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HERNIAS THROUGH THE PELVIC FLOOR.*

BY

CHANNING W. BARRETT, M. D.,

Gynecologist to Chicago Polyclinic School and Hospital; Adjunct Professor of Gynecology, University of Illinois Medical School; Surgeon and Gynecologist
Marion-Sims Hospital; Obstetrician to Cook County Hospital.
Chicago, Ill.

(With illustrations.)

I CANNOT claim the honor of presenting new anatomical facts. The findings described by such well-known workers as Dickinson, Savage, Berry Hart, Holl, Meyer, Thompson, and many others are abundant. To mention the names even of all those who have helped to change the treatment of weak pelvic floor from that of pessary to perineorrhaphy and from superficial flap-splitting and flap-dissecting perineorrhaphy to deep suturing of the muscles would be to call the roll of a long list of workers. It is to stimulate a more universal recognition and application of these observations in the cure of hernias that I present a paper upon this subject. Some have used the term "hernia of the pelvic floor" to signify only those conditions in which pelvic contents are protruding through the levator ani muscle fibers or between different portions of the muscles. These are very rare. I have not used it in this wider sense, including the larger class of cases due to traumatism, to surprise you into thinking we are dealing with a new subject, but because this more nearly accords with pathological anatomy and is more comprehensive than the terms "Lacerations of the Perineum," "Prolapse of the Uterus," "Cystocele," "Rectocele," etc. The rectum, bladder, and uterus protruding through a pelvic opening

* Read before the Chicago Gynecological Society, December 18, 1908.

have all the qualifications of a hernia. Dickinson has written an interesting article upon "The Vagina as a Hernia Canal."

A comprehensive understanding upon which rational treatment must be based is obtained by a consideration of the following points:

1. The abdominal contents and their supports.
2. The abdominal walls and their importance as supports.
3. The greater importance of the pelvic floor over the rest of the abdominal wall, (a) by reason of its being the lowest part and therefore having to stand the greatest strain; (b) by reason of its having to provide against "faults" caused by the passage of several important tracts.
4. The greater importance of the pelvic floor over that of mammals having the longitudinal axis of the body in a horizontal position, and therefore little weight falling upon the perineum.
5. The construction of the pelvic floor in man, more particularly woman, and reference to comparative anatomy.
6. Condition of the pelvic floor after traumatism or arrested development or relaxation.

In four-footed mammals the perineal region is comparatively weak, the musculature having developed in that region being used chiefly for sphincter action. From the lateral and dorsal sides of the pelvis, muscles arise which pass to the side of the rectum and are inserted into the caudal vertebræ for movement of the tail.

In woman the pelvic floor must play fast and loose; being the lowest, it must be the most efficient part of the abdominal wall for support and yet the most elastic for the passage of the child. It is interesting to note how the need for more than a sphincter layer is met by these tail muscles being transformed into the layer of support—the "diaphragm" of Meyer—as the upright position is assumed and the caudal appendage abbreviated.

EMBRYOLOGY.

The celom or body cavity is formed by a cleft in the mesoblast, the outer layer joining the epiblast forming the somatopleure, the inner layer joining the hypoblast forming the splanchnopleure. The celom at first extends beyond the embryo, but becomes confined to it by the right and left layers of the somatopleure meeting at the umbilicus forming the intraembryonic part of the celom. This body cavity is at first divided into a right and left half by a

dorsal and ventral mesentery formed by the united splanchnopleures. The dorsal mesentery persists as a neurovascular pedicle to the organs the ventral mesentery disappears posteriorly, while the middle portion persists and helps to form the diaphragm. At times there is failure of development and we have hernia through the diaphragm. The splanchnopleure is constricted at the umbilicus the extraembryonic portion becoming the yolk sack, the intraembryonic portion becoming the intestinal tract extending the length of the body cavity. As the abdominal portion of alimentary tract outgrows in length the growth of the body of the embryo, it becomes convoluted and at

