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Da Costa

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1903

Modern Surgery - Chapter 27. Diseases and Injuries of the Abdomen - Hernias

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active when the spleen is diseased, and consequently are in full operation when such a spleen is removed. After partial splenectomy these conditions do not arise (Jordan). Changes can be prevented after splenectomy by the administration of tablets of extract of spleen and red bone-marrow (Ballance).

Abdominal Hernia or Rupture.—This condition is a protrusion of peritoneum containing at times or permanently any viscus or part of a viscus from the abdominal cavity. MacCormac says the term implies that the protruded viscus is covered with integument; hence a protrusion of viscera through a wound does not constitute a hernia. A hernia has three parts—the sac, the sac-contents, and the sac-coverings. The *sac* is formed of peritoneum. A congenital sac is due to developmental defect, and is found only in the inguinal or umbilical region. An acquired sac is due to intra-abdominal pressure bulging the peritoneal covering of an abdominal ring and converting it into a pouch. The sac comprises a body, a neck, and a mouth. A sac once formed is almost certain to persist, because it adheres by its outer surface to surrounding parts, and hence the sac of a hernia is usually irreducible even when the contents are reducible. The neck of the sac is due to the constriction through which the sac passes; it becomes furrowed and folded, and the adhesion of these folds causes thickening and rigidity. Hernia of the bladder or of the cecum may have no sac, or but a partial sac. The *contents of the sac* depend chiefly on the situation, a portion of the ileum being the usual contents. The colon, the stomach, the great omentum, the bladder, and other structures may enter the hernial sac. An *enterocele* contains only intestine; an *epiplocele* contains only omentum; an *entero-epiplocele* contains both omentum and intestine; a *cystocele* contains a portion of the bladder. The *coverings of the sac*, which vary with its situation, will be set forth during the consideration of special forms of hernia. In old herniæ the layers are never distinct, fat and muscle waste, tissues adhere, and the skin stretches and atrophies. The sac of an old hernia occasionally becomes tuberculous, and the disease may remain local in the hernial sac or spread to the general peritoneum. Renault tells us that *tuberculosis of a hernia* is made manifest by increase in size, pain on pressure, and loss of body-weight.

Causes of Hernia.—Hernia is a common trouble. According to Berger, in 1000 people 4.4 per cent. suffer from hernia. It occurs at all periods of life, and hereditary predisposition sometimes seems to exist. The male sex is three times as liable to hernia as the female sex. That increase of intra-abdominal tension is a common cause in children has been amply demonstrated. (See Hernia in Childhood, page 846.) Excessive length of the mesentery has been assigned as a cause. In some instances a mass of fat forms and advances before the hernia, and seems to bear a causative relation to it. Lucas-Championnière explains this as follows: when a person begins to take on fat, it is deposited not only under the skin, but also in the omentum, mesentery, and subperitoneal tissues. This semifluid fat is easily influenced by pressure. The deposit of fat within the abdomen lessens the size of that cavity, intra-abdominal pressure is increased, and fat protrudes at any weak spot in the wall. The protruding mass of fat adheres to and makes traction upon the peritoneum, and this membrane is drawn upon to form a sac, and the sac is surrounded by fat. This method of formation is frequently noticed in umbilical herniæ, and occasionally in inguinal herniæ.

Any laborious occupation predisposes to rupture. Any condition which weakens the abdominal wall predisposes (muscular relaxation from ill-health, relaxation of abdominal walls following the termination of pregnancy, the removal of a large tumor, or tapping for ascites, and wounds or abscesses of the abdominal wall). The common cause is repeated muscular effort which increases intra-abdominal tension (straining at stool, coughing, lifting weights, jumping, the sexual act, and straining to make water). The sac exists for a longer or shorter time before the hernia enters it. The sac of a congenital hernia is present at birth; the sac of an acquired hernia gradually forms. A sac may exist for years and yet remain empty. When bowel or omentum enters it from some strain or effort, the parts were long prepared to receive the extruded mass. This extrusion may occur gradually; it may occur suddenly. If it occurs suddenly, the sufferer believes that his hernia was formed then and there, but, as a matter of fact, the extrusion of bowel or omentum and its entrance into the sac are but the last of a long series of antecedent and preparatory changes. Finally, a hernia appears, and usually does so during effort. In rare cases, traumatism may cause a hernia immediately, no sac existing before the accident. It does so in the inguinal region by stretching or tearing the internal ring, the inguinal canal at once enlarging. Such a condition is a true traumatic hernia, traumatism being the sole cause and not simply the exciting cause.

