of vital resistance instead of aiding the same. And there is no part of the whole field of medical knowledge that more needs thorough research and revision than that which relates to the action of drugs on the living body.

OBLIQUE INGUINAL HERNIA.

### TYPIC OPERATION FOR ITS RADICAL CURE.

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A typic operation for the radical cure of oblique inguinal hernia is one that places all the structures involved in the same relationship to one another as they are present in a normal person. The operations that have been hitherto produced to cure inguinal hernia fall far short of being typic. A careful analysis of failures; a painstaking research for hidden truths, and a discernment of contestable premises are ever before the surgeon who hopes for more success, new discoveries and lasting operative procedures.

In the multiplicity of the new environments that have arisen and changed from time to time, herniology shows

operations then in vogue, for I was not wholly satisfied with any of the methods. It was my desire to preserve the steps in each different operation that fulfilled one indication or more and to discard those steps that did not. The result was, I recommended a "combination operation," which was well received. Since then, however, I have been my own severest critic. I freely found fault with my own work, as well as that of others. Several relapses of the rupture occurred after my method, and recurrent cases operated on by other surgeons, after other methods, came to my clinics and practice. The first important observation I made was that the return hernial protrusion began at the upper and outer portion of the seat of operation above the cord, and usually near Poupart's ligament. This I recollected had been referred to by other surgeons. While operating on these relapses I found a slit in the aponeurosis of the external abdominal muscle through which the sac and usually some fat protruded. Determining on a search for the causes of these failures, it was thought advisable to make a semilunar incision and raise a flap of skin, fascia and aponeurosis of the external oblique muscle, in order to bring into view the whole sac, and deeper structures

Fig. 1
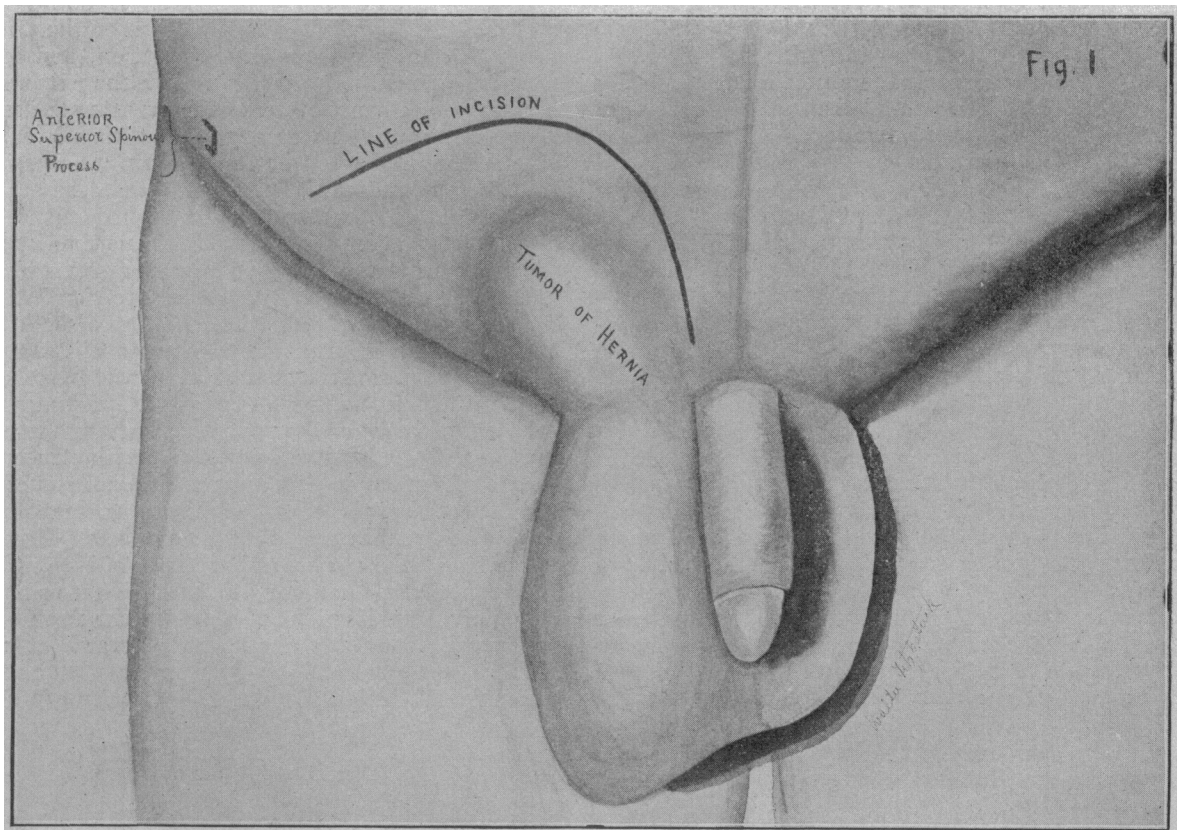
that there has been considerable developmental experimentation, and attendant thereto new suggestions have presented themselves; new ideas were born, and new truths discovered. In response to a firm conviction of having found an improvement on the older operation, independent thinking surgeons invented the different procedures we now possess. It is plainly observable that "do this and he doeth it," without giving the reasons why, has, in this connection, been too frequently blindly followed by the profession. It is now nearly five years since I undertook to criticize the principal

with their relations. To my astonishment, I found an angle between the lower border of the internal abdominal oblique muscle and inner aspect of Poupart's ligament wholly unprotected by the internal oblique and transversalis muscles. In the sixth case the unprotected angle extended upward and outward to the anterior superior spine of the ilium, there being no connection whatever between Poupart's ligament and these muscles, the space being occupied by some fat and a hernial sac. This is how I made the important discovery that a *deficient origin of the internal abdominal oblique* and of the transversalis muscles *at Poupart's ligament* is a direct cause of the rupture returning in this angle

after operation for the radical cure. I then (January, 1898) began the semilunar incision in every hernial operation, and to look for the deficient origin of the internal oblique and transversalis muscles. (Dr. Nicholas Senn tells me that he "has been doing this same incision for about three years.") They were always deficient in origin. In order to clear up this question anatomically, I asked Dr. R. C. Turck, professor of anatomy in the Chicago Post-Graduate Medical School, to make fifty dissections for me of the inguinal region. This he faithfully carried out, assisted by Dr. Walter Fitzpatrick, who is an excellent artist. Dr. Turck presented his work to the Chicago Academy of Medicine as his inaugural thesis.

OPERATION.

First Step: Semilunar Skin Incision.—Begin the incision over Poupart's ligament, 1½ inches below the anterior superior spinous process of the ilium; extend

covered by the deep layer of superficial fascia, and the superficial vessels. (Fig. 2.)