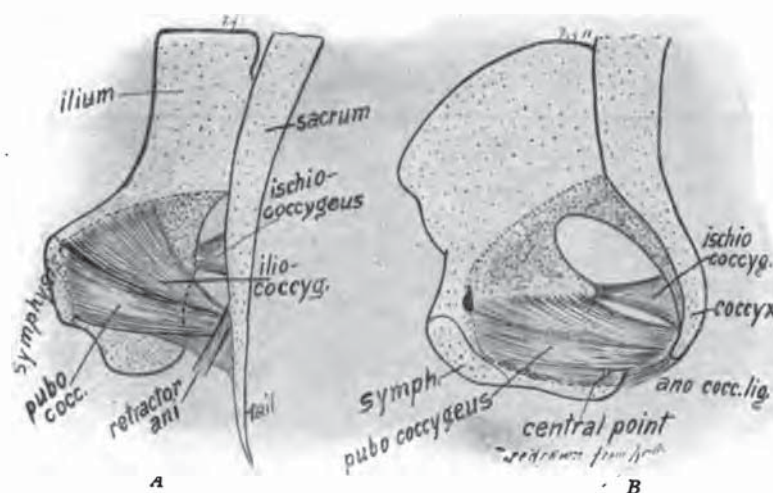


FIG. 1.—A shows the arrangement of the tail muscles in a monkey. B shows the corresponding arrangement of muscles in man. (Redrawn from Keith.)

the same time becomes differentiated to form the future stomach duodenum, jejunum, ileum, colon, cecum, appendix, sigmoid, and rectum. As the loop of the large intestine raises to the left and passes over the small intestine at the duodenojejunal junction, its mesentery meets and blends, leaving just room for the small intestine to pass through. The position of every abdominal organ is determined by its growth, the mesentery following, but, upon obtaining growth, the mesentery and vestigial remains of embryonic structures become ligaments, and they help to determine the future position of the organs. At the third week the hind gut is common to the allantois which is to form the bladder and the intestinal tract which here is to become the

rectum. This common cavity known as the cloaca persists in the lower vertebrates, but in mammals becomes separated into an anal portion and a urogenital portion. Early in fetal life no communication exists between the perineal region and the body cavity, being separated by the cloacal plate. About the end of the fourth week this plate is absorbed by dipping inward of the perineal depression or proctodeum and the growing outward of the cloaca. The septum dividing the cloaca into an anal portion and a urogenital portion is known as the perineum. The



FIG. 2.—Showing the portion of the levator line muscle making a diaphragm for the pelvic outlet. A, Vagina. B, Rectum. C, Pubococcygeus. D, Pre anal fibers of the puborectalis portion of the levator ani muscle. E, Obturator-coccygeus. F, Ischio-coccygeus. In four footed animals the attachment is to the coccyx.

mass of mesoblastic cells become differentiated into definite structures needed in this region, the remaining mesothelial cells forming connective tissue sheaths to the structures formed. Thus do we have the muscles and fascia of the pelvic floor.

However important the proper completion of this process may be, it will be seen that an arrested development may result in no opening in the perineal region, or the perineal septum may not develop while the cloacal membrane may be absorbed, resulting in a common cloacal opening, or the septum may form

and the cloacal plate fail to absorb in the anal depression leaving no intestinal opening, while there may be a urogenital opening, or the anal opening may be through the perineal septum communicating with the urogenital cavity or what is later the vagina. The mesoblastic cells in the perineal region develop into such structures as will be most useful for their owner. In mammals walking upon four feet these muscles are needed very little for support or for "shutters" of the perineal outlet, but are greatly needed for tail muscles, the tail being used as a "shutter" of the perineal outlet.

COMPARATIVE ANATOMY.

In four-footed mammals we have the pubococcygeus muscle and the ileococcygeus used to depress the tail and the ischio-coccygeus or coccygeus muscles which draw the tail to the right or left side. In man assuming the upright position and without the caudal extremity and therefore the muscles not being required for tail motion, these muscles and their fascia have become developed into supporters and are grouped together as the levator ani muscles. The pubococcygeus, which in four-footed mammals passes backward on each side of the rectum without attachment to it, in man has dropped some of its coccygeal attachments and joins its fellow of the opposite side in the median raphe between the anus and tip of the coccyx and between the anus and vagina, also sending fibers to the sides of the rectum and vagina. Holl considers this tendinous insertion between the tip of the coccyx and the anus the fibrous extension of the abbreviated caudal appendage. This change in insertion has led Holl and others to term this portion of the pubococcygeus the puborectalis or sphincter recti. The origin of the ileococcygeus which is from the ileopectineal line in four-footed animals is dropped down to the obturator fascial line, called the white line, and all three muscles are a little more closely blended and yet they are sufficiently distinct to receive names similar to those in lower mammals, the ileococcygeus of mammals being called the obturatococcygeus.