The old and erroneous idea was that a hernia was always formed by tearing of the peritoneum; hence the term *rupture*. An ordinary non-traumatic hernia, when the bowel suddenly and for the first time enters the sac, is the seat of some pain, but the pain is not disabling and the lump disappears on recumbency. In many cases the bowel or omentum gradually finds a way into the sac, and in such cases pain is usually trivial and often absent. In true traumatic hernia there is violent pain, collapse, vomiting, inability to walk and stand, and the mass does not return to the belly on recumbency, but must be reduced by taxis or operation. All congenital herniæ are due to structural defects. Herniæ are divided clinically into *reducible*, *irreducible*, *incarcerated*, *inflamed*, and *strangulated*.

Reducible Hernia.—In this form of hernia the contents of the sac can be reduced into the abdominal cavity. At a known hernial opening the patient has a smooth enlargement (narrower above than below), which began to grow above and extended downward. A distinct neck can often be felt. In enterocele, straining, lifting, or standing enlarges the mass; the protrusion becomes smaller and may disappear on lying down; cough causes impulse or succussion; the protrusion is elastic, and may be tympanitic on percussion, and on reduction the mass suddenly disappears and there is a gurgling sound. In epiplocele the mass is often irregular and compressible, and feels boggy rather than elastic; muscular effort does not have much influence in enlarging it; impulse on coughing is slight; percussion gives a dull note, and reduction is accomplished gradually and produces no gurgling sound. In entero-epiplocele some parts of the mass are smooth, elastic, and tympanitic, others are dull on percussion, irregular, and flabby; but the diagnosis of this especial form is uncertain. The victims of reducible hernia complain of some pain on exertion, of dyspepsia, and often of constipation.

When a hernia is beginning to form there is often premonitory uneasiness. The patient complains of muscular pain in the lower abdomen, and this condition may exist for weeks before it is recognized that a hernia is present. An inguinal hernia can be recognized before it protrudes from the external ring. The tip of the finger is inserted in the ring and the patient is asked to cough. If a hernia has entered the canal, succussion will be detected on coughing. In a healthy man the external ring should admit the tip of the little finger, but not the end of the index-finger. If the end of the index-finger can be made to enter the ring, that aperture is dilated; and even if there is no hernia in the canal, in future a hernia will probably descend. In a man, if the surgeon desires to examine the ring, he inverts the skin of the scrotum over the finger and carries the finger to or in the ring. When the hernia first appears, there may be pain, faintness, and some sick stomach; but often there is no pain or any discomfort.

Treatment of Reducible Hernia.—Palliative Treatment.—Prevent constipation, forbid sudden strains and violent exercise, and order a truss. The continued employment of a truss in young persons may bring about a cure. The day truss should be applied before rising in the morning and be removed after lying down at night, when a light truss should be substituted. A special truss is applied before bathing. In very fat people there is always trouble in adjusting a truss. A femoral hernia is more difficult to keep reduced than an inguinal hernia. In a hernia in which the gut is replaceable, but a portion of omentum is irreducible, it is difficult to maintain reduction of the gut with a truss, and an operation should be performed. In an oblique inguinal hernia the pad of the truss fits over the internal abdominal ring; in a direct inguinal hernia, over the external abdominal ring; in a femoral hernia, over the femoral ring at the level of Gimbernat's ligament. MacCormac's method of measuring for a truss is as follows: in either inguinal or femoral hernia start the tape from the *lower part* of the hernial opening, carry it up to the anterior superior iliac spine of the same side, then take it around the body, one inch below the crest of the ilium, to the other anterior superior iliac spine, and then to the upper part of the hernial opening.* A well-fitting truss will keep the hernia up even when the patient sits in a position to relax the abdominal walls and coughs and strains. A truss is always uncomfortable at first, but a person usually becomes accustomed to it. It should be kept scrupulously clean, and borated talc powder should be dusted upon the skin under the pad at least once a day. A truss which does not keep the hernia up or which causes pain does harm. Too strong a spring tends to enlarge the hernial orifice, and thus aggravates the case. Even after an apparent cure with a truss the instrument must be worn for a long time.