Second Step.—Cut through the external abdominal ring and intercolumnar fascia; separate the longitudinal fibers of the aponeurosis of the external oblique muscle directly over the inguinal canal, far beyond the internal ring, over the surface of the internal abdominal oblique muscle, and up under the skin, to a point nearly opposite the anterior superior spine of the ilium. Delicate transverse fibers are encountered and severed. Retract the aponeurosis of the external oblique muscle and thereby bring into sight the deep structures, viz., the contents of the inguinal canal, the whole sac, with its adhesions, the spermatic cord, ilio-inguinal nerve, internal abdominal ring usually enlarged, frequently an accumulation of subserous fat, the cremasteric muscle, conjoined tendon, internal oblique muscle, and its deficient origin at Poupart's ligament, transversalis

Fig. 11.
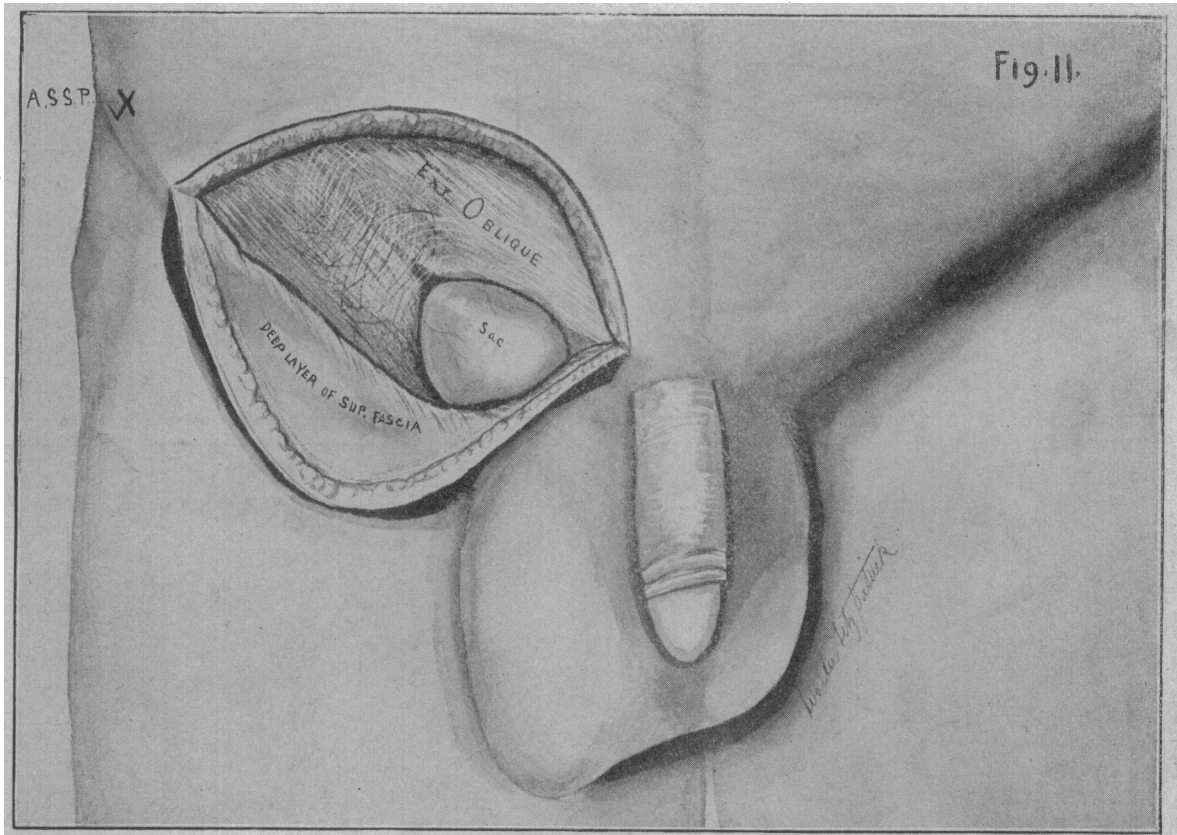
inward and downward in a semilunar manner, circumventing the internal abdominal ring, and terminate it over the conjoined tendon near the public bone. (Fig. 1.) Cut carefully backward with a very sharp knife and expose the vessels and pick them up with forceps before severing them, and thus prevent blood-staining of the tissues. Having passed through the skin, two layers of the superficial fascia, fat between them and superficial epigastric vessels down to the aponeurosis of the external oblique muscle, it will be noticed that it is not necessary to cut the superficial circumflex iliac, nor the superficial pudic vessels. Take a pledget of gauze and with it turn the flap of the skin, subjacent fat and fascia downward and outward over the thigh. This procedure brings into view the aponeurosis of the external oblique muscle, the external abdominal ring, with its pillars and intercolumnar fascia, the hernial sac, if it has descended through the external ring, external surface of Poupart's ligament, the under surface of the flap

fascia, and the internal surface of Poupart's ligament. (Fig. 3.) I consider the congenital deficient origin of the internal oblique and tranversalis muscles one of the most frequent and important causes of oblique inguinal hernia. Inspect these structures carefully, and now determine whether the operation is to be typic or atypic. When the structures are well defined and not too much weakened by pressure atrophy, a typic operation can be proceeded with.