Holl, Thompson, and others have found in their studies of animals, assuming somewhat an upright position, that the muscle has a lower origin, assuming in varying degrees the position that it occupies in man. Thompson has also found, in his dissections of man, cases in which the muscle takes a much higher origin than usual, even having origin within one-fourth

inch of the ileopectineal line, approaching in origin that of the muscle in four-footed animals. This latter arrangement of the muscle explains the predisposition to hernia seen in some cases which have sustained no injury to the pelvic floor. Thompson lays stress upon this development of the puborectalis portion of the levator ani muscle, while he and others look upon the posterior portion of the levator ani as an aponeurotic vestigial



FIG. 3.—Shows hernia through the pelvic floor with marked cystocele and rectocele.

remains of a more active tail muscle. Studies in comparative anatomy, then, make it seem certain that these muscles forming the pelvic diaphragm have undergone an evolutionary process for support as the upright position has been assumed and the caudal extremity has been abbreviated. These supports do their work with varying degrees of efficiency.

Other muscles of the pelvic floor corresponding to the sphincter layers of four-footed animals, but which comprise two layers in man, are the sphincter ani, constrictor vagina, or bulbocavernosus, erector c itoridis, or ischiocavernosus, superficial trans-

versus perinei and compressor urethra or deep transversus perinei (Thompson divides this muscle into an anterior portion, the constrictor urethræ, and a posterior portion, transversus perinei profundus). These latter muscles, while furnishing some strength to the pelvic floor, are by no means as important as supports as the levator ani and its fascia.

The important work of support of the pelvic floor would be much simplified were it not that certain openings or "faults" exist.

Hernia through the vaginal outlet is provided against by a strong posterior segment with a superimposed more movable anterior segment, with the vaginal slit running obliquely so that force from within presses the anterior segment against the posterior, as the internal oblique is pressed against the external in the inguinal region. Were it not for the numerous traumatism to the posterior segment, hernias through the vagina would be infrequent.

With the levator ani muscles injured, the anus and perineal structure (posterior segment) drop backward, leaving no support for the anterior segment. The anterior segment is now called upon to do the work of the pelvic floor. In some cases this fails immediately and hernia develops, in other cases a strong anterior segment acts as a pelvic floor for some time until increased intraabdominal pressure from lifting, coughing, etc., causes it to give way.

Too often the efficiency of the "perineum" has been considered to depend upon the cutaneous structure, the vaginal mucous membrane, the "wedge-shaped perineal body" and "atmospheric pressure." Atmospheric pressure is no factor whatever, the skin and mucous membrane scarcely more, and the wedge-shaped perineal body is of no importance as a "keystone to an arch," but it is only of importance as it represents the integrity of the muscles and fascia of the pelvic floor upon which the nondevelopment of hernias depend. Emmet, Dudley, and others point out the fallacy of considering the perineal body a support and lay stress upon the fascia and muscles, and yet Emmet's operation fails entirely to procure the restoration of the levator ani muscle, as pointed out by Noble. A traumatism of the pelvic floor may separate the preanal fibers of the levator ani, weakening the pelvic floor between the vagina or rectum, or it may injure the anterior portion of the levator ani as it passes back at the side of the vagina, or the muscle may be torn loose from its origin. These injuries may have taken place with

or without a skin or mucous membrane tear. Even in careful hands, then, an immediate repair may not be possible.

