13	24.70	10	20.00	--	-----	1	14.30	--	-----	1	5.26
MUSC. EXCEPT IN LOWER MED. 1/4.	4	5.00	3	3.60	--	-----	--	-----	--	-----	--	-----	--	-----	--	-----
ALL MUSCLE	39	48.75	42	50.00	33	62.70	34	68.00	4	66.60	4	57.20	17	89.42	17	89.42

CHART X

MUSCULAR DEVELOPMENT OF THE TRANSVERSUS IN HESSELBACH'S TRIANGLE.

Number of specimen observed:

	R.		L.
White male	72	-	79
Colored male	49	-	48
White female	5	-	7
Colored female	18	-	17

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
ALL APONEUROSIS	43	58.05	45	57.15	31	63.24	30	62.40	2	40.00	2	33.20	12	66.60	11	64.68
FEW SCATTERED MUSC. FIBERS	9	12.15	11	13.97	4	8.16	4	8.32	--	-----	--	-----	3	16.55	3	17.64
MUSC. IN UPPER 1/4 HESS. TR.	4	5.40	6	7.62	4	8.16	4	8.32	1	20.00	1	16.60	--	-----	--	-----
MUSC. IN UPPER 1/3 HESS. TR.	9	12.15	9	11.43	2	4.08	2	4.16	1	20.00	1	16.60	--	-----	--	-----
MUSC. IN UPPER 1/2 HESS. TR.	5	6.75	5	6.35	7	14.28	7	14.56	1	20.00	1	16.60	2	11.10	2	11.76
MUSC. IN LAT. AND UPPER PART	2	2.70	3	3.81	--	-----	--	-----	--	-----	1	16.60	1	5.55	1	5.88
ALL MUSCLE	--	-----	--	-----	1	2.04	1	2.08	--	-----	--	-----	--	-----	--	-----

CHART XI

THE CONJOINED TENDON

Number of specimen observed:

	R.		L.
White male	75	-	80
Colored male	47	-	49
White female	6	-	7
Colored female	18	-	18

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
NOT PRESENT	37	49.33	46	57.50	33	70.29	32	65.28	2	33.30	3	42.90	11	61.15	11	65.15
PRESENT	38	50.66	34	42.50	14	29.71	17	34.68	4	66.60	4	57.20	7	38.85	7	38.85

CHART XII

LIGAMENTS OF HESSELBACH AND HENLE

Number of specimen observed:

	R.		L.
White male	25	-	20
Colored male	8	-	4
White female	3	-	4
Colored female	6	-	7

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
HESSELBACH'S L.	5	20.00	6	30.00	2	25.00	2	50.00	3	100.	4	100.	1	16.60	2	28.60
Development LTA	--	-----	2	10.00	--	-----	1	25.00	2	66.60	2	50.00	--	-----	1	14.30
" average	5	20.00	3	15.00	2	25.00	1	25.00	1	33.30	1	25.00	1	16.60	1	14.30
Development BTA	--	-----	1	5.00	--	-----	--	-----	--	-----	1	25.00	--	-----	--	-----
C. with F and D	--	-----	3	15.00	1	12.50	1	25.00	1	33.30	1	25.00	--	-----	1	14.30
HENLE'S LIG.	6	24.00	1	5.00	--	-----	--	-----	--	-----	--	-----	1	16.60	1	14.30
Development LTA	1	4.00	--	-----									--	-----	--	-----
" average	3	12.00	--	-----									1	16.60	1	14.30
Development BTA	1	4.00	1	5.00									--	-----	--	-----
C. with F and D	3	12.00	--	-----									--	-----	--	-----
HESS. & HENLE'S	6	24.00	3	15.00	2	25.00	--	-----	--	-----	--	-----	--	-----	1	14.30
Development LTA	--	-----	--	-----	--	-----									--	-----
" average	4	16.00	1	5.00	--	-----									--	-----
Development BTA	2	8.00	2	10.00	2	25.00									1	14.30
C. with F and D	2	8.00	--	-----	--	-----									--	-----

Development LTA - Associated with less than average muscular development of the lower abdominal wall.

Development BTA - Associated with better than average development of the lower abdominal wall.

CHART XIII

PUBOTRANSVERSALIS AND INTERFOVEOLARIS MUSCLES.

Number of specimen observed:

	R.		L.
White male	24	-	20
Colored male	8	-	4
White female	3	-	4
Colored female	6	-	7

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
INTERFOVEOLARIS	2	8.32	1	5.00												
Development LTA	--	-----	1	5.00												
" average	--	-----	--	-----												
Development BTA	2	8.32	--	-----												
PUBOTRANSVERSUS	2	8.32			1	12.50									1	14.30
Development LTA	1	4.16			--	-----									1	14.30
" average	1	4.16			--	-----									--	-----
Development BTA	--	-----			1	12.50									--	-----

Development LTA - associated with less than average muscular development of the lower anterior abdominal wall.

Development BTA - associated with better than average muscular development of the lower anterior abdominal wall.

CHART XIV

LIGAMENTOUS FIBERS EXTENDING FROM THE PELVIS ONTO THE POSTERIOR OF THE TRANSVERSUS APONEUROSIS.

Number of specimen observed:

	R.		L.
White male	26	-	25
Colored male	19	-	17
White female	3	-	4
Colored female	8	-	8

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
FIBERS AVERAGE	7	26.88	7	28.00	7	36.82	6	35.28	3	100.00	2	50.00	7	87.50	4	50.00
Development LTA	1	3.84	--	-----	--	-----	--	-----	1	33.30	--	-----	1	12.50	--	-----
" average	4	15.36	3	12.00	4	21.04	3	17.64	2	66.60	2	50.00	6	75.00	4	50.00
Development BTA	2	7.68	4	16.00	3	15.78	3	17.64	--	-----	--	-----	--	-----	--	-----
FIBERS WELL DEV	6	23.04	5	20.00	2	10.52	2	11.76			1	25.00			2	25.00
Development LTA	1	3.84	1	2.00	--	-----	1	5.88			--	-----			--	-----
" average	5	19.20	2	8.00	--	-----	--	-----			1	25.00			2	25.00
Development BTA	--	-----	2	8.00	2	10.52	1	5.88			--	-----			--	-----
TOTAL PRESENT	13	49.92	12	48.00	9	47.34	8	47.04	3	100.	3	75.00	7	87.50	6	50.00

Development LTA - associated with less than average muscular development of the lower anterior abdominal wall.

Development BTA - associated with better than average muscular development.

CHART XV.