Third Step.—This step deals with the sac and its contents; the cord, cremasteric muscle, and subserous lipomata.
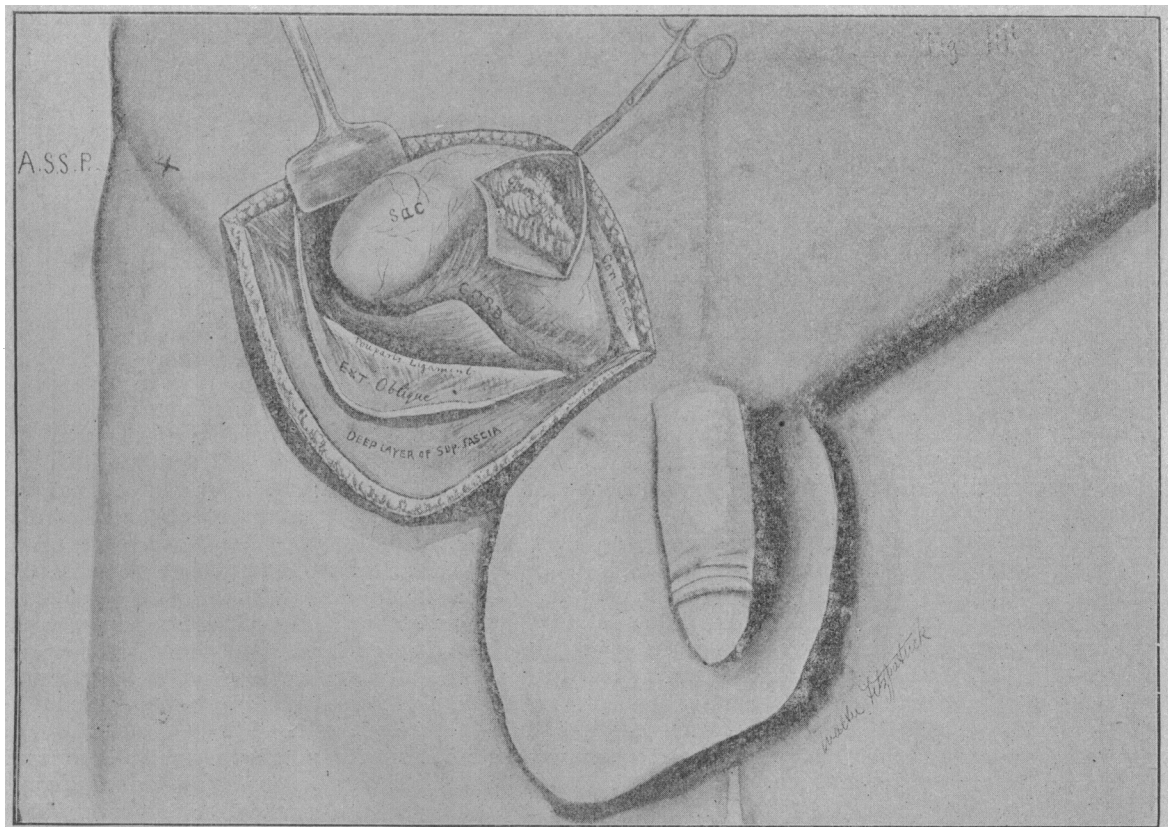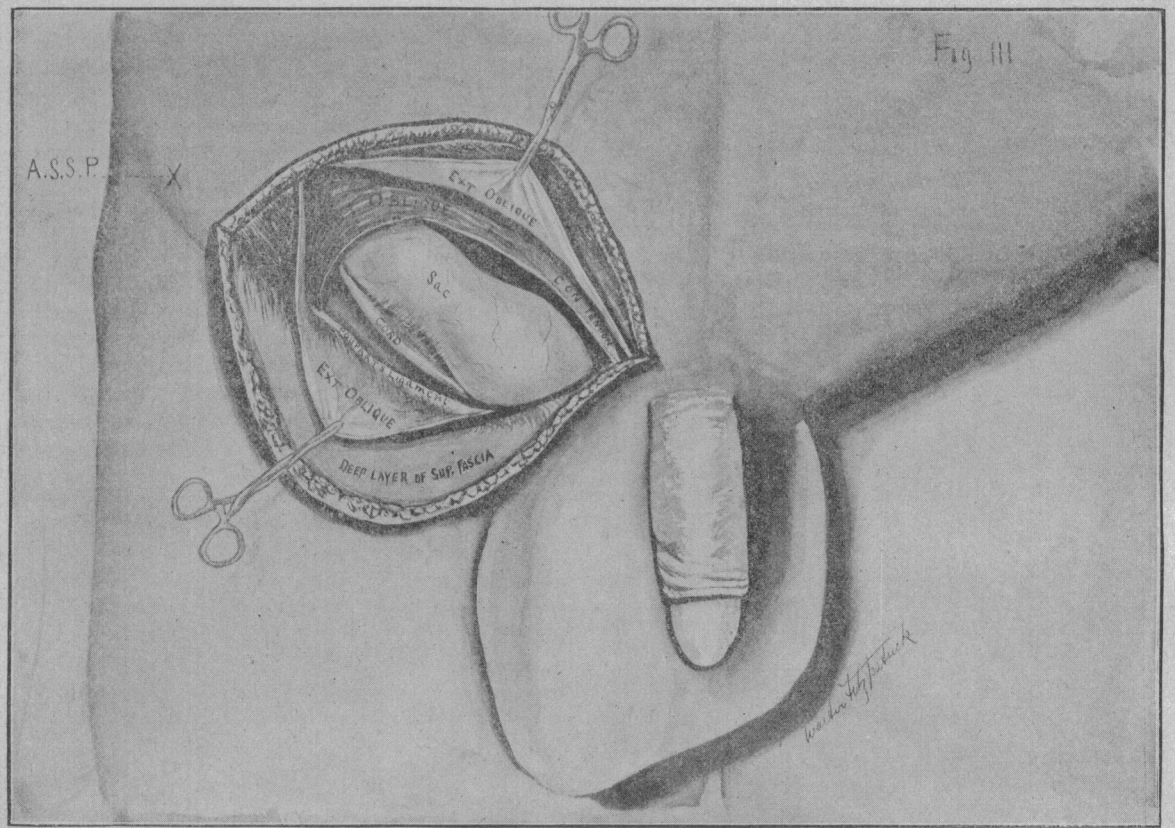
The sac is carefully dissected from the cord and internal ring; it is always opened (Fig. 4), contents inspected and dealt with, and ligated high up over the inserted finger (Fig. 6), cut off, and the stump dropped. In atypic operations the sac is usually preserved, as recommended by Macewen. If the sac be congenital, divide it in two, the distant half to form a tunic for the

testicle and the proximal to be treated as above mentioned.

When omentum is found within the sac it is liber-

ally withdrawn, tied en masse, cut off, the stump covered with its own peritoneum and returned within the abdomen. (Fig. 5.) This decreases the intra-abdominal pressure and lessens the tendency to a return of the hernia. At this stage of the operation when the sac is opened, it is frequently found advantageous to place the patient in the Trendelenburg position to prevent protrusion of and injury to the intestines.

The cord is not disturbed. I have never been satisfied

with the raising and transplantation of the cord. In more cases than have been recorded the testicle has come to grief by this unnecessary procedure. Tearing the

nor brilliant surgical results to justify its continuance. Leave the cord alone, for it is the sacred highway along which travel vital elements indispensable to the perpet-