In late repair, if the injury to the levator and its fascia has been a separation of the portions lying between the vagina and rectum, we have but to unite them to restore normal conditions. If the muscle has been torn to the side of the vagina and retraction has taken place, the most anterior fibers may not be discoverable and we may be compelled to make the best use possible of the more posterior portion of the muscle, bringing it into the

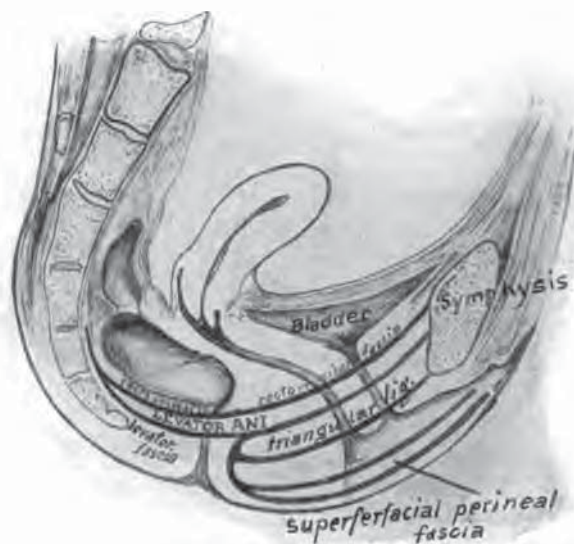


FIG. 4.—Showing the relation of the fascia and muscles of the pelvic floor, forming the lower abdominal wall, and the oblique direction of the vagina as it passes through this wall.

median line to take the place of the lost anterior portion of muscle.

The flap splitting operation, as revived by Tait, was a comparatively superficial operation and united the skin of one labium majus to that of the other, increasing the skin distance between the vagina and rectum. The Emmet operation by reason of its superficial denudation and placing of sutures makes of necessity a superficial and complicated operation. Noble modifies this, laying stress upon the failure of Emmet's operation to bring the levator ani muscles together, yet he places the suture which is to unite the muscles less than one-fifth inch inside the hymen.

Budin, in 1885, and Dickinson later carried out experiments with a soft wax phallus in the vagina to determine the position of the levator ani muscle and found that the lower fibers made an impression in the wax about one-half inch within the vagina. The numerous complicated vaginal flap operations of which Simon's, Hagar's, and Freund's are illustrations, must be viewed in the light of our present knowledge as an effort to cure a hernia by dealing with the sac rather than closing its ring. While I was interne in Harper Hospital, Detroit, I had the opportunity many times of observing Dr. Longyear perform a very efficient operation of extending the flap operation between the vagina and rectum, then beginning at the bottom of the wound and closing with a running kangaroo tendon, bringing the levator muscles together, finishing with a linear wound with buried suture. This was later described by Goldspohn, in 1897, when he pointed out the advisability of dealing with the levator ani muscle, and urges the necessity of going 6 to 9 cm. between the vagina and rectum to obtain the muscle. This otherwise excellent operation, however, united labium majus to labium majus over the vagina. Küstner, the same year, points out the importance of dealing with this muscle. Marcy, in 1883, and in 1884 and yet again in 1887, called attention to the necessity of a deeper perineorrhaphy than had previously been performed and recommended the use of the buried animal sutures for bringing what he called the "deep" structures together. These "deep" structures, however, were the transversus perinei muscles. Goldspohn begins his suturing much deeper than the levator ani and closes with a running catgut suture. Reed and others bring the levator ani muscles together with a figure-of-8 silkworm-gut suture with what seems to be a complicated technic.*

As this developmental process in perineorrhaphy has gone on, little room for improvement would be left if the rank and file had shown a readiness to apply the knowledge gained by our well-known anatomical and clinical investigators. I think it may be said without fear of challenge that by the sins of omission and sins of commission the pelvic floor is the most surgically abused portion of the human anatomy. Too much stress has been laid upon skin union between the vagina and rectum. An importance has also been attached to a structureless wedge-shaped perineal body. Then as the superficial structures were found

*Since the presentation of this paper Haynes has published an article with a sound anatomical basis. See Amer. Jour. Obst., Vol. lviii, 1908, page 995.

insufficient, deeper separations were made, but the superficial structures were still brought together over the vagina. The student of this branch of surgery has not found the illustrations or text clear, as has been the case with inguinal hernia. Illustrations have often been limited to showing the shape of the mucous membrane flap, instead of dealing with definite anatomical structures (the levator muscles). We have been directed to go into the tissues of the labia or perineum for a distance and bring the sides together as though dealing with putty. This would not be counted good surgery in the inguinal region nor should it in the perineal region, for we are just as certainly dealing with hernia in one case as in the other.

PRINCIPLES CONSIDERED IN THE CURE OF HERNIA.