Radical treatment seeks to permanently cure by plugging the mouth of the sac or by obliterating the canal of descent. Radical operations should be performed when a strangulated hernia is operated upon, in ordinary cases of reducible hernia in which a truss is very painful or does not keep the bowel up, in most cases of irreducible hernia, and in any case which has occasional attacks of obstruction. It used to be believed that a cure

* Treves's "Manual of Surgery," "Hernia."

would fail if the subject was under three years of age, but Coley and others have proved that it is a very successful operation in children. It is rarely recommended under the age of four, because in two-thirds of the cases a

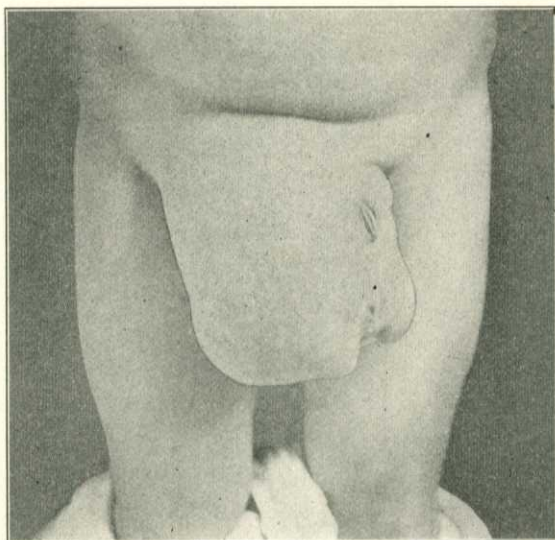


Fig. 448.—Inguinal hernia of large size (duration sixteen years).

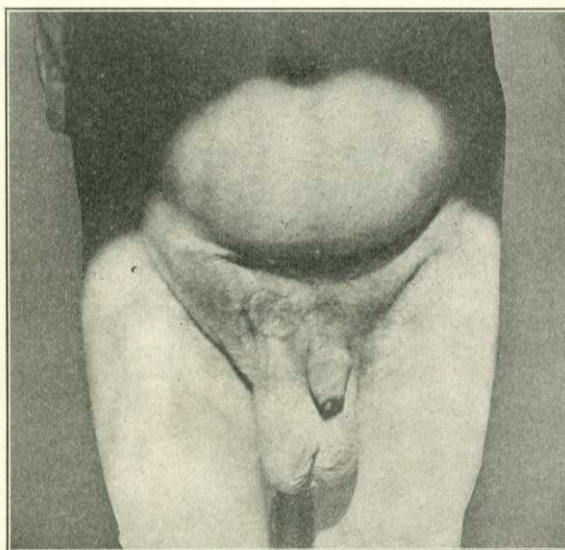


Fig. 449.—The case shown in figure 448, six months after operation.

truss will cure. It is advised after the age of four when a truss has failed, when there is irreducible omentum, or when there is a reducible hydrocele which prevents the truss from folding (Wm. B. Coley, in "Annals of Surgery,"