Fig. V

Fig. VI
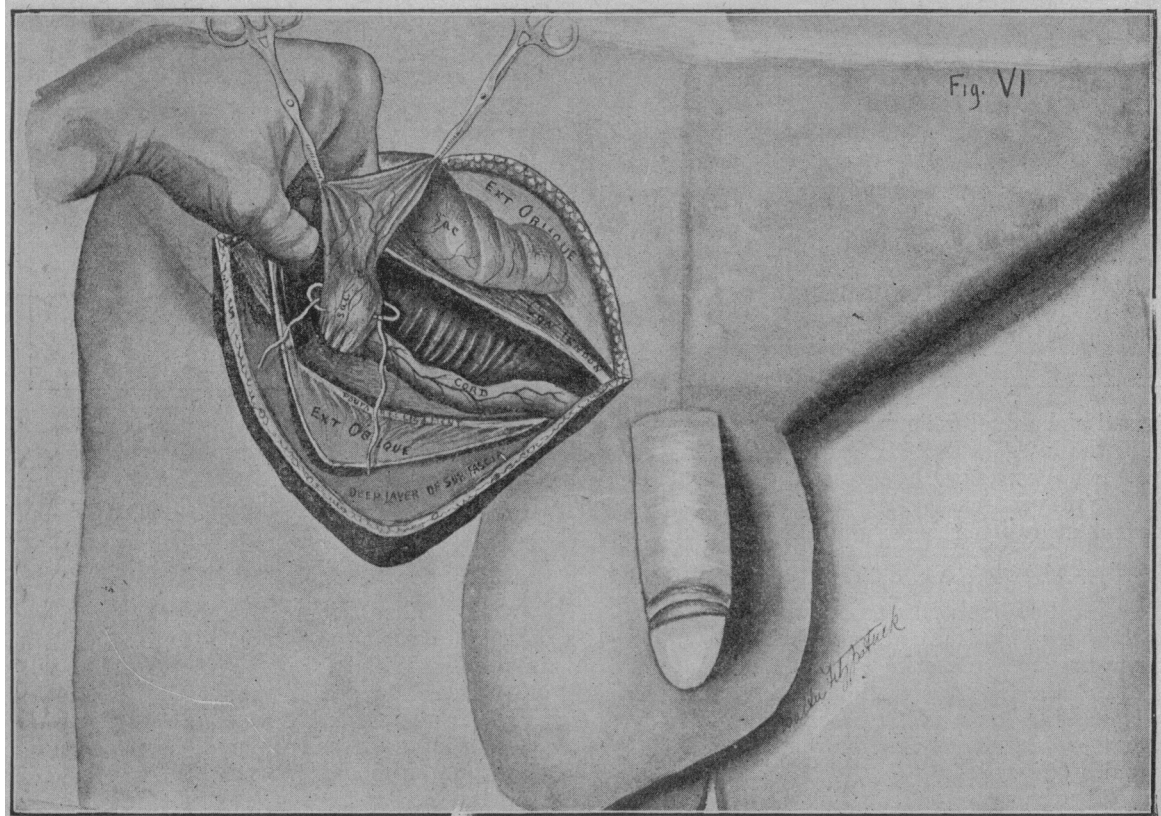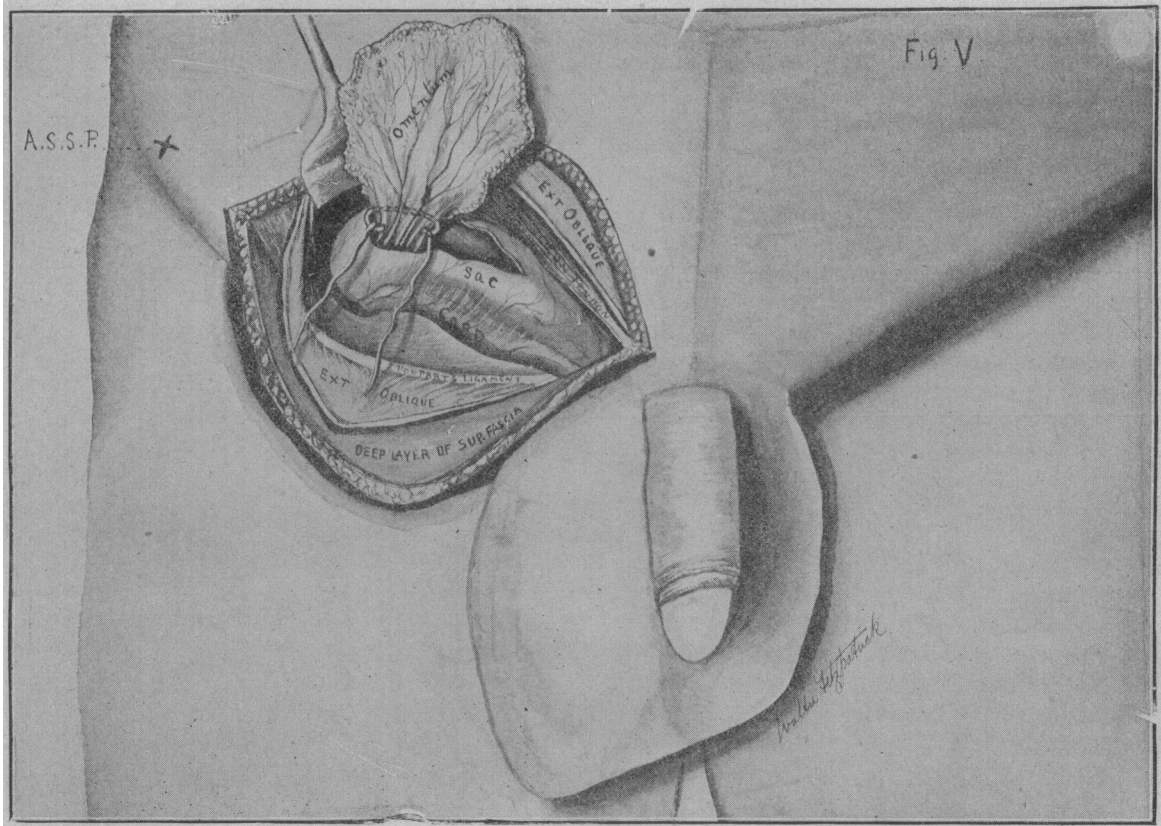
cord out of its bed is without an anatomic reason to recommend it, a physiologic act to suggest it, an etiologic factor in hernia, congenital or acquired, to indicate it,

uity of our race. The veins in the cord are not disturbed, unless a varicocele complicates the hernia. If the cremasteric fibers are unduly thickening the cord,

they would better be removed along with adventitious tissue that is not unfrequently present.

An abnormal quantity of subserous adipose tissue is often deposited around the sac and cord and along Poupart's ligament, an etiologic factor in hernia, and if not removed tends to cause a return of the hernia. A systematic search should be made for fatty aggregations and they should be removed."

Fourth Step.—Restore the structures to their normal positions. The transversalis fascia forms the internal ring. In hernia its fibers have become more or less stretched above and around the cord. The ring in consequence is abnormally large and the fascia bulges outward. To rectify this condition take up the slack in the fascia and make an accurately-fitting ring for the cord by means of a suture, interrupted or continuous. (Fig. 7.) Do not injure the deep epigastric vessels, nor pass the needle too deeply in the direction of the large iliac vessels.

and coapt all its structures, like to like, especially the deep layer of the superficial fascia. (Fig. 10.)

COMMENDABLE FEATURES.

The different structures in the abdominal wall are placed in their normal relationship. a. The tying of the sac restores the normal rotundity of the peritoneum. b. The suturing of the transversalis fascia forming a new internal ring at the same time obliterates the hernial infundibuliform process. c. Sewing the internal oblique and transversalis muscles to Poupart's ligament secures a normal origin for them and they then find perfect protection to the internal ring cord and canal. d. The suturing of the separated fibers of the aponeurosis of the external oblique protects the underlying muscles and cord, while the skin flap covers all.

2. The four lines of suture are not opposite each other, thus securing an overlapping of the weak parts—lines of repair—by normal tissues.

3. The semilunar incision has great advantages: a.

Fig. VII

A.S.S.P.....X
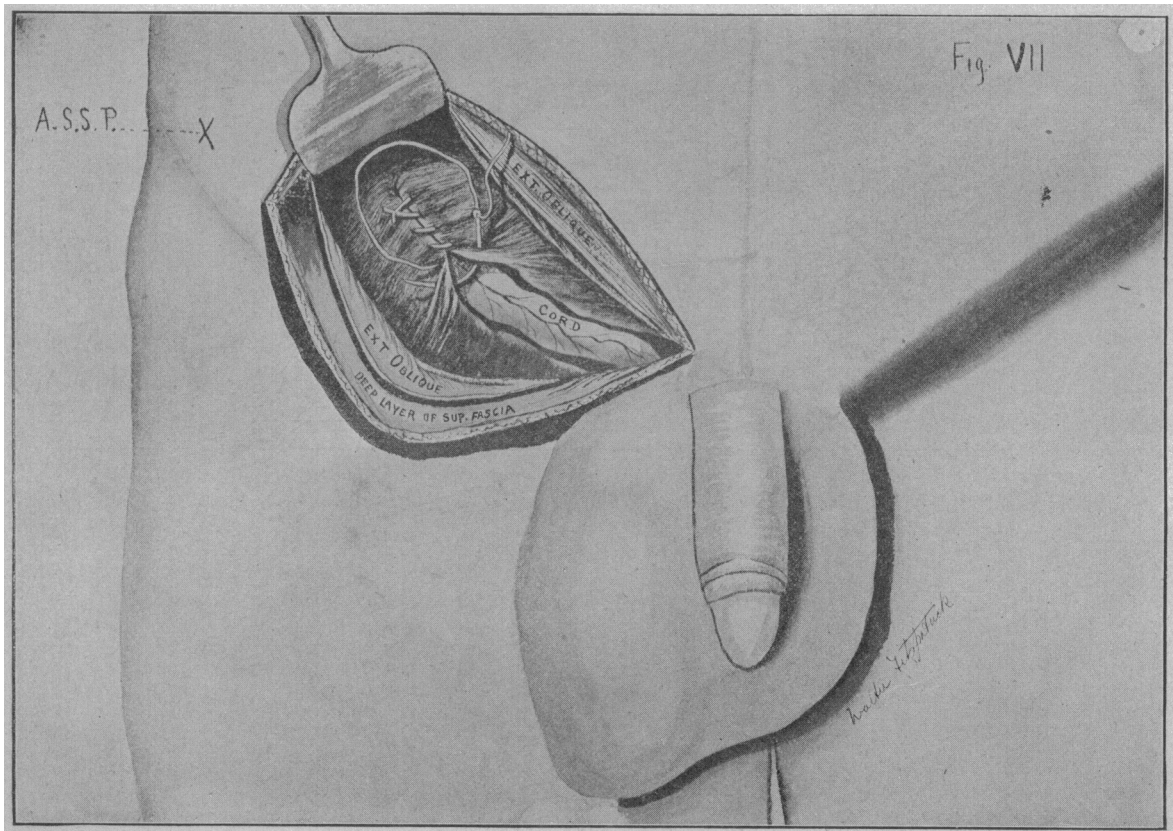
The internal abdominal oblique and tranversalis muscles suture to the internal aspect of Poupart's ligament, and restore their normal origin. I usually freshen the lower border of the muscles and scarify the surface of Poupart's ligament to insure firm union, and extend the sewing fully two-thirds down Poupart's ligament, which is the normal origin of this muscle in the female. Take care not to split Poupart's ligament by grasping with the needle the same longitudinal fibers each time. (Fig. 8) It is surprising how easily these two structures come together without the least discernible tension, and it is gratifying to observe how perfectly these powerful muscles cover and protect the internal abdominal ring and inguinal canal. (Fig. 8½.)