When possible, general principles should be emphasized rather than detailed technic described.

1. The abdominal organs need for support in addition to their own ligaments a limiting wall.
2. The limiting wall should grow stronger from above downward as gravity of the organs exerts a force not exerted above.
3. The pelvic floor being the lowest part of the abdominal wall needs to be the strongest.
4. Abdominal organs herniate through the walls by reason of increased pressure, insufficient supports, and weak places in the walls or "faults."
5. The pelvic floor does not act as a direct support to the uterus, as the uterus does not lie against it.
6. The pelvic floor by reason of its importance in man has developed an additional diaphragm—the levator ani muscle and its fascia.
7. This diaphragm is weakened by "faults" (the rectum, vagina, and urethra).
8. The vaginal canal by reason of extreme dilatation which lacerates the surrounding levator muscle becomes a frequent site for hernia.
9. Atavism of the levator ani muscle occasionally furnishes a congenital predisposing cause of hernia through the rectum in the male, and the rectum and vagina in the female.
10. The cure of these hernias due either to traumatism or congenital defects should look toward
 - (a) Lessening intraabdominal pressure.
 - (b) Correcting the pelvic floor defect.

- (c) Putting the vagina out of a vertical line.
- (d) Putting the uterus out of line with the vagina.

11. The posterior segment of the pelvic floor is repaired by uniting the levator ani muscle and its fascia, and the lower end of the vagina is thereby pushed forward.

12. The anterior segment may be corrected by anterior colporrhaphy and, if occasion demands, a shortening of the sacrouterine ligaments. The upper end of the vagina is thus pushed backward.

13. The uterus is gotten out of line with the vagina

- (a) By shortening the round ligaments.
- (b) Vagino-fixation in cases of mild prolapse past the menopause.
- (c) By vaginal hysterectomy in cases of marked prolapse, especially with a pathological uterus. In case of hysterectomy the ligament should be implanted into the vaginal vault.
- (d) By bringing the lower end of the broad ligaments in front of the cervix, according to Alexandroff, which operation is slightly modified in this country by Dudley and others.

TECHNIC OF REPAIR OF THE PELVIC FLOOR.

With all vaginal work done upon the uterus, be it curettage, amputation of the cervix, vaginal fixation, vaginal shortening of the round ligaments, hysterectomy, or Alexandroff's operation, and with anterior colporrhaphy completed, if necessary, the patient is ready for the repair of the pelvic floor. Our chief aim is to reach and reunite the separated portions of the levator ani muscle and their fascia. Our second aim is to do this without uniting any superficial structures that should remain apart. Most of the flap operations carry forward a portion of the inner surface of the labia majora together with the posterior ends of the labia minora and in some cases these superficial structures are closed over the entrance to the vagina even so far forward that the patient urinates upon the bridge of skin. To avoid such superficial closure and secure the levator muscle the following technic is carried out:

With a small tenaculum the remains of the hymen are picked up on each side of the vagina at such a point as will leave a good vaginal opening.

A U-shaped incision is made from the forceps on one side to that of the other at the junction of the vagina and modified

skin of the vulvar entrance, D. E. F. instead of the usual incision A. B. C. in Cut No. 5. This leaves all inner surfaces of the labia for a vestibule as was the condition before the injury. The edge of the vaginal flap is now picked up with forceps and dissected forward, first with a knife, then with a sponge, leaving all muscle and fascia of the perineal region