June, 1903). The radical operation is almost without danger in properly selected cases and is one of the most successful of surgical procedures. We are justified in doing the operation upon an individual under fifty years of age and free from complications, purely to relieve him or her from the annoyance of wearing a truss. If, however, a patient is sixty years of age or over, and a truss keeps the hernia up satisfactorily, the operation should not be performed unless it is demanded by some complication. Organic diseases of the heart, lungs, and kidneys are contraindications. Enormous herniæ are unfavorable for operation. Restoration is difficult or impossible, the forcible handling produces much shock, and recurrence is to be expected. Restoration is difficult or impossible because the abdominal cavity has contracted and holds with difficulty or cannot hold the huge hernia. As J. L. Petit said, the hernia has forfeited the right of domicile. In an operation for an enormous hernia a great quantity of omentum will require removal, and it may be necessary to resect a considerable piece of intestine. If we decide to operate upon an enormous hernia, treat the patient some time before with the object of making him lose flesh. The absorption of mesenteric fat lessens intra-abdominal pressure. That operation may succeed in such cases is shown by Figs. 448 and 449. In any operation for the radical cure of inguinal hernia always remember that the bladder may be part of the hernia, and be on the lookout for it. As a rule, it is covered with cellular fat, which differs in color and consistence from omental fat and from other fat which may be found about a hernia. It was the author's misfortune on two occasions to open a bladder in operating upon an inguinal hernia. In each case the bladder was sutured, and both patients recovered.

The success of an operation for the radical cure of a hernia depends upon the attainment of primary union. Primary union is favored by wearing gloves while operating; by cutting the parts with a sharp knife instead of tearing them with a dissector; by removing some fat and any superfluous tissue-fragments; by tying the stitches firmly, but not tightly (a tight stitch causes necrosis and creates a point of least resistance); by careful closure; by dressing with pressure; and by keeping the patient recumbent for three weeks.

A truss is not to be used after operation. Wm. B. Coley ("Annals of Surg.," June, 1903) has operated upon 1075 cases of inguinal and femoral hernia. In his report he does not consider operations performed within the last six months, and so presents a study of 1003 cases. Of these, 937 cases were inguinal, 66 cases were femoral. In the 1003 cases, 647 were traced and were found well from one to eleven years after operation; 705 were well six months to eleven years; 460 were well from two to eleven years. If the patient is well one year after operation he will probably remain well. This is proved by Coley's study of relapses, an investigation which shows that 65 per cent. of relapses occur within six months of operation and 80 per cent. within the first year. Only 13 $\frac{2}{3}$ per cent. occur from one to two years, and only 6 $\frac{2}{3}$ per cent. after two years. Coley had 2 deaths in 1075 cases (less than one-fifth of 1 per cent.). After Bassini's operation there are about 1 per cent. of relapses.

Lannelongue's Method.—Lannelongue has for certain cases returned to the old injection plan, using a 10 per cent. solution of chlorid of zinc instead

of white oak bark. The hernia is first reduced and is held up by an assistant who closes the internal ring with a finger, and also holds the cord aside. Several injections of 10 minims each are thrown in the region of the internal pillar, the region of the external pillar, and into the canal behind and outside of the cord. The surgeon must be careful that no zinc solution escapes into the subcutaneous tissue. The effect of the chlorid of zinc is to cause the formation of quantities of fibrous tissue. It is scarcely to be expected that a cure so produced will be permanent in an adult, though it may be in a child.

Macewen's Operation for Inguinal Hernia.—The instruments required in this operation are scalpels, a blunt, straight bistoury, a dry dissector, a grooved director, scissors, a hernia director (Fig. 450, B), hernia needles (Fig. 450, A), dissecting forceps, toothed forceps, hemostatic forceps, an aneurysm needle, blunt hooks, half-curved needles, needle-holder, and chromicized catgut sutures. The patient lies recumbent, the thigh

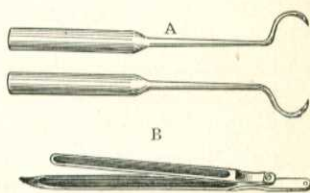


Fig. 450.—A, Hernia needles; B, hinged hernia director.