OBLIQUE PERITONEAL SAC (FOVEAE OR DIVERTICULA)

Number of specimen observed:

	R.	L.
White male	79	84
Colored male	50	49
White female	7	7
Colored female	18	18

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
SAC NOT PRESENT	44	55.88	55	66.60	32	64.00	40	81.60	5	71.50	6	85.80	17	94.45	16	88.80
Development LTA	1	1.27	1	1.20	3	6.00	3	6.12	--	-----	--	-----	2	11.10	1	5.55
" average	22	27.94	31	37.20	10	20.00	15	30.60	4	57.20	4	57.20	15	83.25	14	77.70
Development BTA	21	26.67	23	27.60	19	38.00	22	44.88	~~1~~	~~14.30~~	~~2~~	~~28.60~~	--	-----	1	5.55
SLIGHT DIMPLE	13	16.51	17	20.40	6	12.00	6	12.24	1	14.30	1	14.30				
Development LTA	2	2.54	5	6.00	--	-----	1	2.04	--	-----	--	-----				
" average	9	11.43	9	10.80	1	2.00	2	4.08	--	-----	1	14.30				
Development BTA	2	2.54	3	3.60	5	10.00	3	6.12	1	14.30	--	-----				
.5 cm. sac.	11	13.97	3	3.60	6	12.00	2	4.08								
Development LTA	1	1.27	--	-----	1	2.00	--	-----								
" average	7	8.89	1	1.20	5	10.00	2	4.08								
Development BTA	3	3.81	2	2.40	--	-----	--	-----								
1 cm. sac.	2	2.54	3	3.60	3	6.00										
Development LTA	--	-----	1	1.20	--	-----										
" average	2	2.54	1	1.20	2	4.00										
Development BTA	--	-----	1	1.20	1	2.00										
1.5 cm. sac.	3	3.81	4	4.80	2	4.00	1	2.04	1	16.60			1	5.55	1	5.55
Development LTA	2	2.54	2	2.40	1	2.00	1	2.04	1	16.60			--	-----	1	5.55
" average	--	-----	1	1.20	--	-----	--	-----	--	-----			1	5.55	--	-----
Development BTA	1	1.27	1	1.20	1	2.00	--	-----	--	-----			--	-----	--	-----

CHART XV (Continued)

OBLIQUE PERITONEAL SAC (FOVEAE OR DIVERTICULA)

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
2 cm. sac.	1	1.27													1	5.55
Development LTA	--	-----													--	-----
" average	--	-----													1	5.55
Development BTA	1	1.27													--	-----
2.5 cm. sac.	1	1.27			1	2.00										
Development LTA	--	-----			--	-----										
" average	1	1.27			1	2.00										
Development BTA	--	-----			--	-----										
3 cm. sac.	3	3.81	2	2.40												
Development LTA	1	1.27	1	1.20												
" average	1	1.27	--	-----												
Development BTA	1	1.27	1	1.20												
4 cm. sac.	1	1.27														
Development LTA	1	1.27														

CHART XVI

THE URACHUS (Measurement of associated mesentery)

Number of specimen observed:

White male	80
Colored male	50
White female	7
Colored female	18

	W. male		C. male		W. female		C. female	
	#	%	#	%	#	%	#	%
URACHUS M[illegible] NOT PRES.	51	63.75	34	68.00	7	100.	16	88.80
Assoc. devel. LTA.	5	6.25	3	6.00	2	28.60	2	11.10
Assoc. devel. Ave.	27	33.75	16	32.00	2	28.60	12	66.60
Assoc. devel. BTA	18	22.50	15	30.00	3	42.90	2	11.10
Corr. with O.H.A.	35	43.75	26	52.00	4	57.20	8	44.40
Corr. with fovea	27	33.75	14	28.00	3	42.90	2	11.10
.5 cm. MESENTERY	13	16.25	5	10.00			1	5.55
Assoc. devel. LTA.	2	2.50	--	-----			--	-----
Assoc. devel. Ave.	6	7.50	1	2.00			1	5.55
Assoc. devel. BTA.	5	6.25	4	8.00			--	-----
Corr. with O. H.A.	12	15.00	5	10.00			1	5.55
Corr. with fovea.	7	8.75	2	4.00			--	------
1 cm. MESENTERY	4	5.00	6	12.00				
Assoc. devel. LTA.	--	-----	2	4.00				
Assoc. devel. Ave.	4	5.00	1	2.00				
Assoc. devel. BTA.	--	-----	3	6.00				
Corr. with O.H.A.	4	5.00	6	12.00				
Corr. with fovea	3	3.75	2	4.00				
1.5 cm. MESENTERY	5	6.25						
Assoc. devel. LTA	--	-----						
Assoc. devel. Ave.	4	5.00						
Assoc. devel. BTA	1	1.25						
Corr. with O.H.A.	5	6.25						
Corr. with fovea.	4	5.00						
2 cm. MESENTERY	2	2.50	1	2.00			1	5.55
Assoc. devel. LTA.	--	-----	--	-----			--	-----
Assoc. devel. Ave.	1	1.25	1	2.00			1	5.55
Assoc. devel. BTA	1	1.25	--	-----			--	-----
Corr. with O.H.A.	1	1.25	1	2.00			--	-----
Corr. with fovea.	--	-----	--	-----			--	-----
2.5 cm. MESENTERY			3	6.00				
Assoc. devel. LTA.			--	-----				
Assoc. devel. Ave.			1	2.00				
Assoc. devel. BTA.			2	4.00				
Corr. with O.H.A.			3	6.00				

CHART XVI (Continued)

THE URACHUS (Measurement of the associated mesentery)

	W. male		C. male		W. female		C. female	
	#	%	#	%	#	%	#	%
Corr. with fovea.			2	4.00				
3.5 cm. MESENTERY	1	1.25						
Assoc. devel. BTA	1	1.25						
Corr. with O.H.A.	1	1.25						
4 cm. MESENTERY	2	2.50	1	2.00				
Assoc. devel. LTA.	--	-----	--	-----				
Assoc. devel. Ave.	1	1.25	--	-----				
Assoc. devel. BTA.	1	1.25	1	2.00				
Corr. with O.H.A.	1	1.25	1	2.00				
Corr. with Fovea.	--	-----	--	-----				
4.5 cm. MESENTERY	1	1.25						
Assoc. with Ave.D.	1	1.25						
Assoc. with O.H.A.	1	1.25						
Corr. with fovea.	1	1.25						
5 cm. MESENTERY	1	1.25						
Assoc. devel. Ave.	1	1.25						
Corr. with O.H.A.	--	-----						
Corr. with fovea.	1	1.25						

Assoc. devel. LTA - associated with less than average muscular development of the lower ant. abd. wall.

Assoc. devel. BTA - associated with better than average muscular development.

Corr. with O.H.A. - Corrolation with the obliterated hypogastric arteries.

Corr. with fovea - Corrolation with fovea and diverticula.