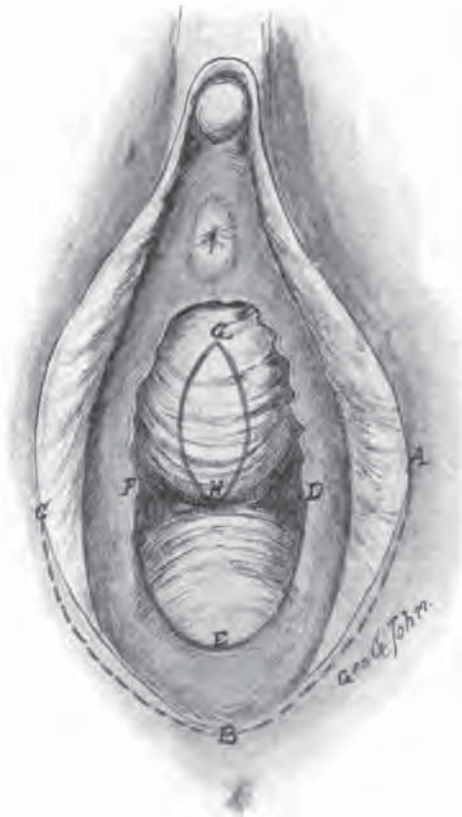


FIG. 5.—Showing a rectocele and cystocele (Hernia) with a common erroneous incision, A. B. C. in dotted lines and the proper incision D. E. F. G. H. shows the outline for the author's colporrhaphy.

behind. The dissection is carried between the vagina and rectum until we are above the levator ani muscle (about one and one-half inches) and well to the sides to uncover these muscles. The guide is not to be indicated in inches, however, as the test is to be able to find the muscle. With the flap held forward, the index-finger of the left hand crowds the rectum backward and puts the levator on the stretch. With a strong, round

curved needle that would about fit the three-eighths circumference of a silver half-dollar and threaded with catgut, we pick up a good bite of the left levator ani muscle as far forward as we wish to unite it, we then include a little of the deep part of the flap, after which the needle picks up a corresponding portion of the levator muscle on the right side. With the same suture and needle we now go back to the left side and pick up the levator ani muscle

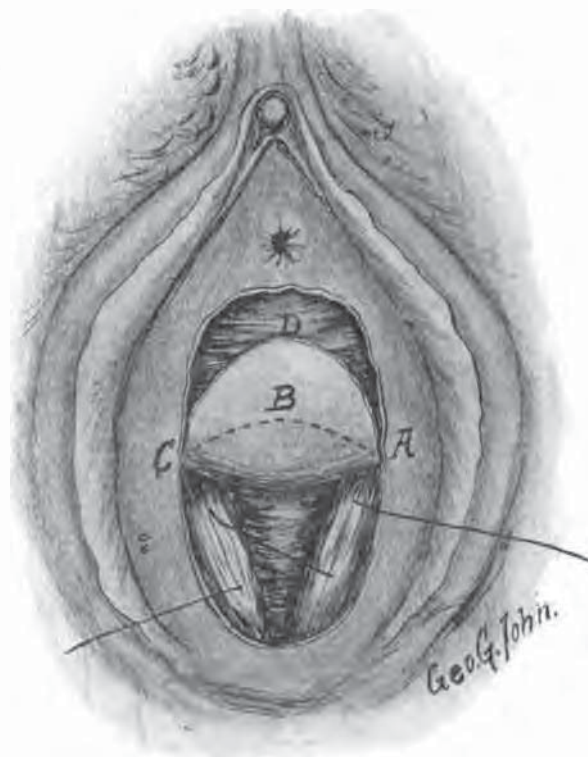


FIG. 6.—Showing the flap A. D. C. carried forward leaving all labial structures as before injury and exposing the levator ani muscle with the suture in place ready to tie. A. B. C. shows line of incision for shortening the flap.

one-half inch nearer the rectum, the needle is then made to pick up a portion of the rectal wall, after which it picks up a corresponding portion of the levator muscle on the right side. The catgut at the first entrance on the left side is now tied with the catgut of the last exit on the right, approximating the levator with two loops of catgut which cross upon the exposed surface of the muscle in the form of an X (Figs. 6 and 7) with only

one knot. Usually a triangle is felt between the vaginal flap and the diverging portions of the muscle, which is closed by picking up a small bit of the left muscle, then the flap, and then a corresponding portion of the right muscle (Fig. 7). This closes the opening and fixes the vaginal wall. The hernia is now cured, and we have but to close the superficial wound. The