Bring together the separated edges of the aponeurosis of the external oblique muscle. Restore the external abdominal ring. (Fig. 9.)

In bringing the skin flap into normal position, be sure

The hernial area is uncovered as in no other way, thus affording an accurate observation of structural relationship, etiologic factors and pathologic conditions. b. There is less tendency of skin infection, extending to the deeper structures. c. Should, unhappily, a return of the rupture occur, there is no scar over it and a truss can be better borne.

4. Of all the operations I have performed, this is the simplest and easiest to execute. There is a good scientific reason furnished for every step in the operation.

5. Results so far are excellent. In the last eighteen months I have performed the above operation sixty-four times, counting each case of double hernia as two operations. There have been no relapses as yet. I do not wish to say that recurrence can not take place. The ages of my patients varied from 5 to 76 years; station in life, from poorhouse cases to the most affluent. Seven hernias in 4 men were complicated with enlarged pros-

tate, where at the same time I performed gonangiotomy; 4 were strangulated; 1 (double) had chronic gonorrhea; 2 cases had non-descending testicle; 4 had varicocele; 2 had a femoral and umbilic hernia; 1 case had an epigastric and a femoral hernia as well, all three operated on at the same time; and 1 had oblique inguinal congenital, and an acquired direct hernia on the same side.

There was one death on the fourth day after the operation—an old man, 74 years old. He had enlarged prostate, chronic cystitis, diseased kidneys, etc. The effect of the anesthetic was most likely the cause of death. Three cases suppurated, 2 had chronic gonorrhea and the third had chronic cystitis. In 61 out of 64 cases primary union occurred. All the strangulated cases healed by first intention. Rubber gloves were used in 3 cases only—six operations. In doing the rest of these operations with bare hands, the fingers were allowed to touch the tissues as little as possible.

With a special flat, ruled probe accurate measurements were made on the operating table to ascertain: 1, the length of Poupart's ligament; 2, the length of origin of the internal oblique muscle from Poupart's ligament; 3, size of "Ferguson angle" and position of internal ring.

In the sixty-four operations the internal abdominal oblique and transversalis muscles were deficient in every case. To differentiate between the border of the internal oblique and the fibers of the cremasteric muscle a blunt dissector or protected finger is passed underneath the conjoined tendon and made to travel rapidly to Poupart's ligament, well under the border of the muscle, thus sending the cremasteric downward and hugging the main muscle to its origin, and then the measurements are taken. The origin—which is the main thing—of these two muscles was deficient in every case, the average length being $1\frac{3}{8}$ inch. It was rare to find an
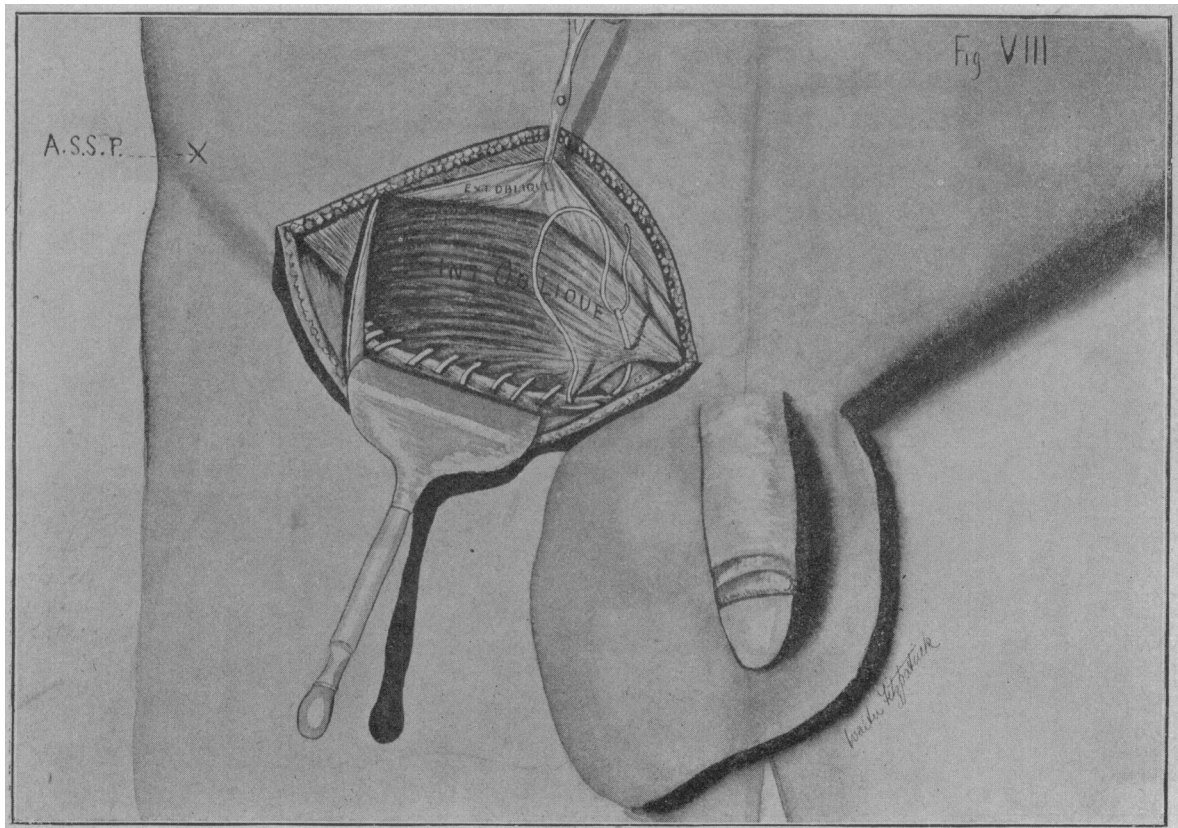
The wound was occasionally cleansed with salt, and the skin with bichlorid solution (1-2000). In about half the cases chromoform catgut (Nos. 0, 1, 2 and 3) was used in skin, as well as in deeper structures. The last six months I have discarded Nos. 2 and 3. If additional strength is deemed necessary the catgut is used double. Horsehair and silkworm gut were the other materials used for the skin. Different stitching methods have been employed,viz., interrupted and containing in the deeper structures, and for skin I used external interrupted, subcutaneous interrupted, external continuous and subcutaneous continuous. Half the stitches were removed on the sixth or seventh day, the rest within ten or twelve days. The patients were kept in bed from twenty-one to twenty-eight days, enjoined not to assume any work for six weeks after operation, and advised to wear a broad support—no truss—for three or four months.

origin of 2 inches; $\frac{1}{2}$ or 1 inch was much more common.