CHART XVII

THE OBLITERATED HYPOGASTRIC ARTERY (Measurement of associated mesentery)

Number of specimen observed:

	R.	L.
White male	84	85
Colored male	52	50
White female	6	7
Colored female	19	18

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
MES. NOT PRESENT	21	25.20	30	35.10	9	17.28	10	20.00	5	83.00	4	57.20	10	52.60	10	55.50
Development LTA	2	2.40	4	4.68	--	-----	2	4.00	2	33.30	2	28.60	--	-----	--	-----
" average	6	7.20	11	12.87	4	7.68	3	6.00	1	16.60	1	14.30	10	52.60	9	49.95
Development BTA	13	15.60	15	17.15	5	9.60	5	10.00	2	33.30	1	14.30	--	-----	1	5.55
C. with F and D	3	3.60	7	8.19	3	5.76	--	-----	2	33.30	1	14.30	1	5.26	1	5.55
.5 cm. MESENTERY	18	21.60	17	19.90	7	13.44	13	26.00	1	16.60	1	14.30	5	26.30	3	16.65
Development LTA	2	2.40	4	4.68	2	3.84	4	8.00	--	-----	--	-----	2	10.52	1	5.55
" average	12	14.40	8	9.36	2	3.84	4	8.00	1	16.60	1	14.30	3	16.78	1	5.55
Development BTA	4	4.80	5	5.85	3	5.76	5	10.00	--	-----	--	-----	--	-----	1	5.55
C. with F and D	6	7.20	7	8.19	2	3.84	4	8.00	--	-----	1	14.30	--	-----	--	-----
1 cm. MESENTERY	8	9.60	11	12.87	12	23.04	7	14.00	1	16.60			1	5.26	3	16.65
Development LTA	--	-----	--	-----	2	3.84	--	-----	--	-----			1	5.26	1	5.55
" average	4	4.80	4	4.68	5	9.60	3	6.00	--	-----			--	-----	2	11.10
Development BTA	4	4.80	7	8.19	5	9.60	4	8.00	1	16.60			--	-----	--	-----
C. with F and D	3	3.60	5	5/85	5	9.60	2	4.00	--	-----			--	-----	1	5.55
1.5 cm. MESENT.	11	13.20	9	10.53	2	3.84	8	16.00			1	14.30	1	5.26	1	5.55
Development LTA	2	2.40	--	-----	--	-----	--	-----			--	-----	--	-----	--	-----
" average	7	8.40	6	7.02	1	1.92	5	10.00			--	-----	1	5.26	1	5.55
Development BTA	2	2/40	3	3.51	1	1.92	3	6.00			1	14.30	--	-----	--	-----
C. with F and D	7	8.40	4	4.68	--	-----	--	-----			--	-----	--	-----	--	-----
2 cm. MESENTERY	8	9.60	8	9.36	6	11.52	6	12.00			1	14.30	2	10.52	1	5.55
Development LTA	1	1.20	1	1.17	--	-----	--	-----			--	-----	--	-----	--	-----
" average	4	4.80	6	7.02	3	5.76	3	6.00			--	-----	1	5.26	1	5.55
Development BTA	3	3.60	1	1.17	3	5.76	3	6.00			1	14.30	1	5.26	--	-----
C. with F and D	3	3.60	2	2.34	3	5.76	1	2.00			--	-----	--	-----	--	-----

CHART XVII (Continued)

THE OBLITERATED HYPOGASTRIC ARTERY (Measurement of associated mesentery)

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
2.5 cm. MESENT.	5	6.00	1	1.17	6	11.52	2	4.00								
Development LTA	--	-----	--	-----	--	-----	--	-----								
" average	3	3.60	--	-----	3	5.76	2	4.00								
Development BTA	2	2.40	1	1.17	3	5.76	--	-----								
C. with F and D	2	2.40	--	-----	1	1.92	--	-----								
3 cm. MESENTERY	4	4.80	3	3.51	5	9.60	2	4.00								
Development LTA	--	-----	--	-----	1	1.92	--	-----								
" average	3	3.60	2	2.34	1	1.92	1	2.00								
Development BTA	1	1.20	1	1.17	3	5.76	1	2.00								
C. with F and D	3	3.60	1	1.17	1	1.92	1	2.00								
3.5 cm. MESENT.	2	2.40	2	2.34	1	1.92	2	4.00								
Devel. average	2	2.40	1	1.17	1	1.92	--	-----								
Development BTA	--	-----	1	1.17	--	-----	2	4.00								
C. with F and D	1	1.20	1	1.17	--	-----	1	2.00								
4 cm. MESENTERY	5	6.00	2	2.34	2	3.84										
Development LTA	2	2.40	--	-----	--	-----										
" average	2	2.40	1	1.17	1	1.92										
Development BTA	1	1.20	1	1.17	1	1.92										
C. with F and D	3	3.60	1	1.17	2	3.84										
5 cm. MESENTERY	1	1.20	1	1.17	2	3.84										
Development LTA	--	-----	1	1.17	--	-----										
Development BTA	1	1.20	--	-----	2	3.84										
C. with F and D	1	1.20	1	1.17	1	1.92										
6 cm. MESENTERY			1	1.17												
Development LTA			1	1.17												
C. with F and D			1	1.17												
7 cm. MESENTERY	1	1.20														
Development LTA	1	1.20														
C. with F and D	1	1.20														

Development LTA - associated with less than average muscular development.
Development BTA - associated with better than a verage muscular development.
C. with F and D - Correlation with fovea or diverticula.

CHART XVII (Continued)

THE OBLITERATED HYPOGASTRIC ARTERY (Measurement of associated mesentery)

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
2.5 cm. MESENT.	5	6.00	1	1.17	6	11.52	2	4.00								
Development LTA	--	-----	--	-----	--	-----	--	-----								
" average	3	3.60	--	-----	3	5.76	2	4.00								
Development BTA	2	2.40	1	1.17	3	5.76	--	-----								
C. with F and D	2	2.40	--	-----	1	1.92	--	-----								
3 cm. MESENTERY	4	4.80	3	3.51	5	9.60	2	4.00								
Development LTA	--	-----	--	-----	1	1.92	--	-----								
" average	3	3.60	2	2.34	1	1.92	1	2.00								
Development BTA	1	1.20	1	1.17	3	5.76	1	2.00								
C. with F and D	3	3.60	1	1.17	1	1.92	1	2.00								
3.5 cm. MESENT.	2	2.40	2	2.34	1	1.92	2	4.00								
Devel. average	2	2.40	1	1.17	1	1.92	--	-----								
Development BTA	--	-----	1	1.17	--	-----	2	4.00								
C. with F and D	1	1.20	1	1.17	--	-----	1	2.00								
4 cm. MESENTERY	5	6.00	2	2.34	2	3.84										
Development LTA	2	2.40	--	-----	--	-----										
" average	2	2.40	1	1.17	1	1.92										
Development BTA	1	1.20	1	1.17	1	1.92										
C. with F and D	3	3.60	1	1.17	2	3.84										
5 cm. MESENTERY	1	1.20	1	1.17	2	3.84										
Development LTA	--	-----	1	1.17	--	-----										
Development BTA	1	1.20	--	-----	2	3.84										
C. with F and D	1	1.20	1	1.17	1	1.92										
6 cm. MESENTERY			1	1.17												
Development LTA			1	1.17												
C. with F and D			1	1.17												
7 cm. MESENTERY	1	1.20														
Development LTA	1	1.20														
C. with F and D	1	1.20														

Development LTA - associated with less than average muscular development.
Development BTA - associated with better than average muscular development.
C. with F and D - Correlation with fovea or diverticula.