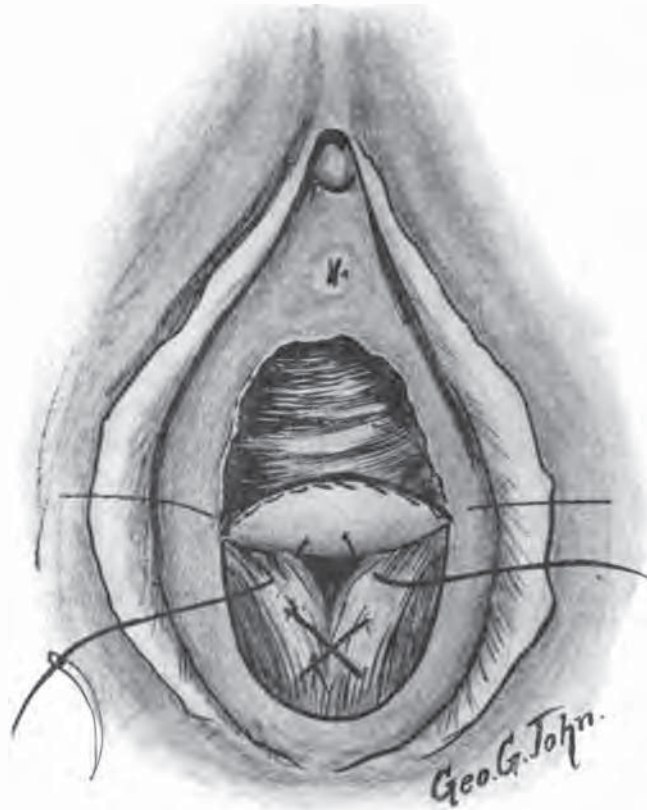


FIG. 7.—Showing suture tied, bringing levator ani muscles together. With additional suture in place ready to tie.

vaginal flap is usually a little long or a little irregular and is trimmed according to A. B. C. (Fig. 6). The flap suture then picks up the lower remaining portion of the hymen on the left side, runs along the edge of the vaginal flap and picks up a corresponding portion of the hymen on the right side, which when tied reunites the edges of the hymen (Fig. 7). With three or four interrupted silkworm-gut sutures the right and left

surfaces of the wound are closed down to the levator ani muscle. This leaves as good separation of the labia [posteriorly as anteriorly, with no drawing of the skin over the vagina (Fig. 8). I have formerly used figure-of-8 silkworm-gut sutures for approximating] the levator ani muscles, hesitating to use catgut in the perineal region, but the suturing was much more technical

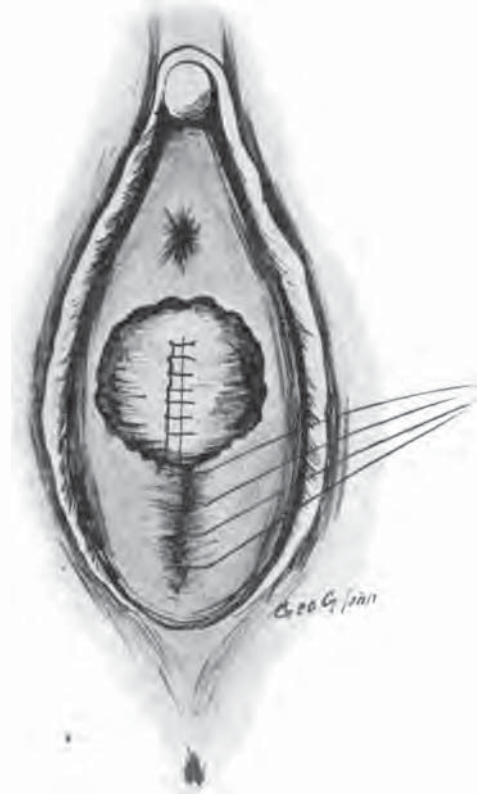


FIG. 8.—Shows the operation completed after the vaginal flap of *D. E. F.* of Fig. 5 has been made, leaving a normal approximation of the hymen and separation of the labia.

and did not leave as smooth external results. I have used the catgut for approximation with great satisfaction and have had no reason to regret the change.

Many of these cases require a careful examination to discover that traumatism and repair has taken place.