CADAVER WORK.

As already intimated, I requested Dr. Raymond Custer Turck to execute fifty inguinal dissections in this connection. In support of my "Typic Operation for Radical Cure of Inguinal Hernia" I shall here give a few quotations from his thesis, which clearly establish my claims:

In the course of numerous operations for the relief of oblique inguinal hernia, Dr. Alexander Hugh Ferguson, of this city, has observed: 1, that with but few exceptions there was a marked deficiency in the origin of the internal oblique and the transversalis muscles from Poupart's ligament; 2, that these muscles arising only from the outer portion of Poupart's ligament, with their lower fibers deficient in number and strength, afforded but poor protection, if any, to the internal abdominal ring; 3, that a strong barrier being thus removed, the descent of the hernia through the internal ring and downward along the inguinal canal was greatly facilitated.

Nearly every writer on hernia makes the statement that the

hernia in its descent pushes the arched fibers of the internal oblique and the transversalis muscles out of its way, displacing them outward and upward. Dr. Ferguson, while granting that the muscles are to a greater or less degree thus displaced, asserts that this displacement would not be possible, providing always that no congenital defect in the internal ring existed, were there not an abnormally short attachment of the muscles to Poupart's ligament; that the fact that the internal oblique, by reason of this deficiency in the origin of the muscle fibers and their consequent abnormal upward arching, fails to adequately cover and protect the internal ring and assist in the support of the abdominal viscera at that point is not altogether an effect of hernia, but rather a cause. He further asserts that in a fair percentage of cases of indirect hernia, a congenital—not an acquired—deficiency in the origin of the internal oblique had been present, and had formed in the individual a predisposition to the hernia, and that the hernia had been then occasioned by the gradual "giving way" of the peritoneum and of the transversalis fascia, or by a more immediate "exciting" cause.

Arguing on this hypothesis, Dr. Ferguson concludes that in an individual of well-developed internal oblique and transversalis muscles having a firm, normal attachment well down

which 27 were of adult males and 9 of adult females, whose ages it was impossible to obtain; 1 of male and 2 of female children, with given ages, and 11 fetuses of both sexes, with ages varying from seven months to full term. In regard to the latter, they were either still-born or had died shortly after birth, for in all cases the divided funis was present.

To insure against possible mistake, the lower border of the muscle passing from Poupart's ligament to the conjoined tendon was carefully exhibited, and the cremasteric fibers differentiated. The length of origin of the internal oblique given, then, is the distance between the anterior superior spine and the lowest point on Poupart's ligament, from which well-marked internal oblique fibers pass over to the conjoined tendon. The spermatic cord, or round ligament, was then followed upward along the inguinal canal to the internal ring, the fibers of the internal oblique being thus divided in the direction of the canal. The infundibuliform process of transversalis fascia was then removed, and the margins of the internal ring defined. A needle or probe was placed as exactly as possible in the center of the ring, and from the center the following measurements were taken: the distance to the anterior superior spine of the ilium; the distance to the spine of the pubes, and to Poupart's ligament. For the length of
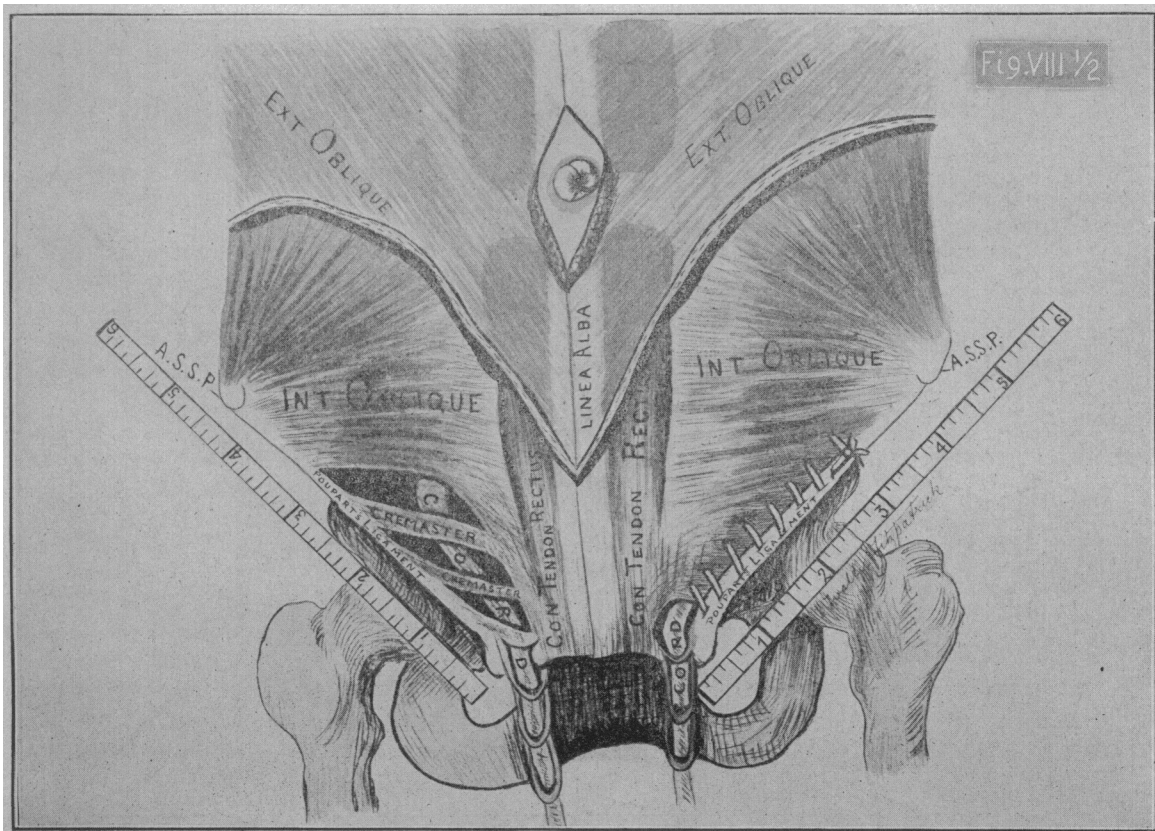
along Poupart's ligament, these muscles, especially the internal oblique—by closely covering and protecting the internal ring—offer strong resistance to pressure from within, and thus render the liability to hernia very small.

The lower fibers of the internal oblique, leaving Poupart's ligament and passing inward to the conjoined tendon, normally form, with the ligament, an acute angle. This we have taken the liberty to call the "Ferguson Angle." The lowest point of the muscular origin in its relation—external or internal—to the internal ring, considered together with the degree of the Ferguson angle, goes far to show the relative strength or weakness of the resistance offered by the muscle at the internal ring, and hence should not be overlooked in the study of the causation of hernia.

Acting on Dr. Ferguson's suggestion, dissections were undertaken with a view of determining in the normal cadaver: 1, the average length of the attachment of the internal oblique muscle to Poupart's ligament; 2, the position of the external and internal abdominal rings; 3, the length of the inguinal canal; 4, to estimate the amount of protection afforded the internal ring, and, 5, to note other points of interest in this connection which might come under observation in the course of the work. There were in all fifty cadavers dissected, of

the canal the distance was taken between the center of the internal ring and the outer angle of the external aperture.