CHART XIX

THE VAS BAND

Number of specimen observed:

	R.	L.
White male	76 -	74
Colored male	44 -	38

	White male				Colored male			
	Right		Left		Right		Left	
	#	%	#	%	#	%	#	%
V. B. NOT PRESENT	17	22.27	25	33.75	9	20.43	16	42.08
Development LTA	--	-----	--	-----	--	-----	1	2.63
" average	8	10.48	14	18.90	4	9.08	7	18.41
Development BTA	9	11.80	11	14.85	5	11.35	8	21.04
C. with F and D	2	2.62	2	2.70	1	2.27	--	-----
V. BAND PRESENT	31	40.61	36	48.60	26	59.02	19	50.00
Development LTA	2	2.62	5	6.85	2	4.54	1	2.63
" average	16	20.96	15	20.35	10	22.70	9	23.67
Development BTA	13	17.03	16	21.70	14	31.78	9	23.67
C. with Fand D	10	13.14	17	23.05	11	24.97	5	13.15
V.B. WELL DEVEL.	28	36.68	13	17.55	9	20.43	3	7.89
Development LTA	7	9.17	2	2.70	3	6.81	--	-----
" average	15	19.61	8	10.80	5	11.35	2	5.26
Development BTA	6	7.68	3	4.05	1	2.27	1	2.63
C. with F and D	22	28.82	7	9.45	5	11.35	2	5.26
TOTAL PRESENT	59	77.29	49	66.15	35	79.45	22	57.89
TOTAL ASSOC.PITS	32	41.96	24	32.50	16	36.32	7	18.41

Development LTA - associated with less than average muscular development of the anterior abdominal wall.

Development BTA - associated with better than average muscular development of the anterior abdominal wall.

C. with F and D - correlation with associated foveae and diverticula.

CHART XX

THE SPERMATIC BAND

Number of specimen observed:

	R.	L.
White male	77	72
Colored male	41	36

	White male				Colored male			
	Right		Left		Right		Left	
	#	%	#	%	#	%	#	%
NOT PRESENT	36	46.80	43	59.77	18	43.92	25	69.50
Development LTA	1	1.30	3	4.17	--	-----	--	-----
" average	21	27.30	19	26.41	7	17.08	13	36.14
Development BTA	14	18.20	21	29.19	11	26.84	12	33.36
C. with F and D	10	13.00	8	11.12	2	4.88	1	2.78
AVERAGE DEVEL.	25	32.50	21	29.19	18	43.92	10	27.80
Development LTA	4	5.20	4	5.56	3	7.32	2	5.56
" average	10	13.00	10	13.90	8	19.52	2	5.56
Development BTA	11	14.30	7	9.73	7	17.08	6	16.68
C. with F and D	12	15.60	13	18.07	9	21.96	5	13.90
WELL DEVELOPED	16	20.80	8	11.12	5	12.20	1	2.78
Development LTA	2	2.60	--	-----	--	-----	--	-----
" average	11	14.30	6	8.34	3	7.32	1	2.78
Development BTA	3	3.90	2	2.78	2	4.88	--	-----
C. with F and D	12	15.60	5	6.95	4	9.76	1	2.78
TOTAL PRESENT	41	53.30	29	40.31	23	56.12	11	30.58
TOTAL OF FOVEA ASSOCIATED	24	31.20	18	25.02	13	31.72	6	16.68

Development LTA - Associated with less than average muscular development of the lower anterior abd. wall.
Development BTA - Associated with better than average muscular development of the lower anterior abd. wall.
C. with F and D - Correlation with foveae and diverticula.

CHART XXI

LIPOMATA (FATTY PEDICLES)

Number of specimen observed:

	R.	L.
White male	95 -	95
Colored male	56 -	56
White female	7 -	7
Colored female	19 -	19

	White male				Colored male				White female				Colored female			
	Right		Left		Right		Left		Right		Left		Right		Left	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
IN ING. CANAL	13	13.65	11	11.55	7	12.60	3	5.40	1	14.30			2	10.52	2	10.52
Development LTA	2	2.10	3	3.15	2	3.60	--	-----	--	-----			1	5.26	--	-----
" average	7	7.35	6	6.30	2	3.60	1	1.80	--	-----			1	5.26	2	10.52
Development BTA	4	4.20	2	2.10	3	3.54	2	3.60	1	14.30			--	-----	--	-----
C. with F and D	4	4.20	5	5.25	3	5.40	1	1.80	--	-----			--	-----	--	-----
THROUGH LOWER ABDOMINAL WALL	4	4.20	9	9.45	2	3.60	2	3.60			1	14.30	3	15.78	1	5.26
Development LTA	1	1.05	1	1.05	--	-----	1	1.80			--	-----	--	-----	1	5.26
" average	3	4.15	5	5.25	1	1.80	1	1.80			1	14.30	3	15.78	--	-----
Development BTA	--	-----	3	3.15	1	1.80	--	-----			--	-----	--	-----	--	-----
C. with F and D	2	2.10	2	2.10	1	1.80	--	-----			--	-----	--	-----	--	-----
INFILTRATING THE MUSCLE WALL									1	14.30	1	14.30	1	5.26		
C. with F and D									1	14.30						

Development LTA - Associated with less than average muscular development of abd. wall.
Development BTA - Associated with better than average muscular development of the lower anterior abdominal wall.
C. with F and D - Correlation with foveae and diverticula.

CHART XXII

Number of specimen observed:

White male	95
Colored male	56
White female	7
Colored female	19

	White male				Colored male			
	Right		Left		Right		Left	
	#	%	#	%	#	%	#	%
INDIRECT ING. HERNIA	7	7.35	6	6.30	2	3.73		
Sliding indirect	1	1.05					2	3,73
DIRECT ING. HERNIA	5	5.25	4	4.20				
FEMORAL HERNIA	4	4.20	2	2.10	2	3.73	1	1.86
OBTURATOR HERNIA	1	1.05						
TOTAL INDIRECT INGUINAL HERNIA	8	8.40	6	6.30	2	3.73	2	3.73
TOTAL INGUINAL HERNIA	13	13.65	10	10.50	2	3.73	2	3.73

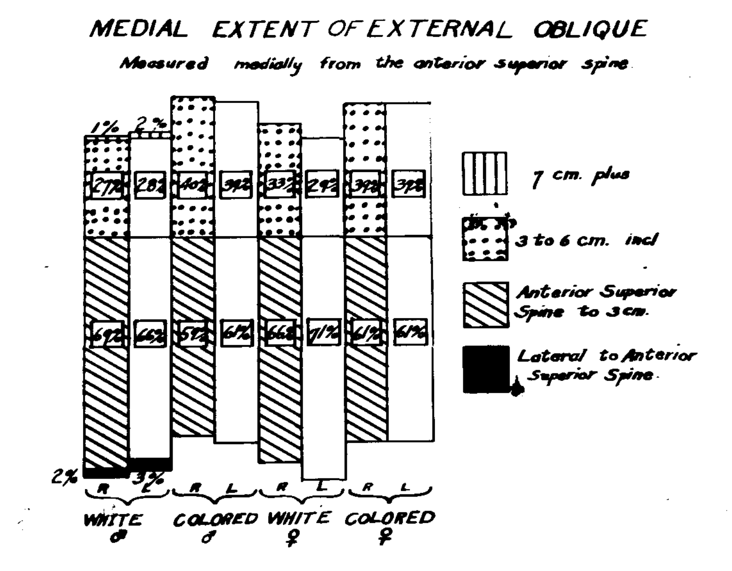

Figure 1. Diagram of Chart I.
Base line represents the average condition as is generally accepted in anatomy text-books.