It is not the purpose of this paper to go into detail as to the technic of dealing with the uterus to prevent a return of the

hernia after the repair. In addition to the repair of the posterior segment for support, an anterior colporrhaphy will be necessary if cystocele exists, otherwise the baggy anterior segment will roll out over the posterior. A prolapsed uterus will have to be

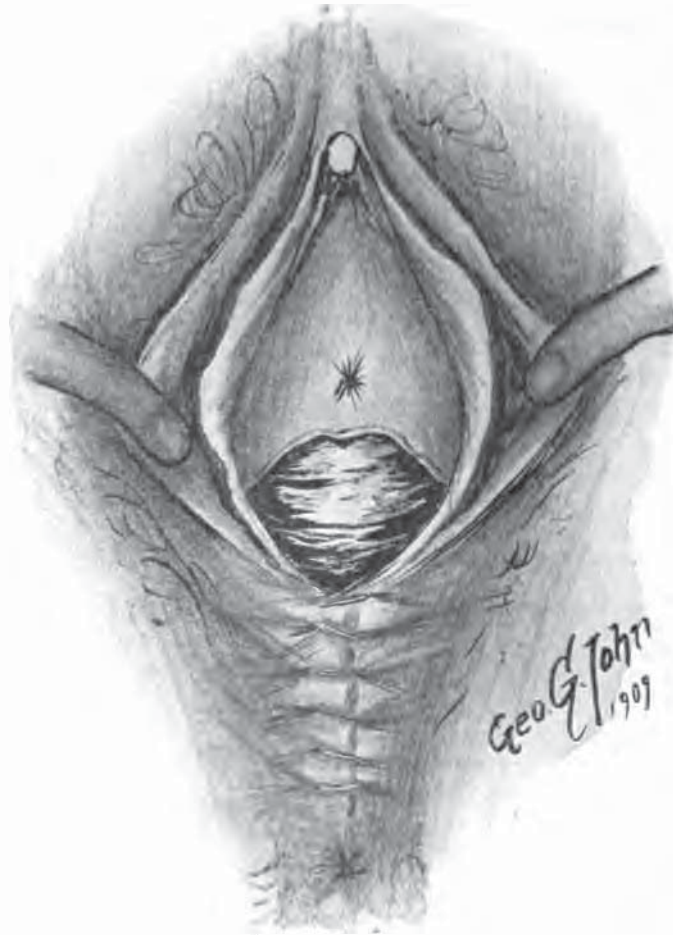


FIG. 9.—Case in which the erroneous incision shown in Fig. 5 (A. B. C.) had been made and the skin of the labia majora brought together over the vagina.

removed or put out of line with the vagina or it will dissect its way through the vaginal canal. The mistake has not infrequently been made of considering these hernias prolapse of the uterus and attempting relief by hysterectomy alone, only to find that the hernia of the bladder and rectum still persists and

in some cases to an increased degree with the inverted vagina as a hernial sac.

With hemorrhoids and prolapse of the rectum in the female, we frequently have injury to the levator ani muscle and in the same conditions in the male the levator muscle should be studied with a view to determining any congenital defect due to atavism. Should prolapse of the rectum in the male occur on account of separation of the levator muscles or freedom of the rectum from the muscle, a curved incision should be made posteriorly to the rectum in properly selected cases and the separated levators reunited with attachment of the rectal wall to this muscle.

In conclusion I would emphasize the following points:

1. The pelvic floor, while not a direct support to the uterus, is an important factor in abdominal support.
2. Comparative anatomy and clinical research demonstrate the importance of the levator ani muscle in pelvic floor support.
3. The pelvic floor support is weakened by the passage through it of certain canals called "faults."
4. The vagina may and oftentimes does become a hernial canal.
5. This tendency is greatly increased by traumatism and to a less extent by congenital defects.
6. This tendency is further increased by increased intra-abdominal pressure, a displaced uterus, and a vertical vagina.
7. These hernias, when slight and incipient, should be treated by rest, lessening of intraabdominal pressure, by reducing fat, curing a cough, knee-chest positions, tampons, pessaries, etc.
8. When more extensive or when resisting treatment, the pelvic floor should be repaired, the cystocele should be reduced, the vagina made less vertical and the uterus put at an angle with the vagina or removed according to the condition of the uterus, age of patient, etc.
9. If hysterectomy is performed the stumps of ligaments should be united to the upper part of the vagina.
10. Two points should be observed in the herniotomy of the pelvic floor.
 - (a) The levator muscle should be reunited.
 - (b) Superficial vulvar structures should not be united, but left with the natural vulvar opening into the vagina, which may easily be accomplished by making the U-shaped incision at the lower end of the vagina instead of the usual incision in the labia majora.

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