The average length of Poupart's ligament was found to be 11.2 cm. (4⅜ inches) in the male adult—25 subjects, Dissections 40 and 43 not being counted in the averages—and 12.5 cm. (4 15-16 inches) in the female adult—9 subjects. The average distance of the apex of the external ring from the pubic spine was 2.1 cm.—13-16 inch—in the male, and in the female 1.57 cm.—⅝ inch. These measurements present no points of particular interest or importance other than those given by obstetricians and anatomists regarding the greater width of the female pelvis, and the smaller size of the ring in woman than in man. In a majority of the male subjects, however, I found the length of the external ring to be less than an inch (2.5 cm.), the distance usually given, in several but half an inch (1.3 cm.), in one three-eighths of an inch (1 cm.). As shown by the tables, in these dissections, the size of the female ring averaged a little less than three-fourths that of the male.

The average length of the origin of the internal oblique muscle in the male was found to be 8 cm.—3⅛ inches. On comparing this with the average length of Poupart's ligament, it will be seen that the muscular attachment averages a little

more than two-thirds the length of the latter. Gray, Morris and others state that the internal oblique takes origin from the outer half; Quain, that it arises "from the outer half or two-thirds of the deep surface of Poupart's ligament." The

directly on Dr. Ferguson's asssertion that the internal ring derives its greatest protection from the internal oblique muscle. For it is well known that the lower (innermost) fibers of the muscle are the weaker, therefore the longer the ligamentous

Fig: IX

Fig X
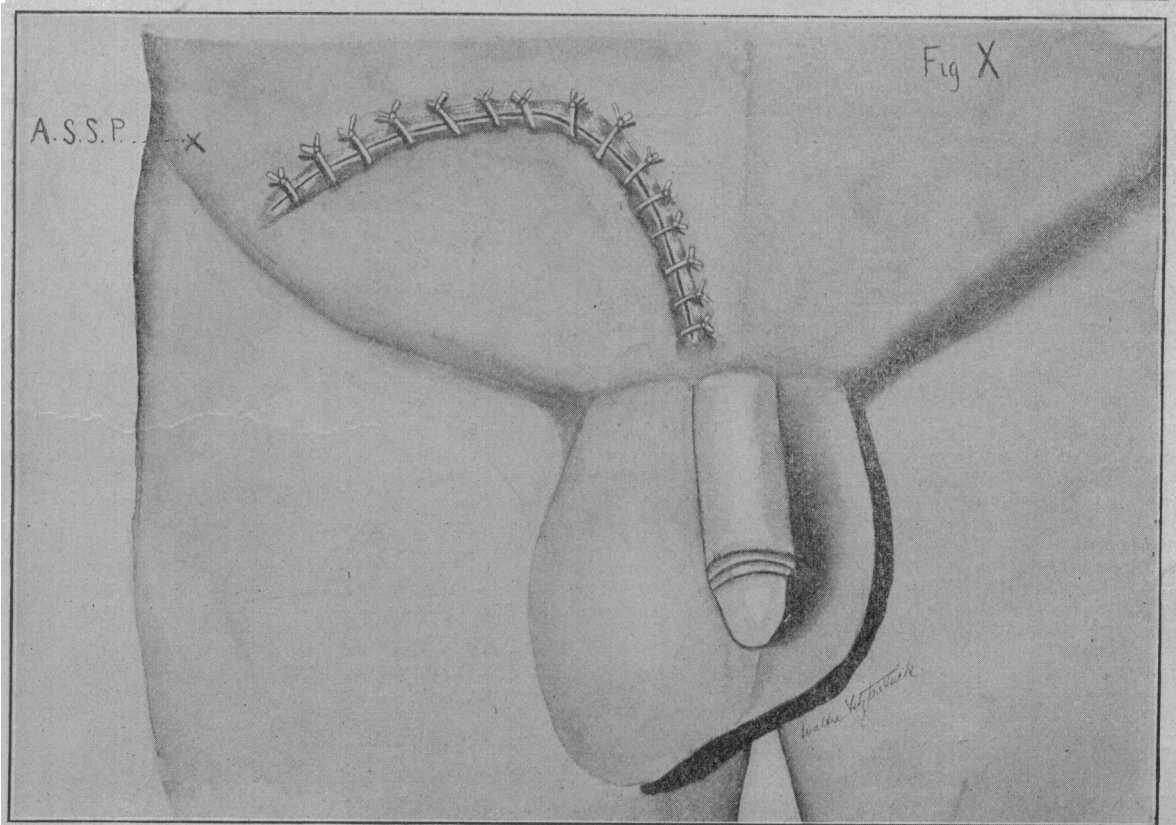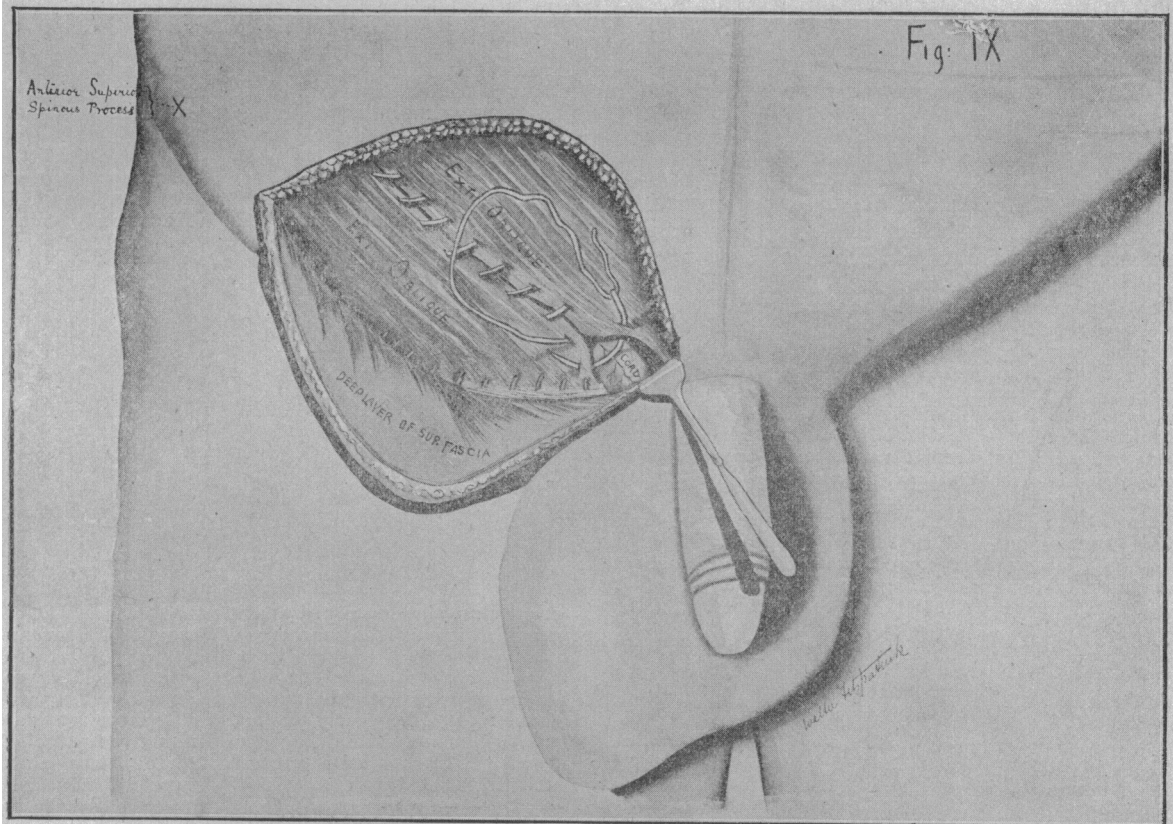
results obtained here do not bear out the text-book statements, the internal oblique being attached in a majority of the normal cadavers to rather more than the outer two-thirds of ligament. This fact is important, bearing as it does

origin, the farther the weak fibers pass below and internal to the internal ring, the greater is the protection afforded the ring by the strong outer muscular fibers which pass over it.