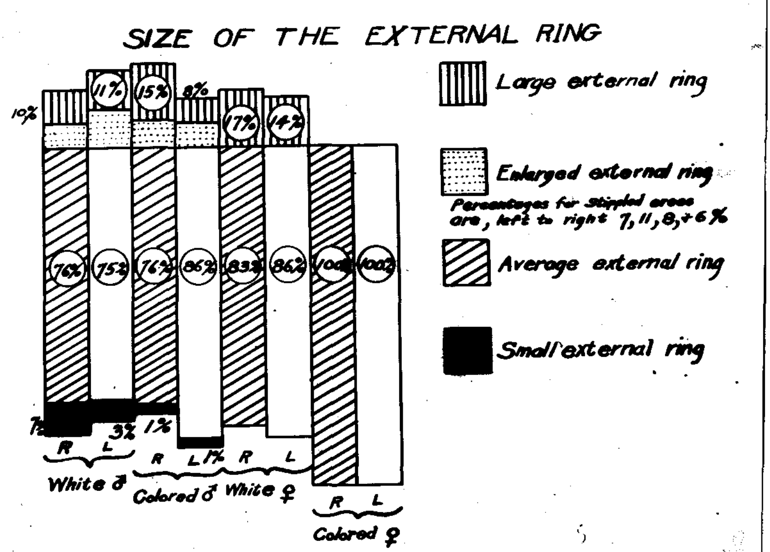

Figure 2. Diagram of Chart III.

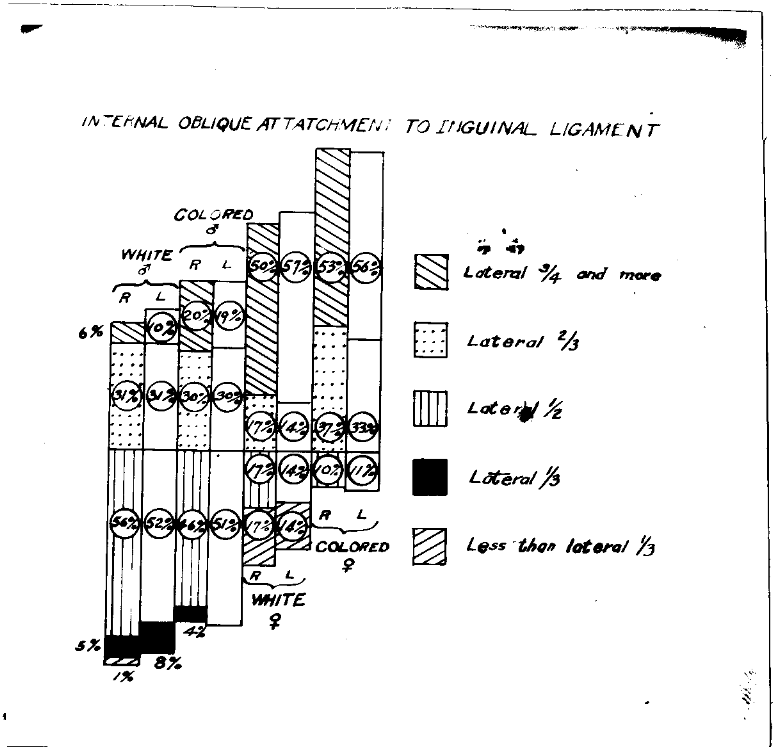

Figure 3. Diagram of Chart V.

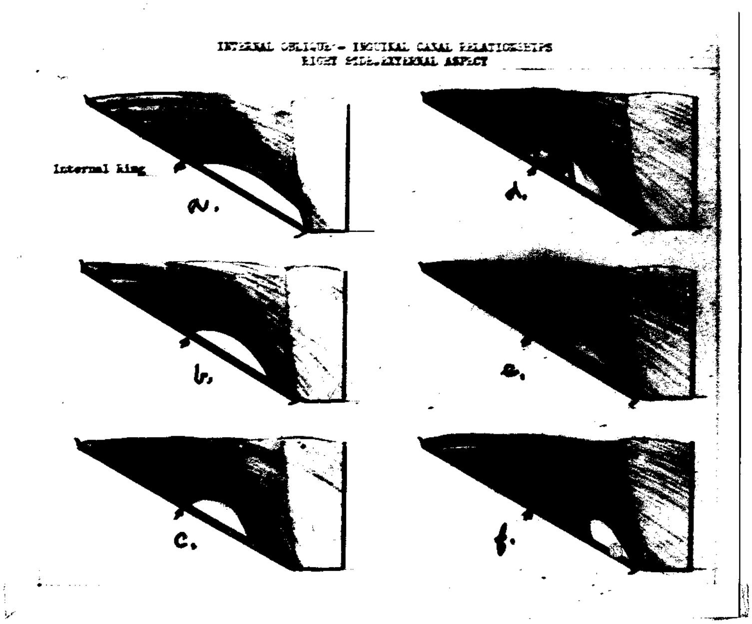

Figure 4. Variation in the anatomy of the lower fibers of the internal oblique muscle.

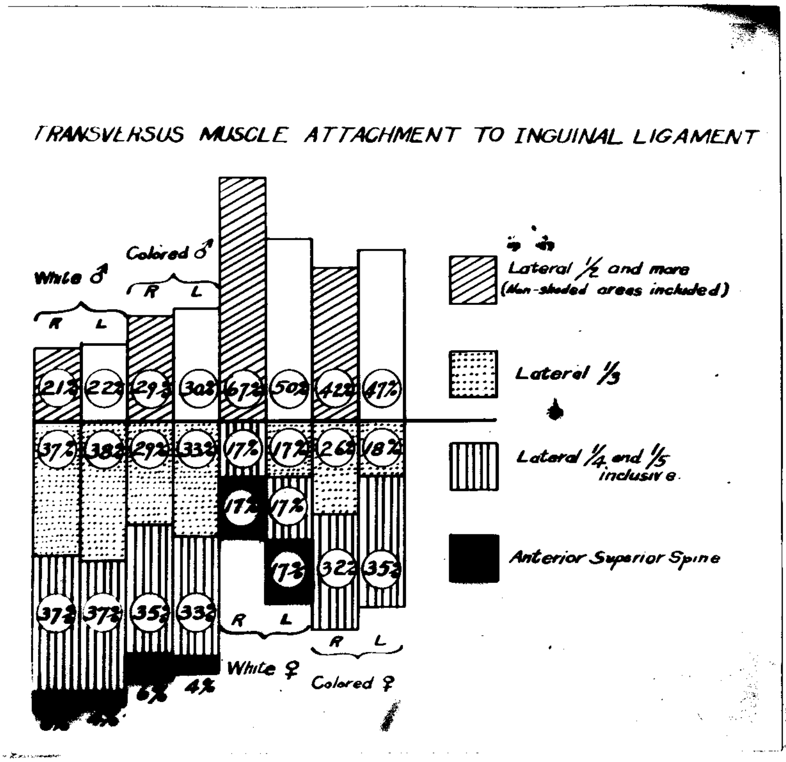

Figure 5. Diagram of Chart VIII.