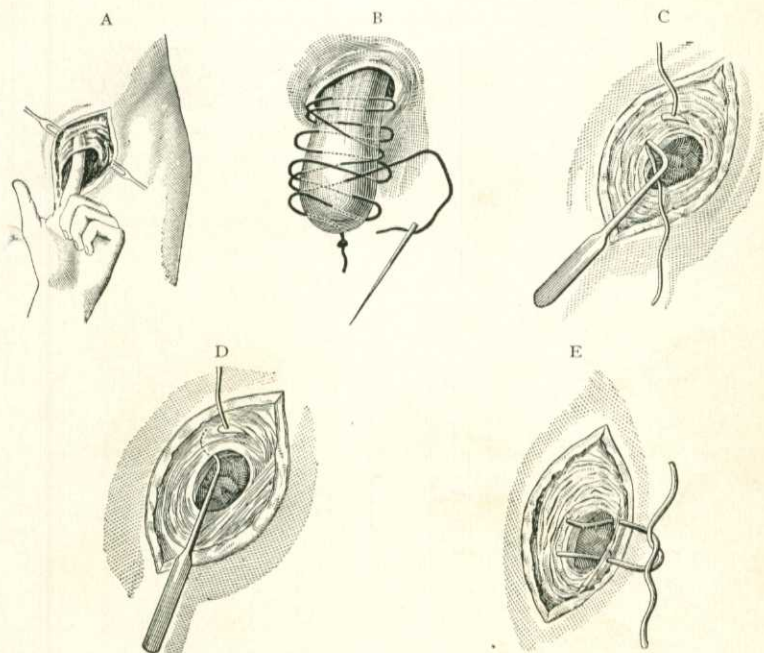


Fig. 451.—Macewen's operation for radical cure of inguinal hernia: A, Stripping of the sac; B, purse-string suture; C, fastening the purse-string suture; D, passing, and E, tying, the sutures for the internal ring.

being abducted and partly flexed and resting on a pillow beneath the knee. The bowel is reduced, and an incision three inches long is made in the direction of the inguinal canal; the center of the incision corresponding to the external ring. The sac is freed from its attachments below and is lifted up. The sur-

geon introduces a finger into the inguinal canal and separates the sac from the cord and from the walls of the canal, and then carries the finger through the internal ring and separates the peritoneum for one inch about the periphery of this aperture (Fig. 451, A). A chromicized catgut stitch is fastened to the lowest portion of the sac, and is passed through the sac several times, so that pulling on the stitch will purse the sac (Fig. 451, B). The free end of this stitch is carried through the internal ring into the belly, and is pushed out through the abdominal muscles one inch above the internal ring, the skin being pushed aside so as to escape perforation by the needle. The thread is tightened so as to fold up the sac and pull it into the belly. This plugs the ring (Fig. 451, C). The thread is handed to an assistant to keep tight until the sutures are introduced into the ring, when the sac is permanently anchored by taking several stitches in the external oblique muscle. A strong catgut suture is passed with a Macewen needle through the conjoined tendon from below upward, the ends of this suture being carried through Poupart's ligament and the outer border of the internal ring from within outward. This suture is tightened, and closes the internal ring. The external ring is sutured and the skin is stitched (Fig. 451, E).

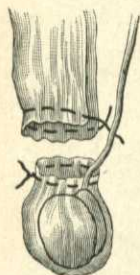


Fig. 452.—Macewen's operation for the radical cure of congenital hernia.

In congenital hernia the sac is divided in its middle, and the lower part is closed by stitches of chromic catgut, forming a tunica vaginalis. The upper part of the sac is slit posteriorly to permit the escape of the cord, and is closed by stitches of chromic catgut. The operation is finished as in the acquired form (Fig. 452). After Macewen's operation the patient should stay in bed for at least three weeks, and must not work for eight or nine weeks. Workmen after this operation should always wear for a time a pad and a spica bandage. Children require no pad. Never

apply a truss, as strong pressure will produce atrophy of the curative scar.