Dr. Turck was fortunate in getting a full-term male fetus that had a left congenital hernia with retained testicle, while the right side was normal. Having carefully dissected the left side, he then says: "Diagrams 1 and 2, which are life-size, drawn from the general averages, show the relative position of the rings and the length of the internal oblique origin in the male and female. The difference between the sexes is even more strikingly shown in comparison of individual cases."

COMPARISON OF THE AVERAGES OF MEASUREMENTS IN MALE AND FEMALE.

The Doctor, having assisted me at several operations, and possessing a thorough knowledge of the technic of my operation, carried out an interesting and convincing experiment on this fetus, viz.:

Measurements were taken which showed the length of Poupart's ligament to be 3.5 cm., the distance of the center of the internal ring.from Poupart's ligament 9 cm., the distance from the anterior superior spine 2 cm., and from the spine of the pubes 1.8 cm. The length of the origin of the internal oblique muscle was found to be but 1.3 cm., about one-third the length of the ligament. It will be seen from these measurements, taking into consideration the 90 degrees of the Ferguson angle, that the internal ring derived but little, if any, protection from the internal oblique. The fact that the 90 degrees of the Ferguson angle persisted when no hernial protrusion was present, and that the angle was further increased when the descent occurred, would seem to indicate that the abnormal upward arching—and weak origin—of the internal oblique was not altogether due to the hernia, but

Diagram 1.—General average in male—twenty-five dissections.

Diagram 2.—General average in female—nine dissections.

that it was a congenital defect and, as such, a contributing cause to the escape of the gut.

Experimentally, the gut being replaced in the abdomen, the processus funiculovaginalis was cut off flush with the internal ring, the testicle being placed between the peritoneum and transversalis fascia well to the outer side of the ring, and the ring closed by interrupted sutures through peritoneum and transversalis fascia. The internal oblique and transversalis muscles were then sutured to Poupart's ligament well down toward the pubic spine, after Dr. Ferguson's method of operation. Strong pressure was then made on the abdomen, forcing the viscera downward into the pelvis and against the lower abdominal wall, especially at the internal ring—the same procedure which had caused the hernial descent before the normal relations of the parts were restored—but no protrusion through the internal ring was obtainable.

For comparison, dissections were conducted on the right side of the same fetus, and the measurements revealed a radical difference in the position of the parts when compared with those of the left side. Diagrams 6 and 7 show the position of the parts on the right and left sides. They represent exactly the measurements given in the tables, and when compared clearly demonstrate the greater amount of muscular protection which the right internal ring received. That this child, or man—providing development had gone forward normally—would have had a right oblique inguinal hernia is altogether improbable.

SHOWING RELATIVE LENGTH OF ORIGIN OF INTERNAL OBLIQUE, AND POSITIONS OF INTERNAL RINGS IN DISSECTIONS 29 AND 30.

After dividing the internal oblique fibers upward to the internal ring, the ring was enlarged to the size of the internal ring on the left side before the latter had been restored, and downward pressure again applied on the abdomen. The in-

testine descended easily through the ring. The gut being returned, the cut edges of the internal oblique were united by interrupted suture, without, however, in any way reducing the size of the internal ring, and pressure once more applied to the abdomen. No amount of force, however, produced a protrusion of the abdominal contents, demonstrating clearly the valve-like action of the internal oblique.

Finally, let me draw your attention to two dissections on a male adult, who had a left oblique inguinal hernia.

SHOWING LENGTH OF ORIGIN OF INTERNAL OBLIQUE AND POSITION OF INTERNAL RINGS IN DISSECTIONS 43 AND 44—MALE ADULT.

Dissections 43 and 44, respectively, of the left and right side of the cadaver of a male adult, are represented in diagrams 8 and 9. In this subject there was present on the left side an oblique inguinal hernia. The exceptionally enlarged ex-
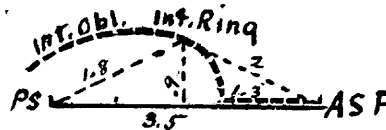

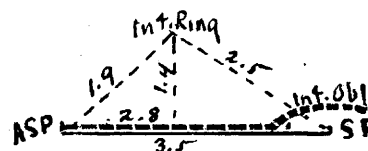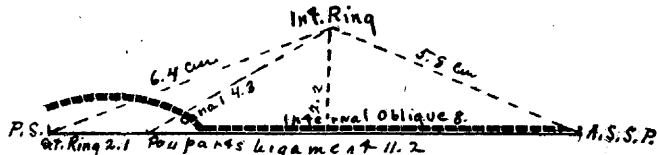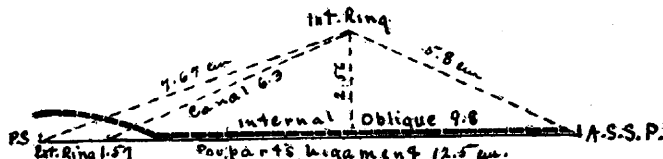Diagram 6.—Left side—Congenital hernia.

Diagram 7.—Right side—Normal.

ternal ring, the downward and inward displacement of the internal ring, and the marked deficiency in the origin of the internal oblique, together with the largely increased degree of the Ferguson angle—in this case about 90 degrees—are, when compared with the normal relations of the parts shown on the right side, clearly exhibited. That the internal oblique muscle, because of its deficient origin and the pathologic arching of its fibers, failed to protect the left internal ring, is self-evident. That this defect in the muscle was altogether induced, or, we may say, artificially produced, by the hernia, is improbable, especially when the length of origin on the right side (8.1 cm.) is considered. It seems likely that this subject illustrates exactly one of Dr. Ferguson's points, namely, that a congenital defect in the muscle had predisposed the subject to the hernia.

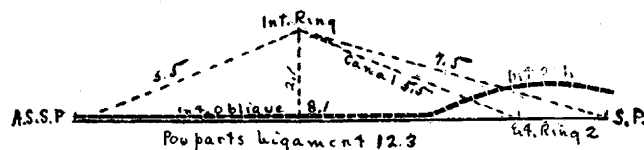Diagram 8.—Left side—Oblique inguinal hernia.

Diagram 9.—Right side—Normal.

ATYPIC OPERATIONS.

Atypic operations for the radical cure of oblique inguinal hernia are all those which do not in the completed operation leave all structures as they are present in a normal inguinal region. It is not necessary to mention these, but I wish to draw attention to plastic procedures on the sheaths of the rectus muscle, when the conjoined tendon is abnormally thinned out (Bloodgood); to the utilization of the sac (Macewen); and to the employment of the sartorius muscle to strengthen the inguinal region (Ferguson).

Some cases may present themselves—but they must be comparatively rare—where it may be advisable to do plastic work in addition to the typic operation.

10 Drexel Square.