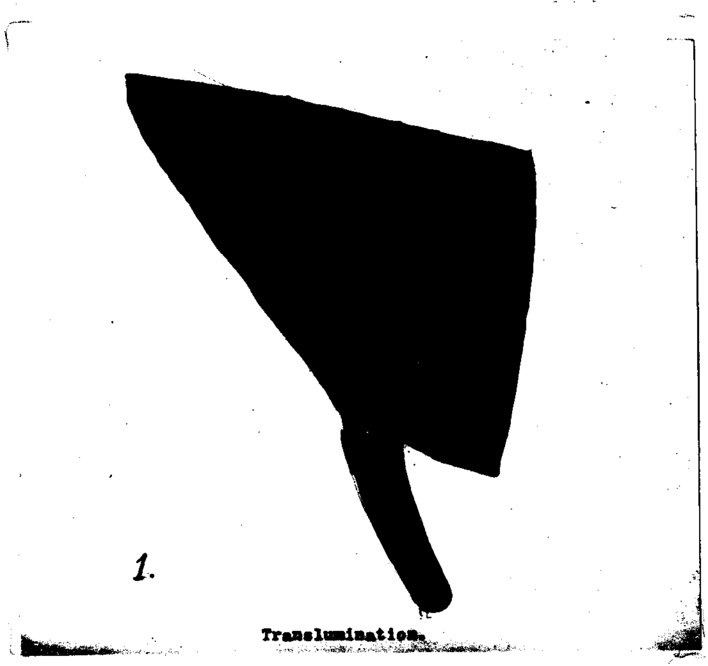

Figure 6.

Figures 6 to 14 show a series of variations which were found to occur in the development of muscle in Hesselbach's triangle. These were made by transillumination.

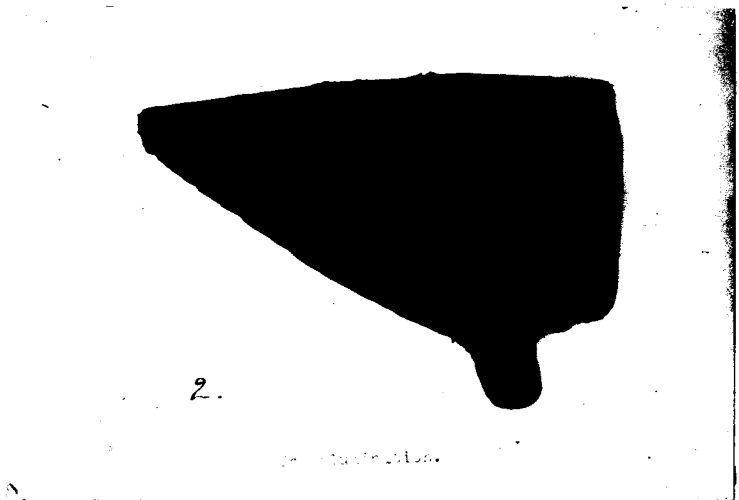

Figure 7.

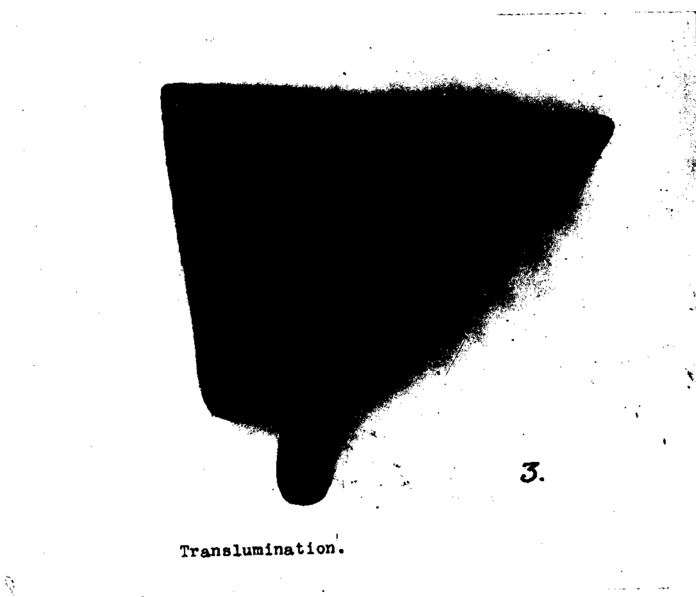

Figure 8.

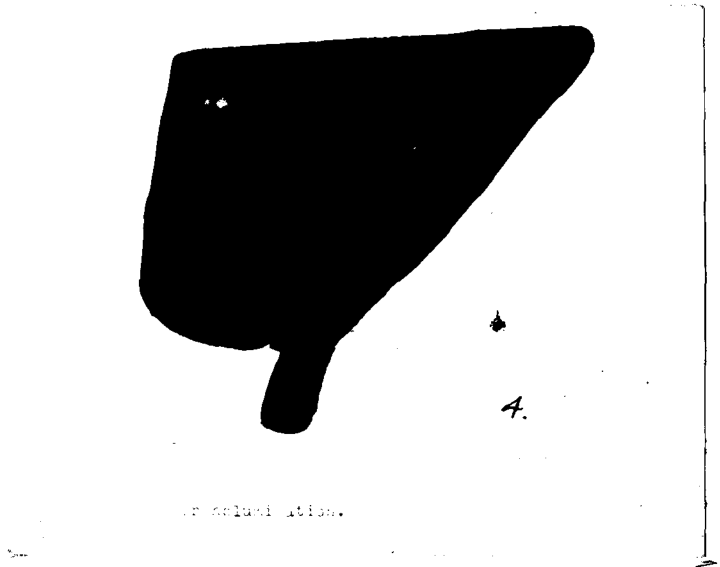

Figure 9.

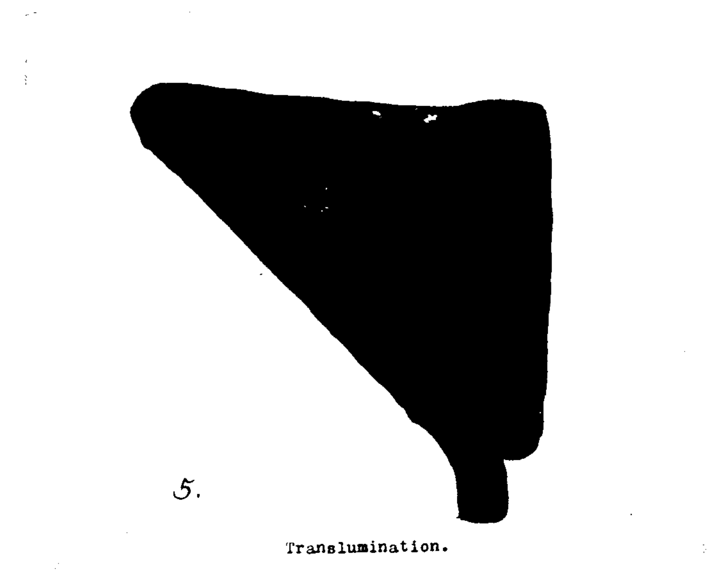

Figure 10.

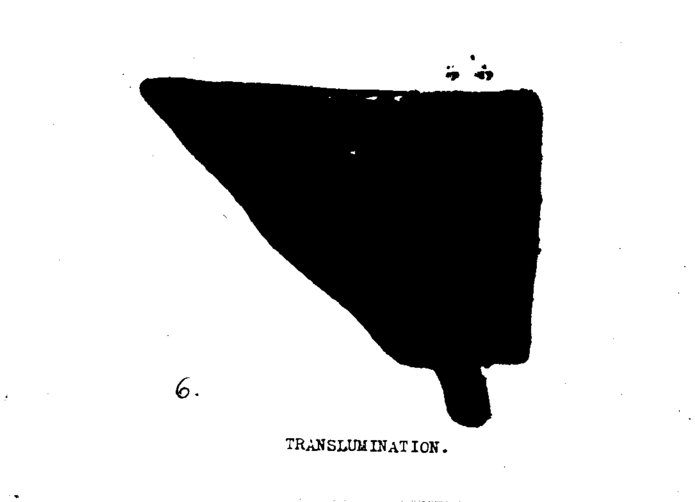

Figure 11.

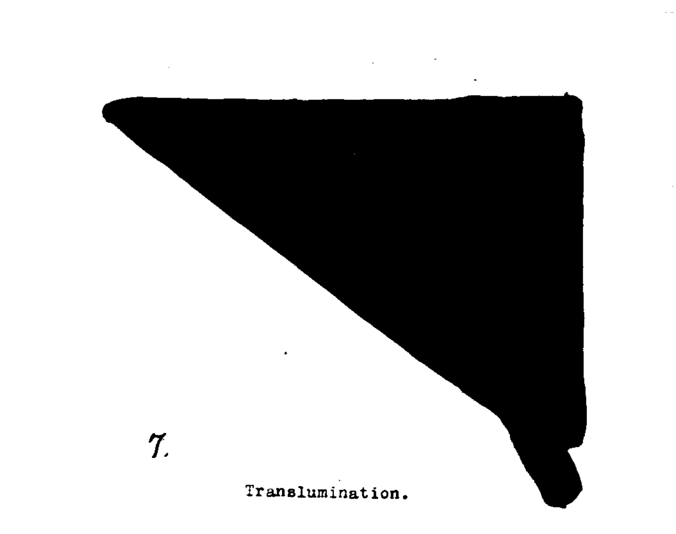

Figure 12.

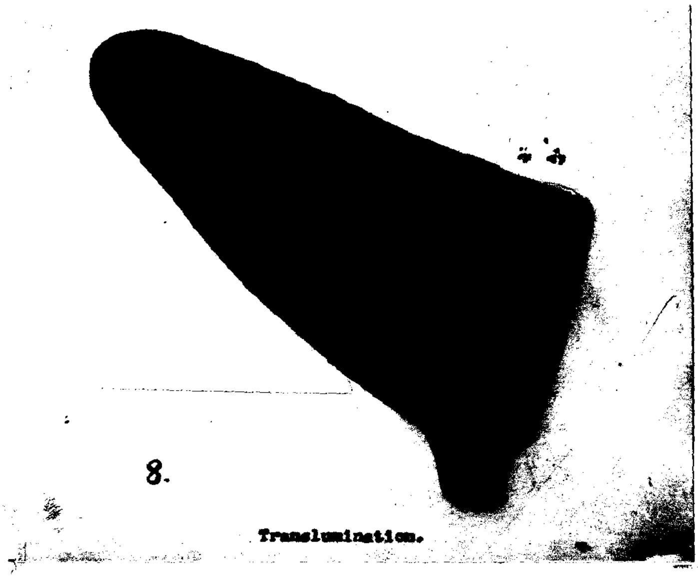

Figure 13.

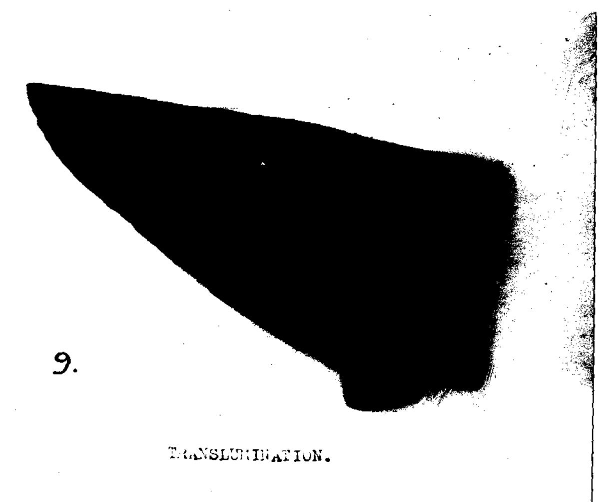

Figure 14.

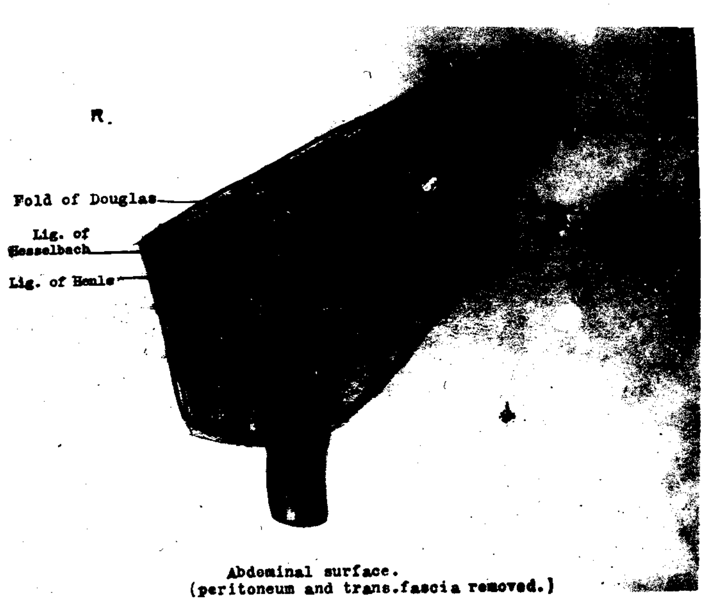

Figure 15. Showing the ligaments of Hesselbach and Henle, and the ligamentous fibers posterior to the conjoined tendon.

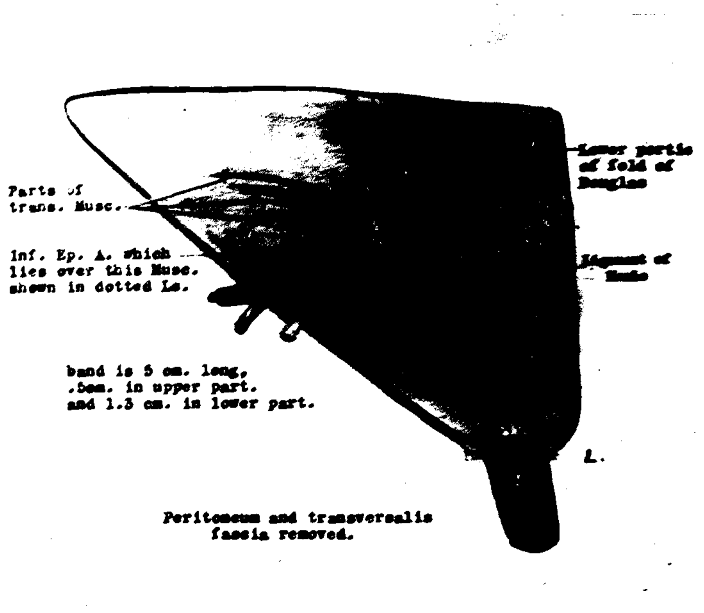

Figure 16. Henle's ligament.

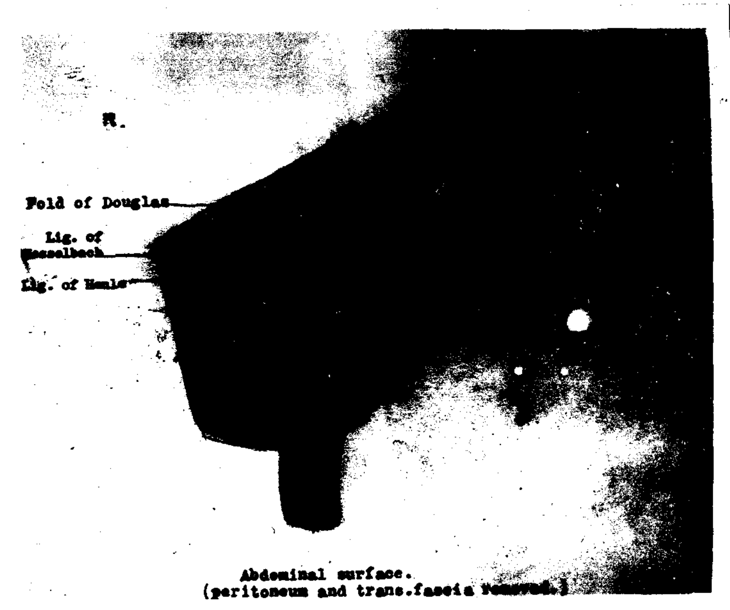

Figure 15. Showing the ligaments of Hesselbach and Henle, and the ligamentous fibers posterior to the conjoined tendon.

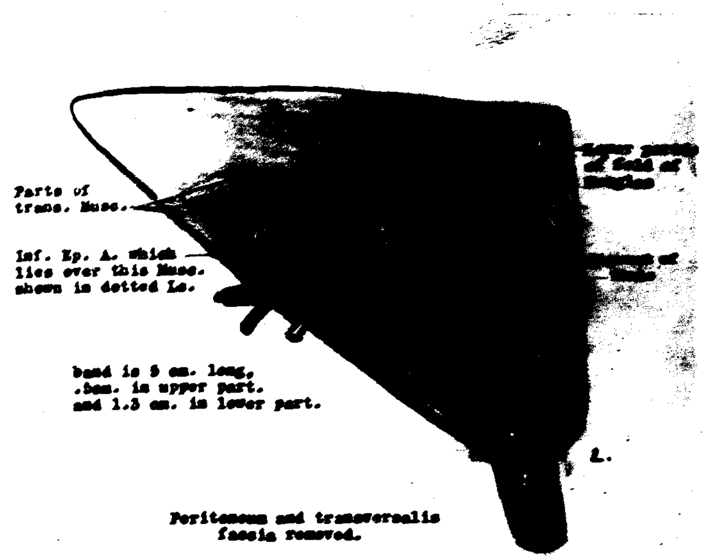

Figure 16. Henle's ligament.

Figure 17.

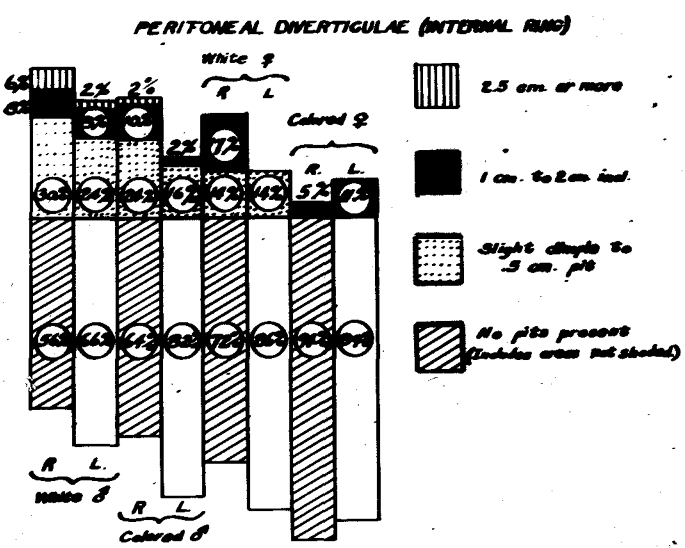

Figure 18. Diagram of Chart XV.

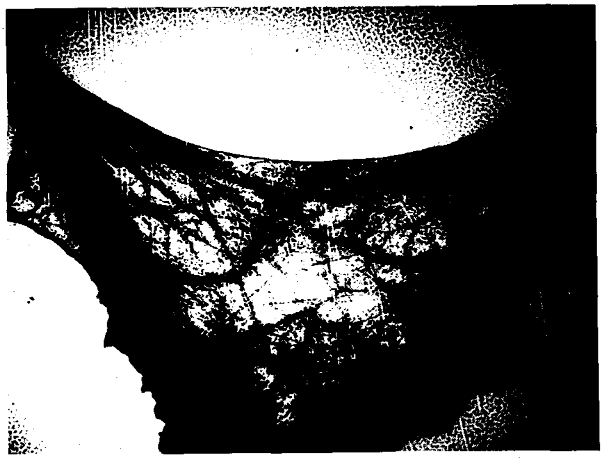

Figure 19. Intervasa deferential fascia (original finding) The ligamenta ducti deferentia are seen at the upper lateral border of this structure, medial to the vasa deferentia.