Bassini's Operation for Oblique Inguinal Hernia.—(See E. Wyllys Andrews, in "Med. Record," Oct. 28, 1899, who describes from personal observation how Bassini does his operation. I have drawn upon his description in the following section.) Bassini's operation displaces the spermatic cord from the old canal and places it in a new canal, and this new canal is oblique. The instruments employed are the same as for Macewen's operation, excepting the special needles, which are not needed. Curved and rounded needles are employed to insert the stitches. The suture material is kangaroo-tendon or chromicized catgut. Silk or silver wire is apt to make trouble—it may be long after the operation. The patient is placed supine with the thighs extended. An incision is made parallel to Poupart's ligament and extending from the external ring to a point external to the internal ring. The incision is about one and one-half inches above the ligament and is from five to seven inches in length. By this incision the aponeurosis of the external oblique and the pillars of the external ring are exposed. All bleeding is arrested, the aponeurosis is incised in the direction of its fibers and from above downward, and the inguinal canal is opened. The aponeurosis of the external oblique is dissected up with a blunt instrument until Poupart's ligament

is exposed. We speak of this ligament as the shelf. A mass containing the sac of the hernia, the cord, the cremaster muscle, and considerable fat is lifted up. Bassini employs blunt dissection. Coley advocates the use of the knife. Masses of fat and usually the cremaster muscle are removed. The sac is isolated first at its neck and the neck is stripped from the inner aspect of the internal ring for the distance of four-fifths of an inch. The object of this stripping is to permit the removal of the sac at a high level. High removal obviates the leaving of a funnel-shaped depression of peritoneum. Such a depression predisposes to relapse. The sac is opened at the fundus, the interior is investigated, and if the contents are reducible they are restored to the abdominal cavity and the neck of the sac is clamped high up. If adherent masses of omentum are found, the adhesions are separated, bleeding is arrested, and the omentum is restored to the abdomen unless it is in a hard and thick mass, when it is tied off and removed.

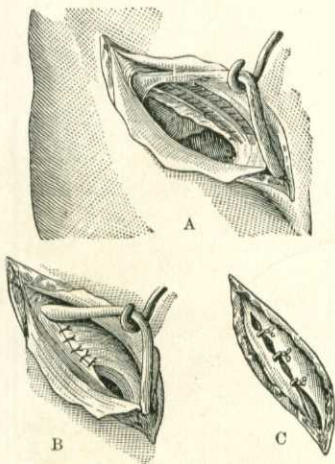


Fig. 453.—A-C. Bassini's operation for the cure of inguinal hernia.

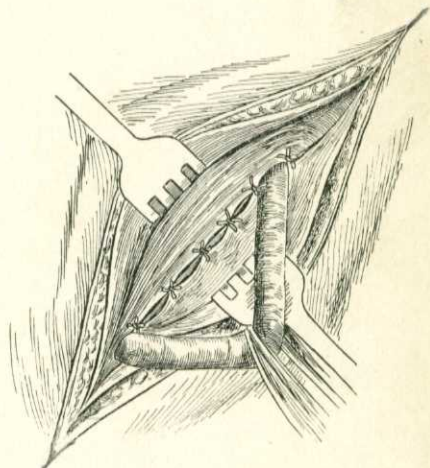


Fig. 454.—Bassini's operation (deep sutures), showing extra suture above the cord.

Bassini ties off the neck of the sac above the clamp with a strong ligature of silkworm-gut. If the sac is large and thick, he also threads both ends of a ligature upon a needle, passes the strand through the stump, and ties around over the first loop. (See E. Wyllys Andrews, "Med. Record," Oct. 28, 1899.) Dr. Coley and many other operators prefer to tie off the sac with a catgut suture rather than with silkworm-gut or silk. It is my usual custom to employ black silk, catching it to prevent slipping by running a stitch through the wall of the neck of the sac. After ligating the neck of the sac the sac is cut across and removed. The cord is now lifted out of the way (Fig. 453, A), the inner surface of Poupart's ligament is exposed by retraction, and the deep sutures are passed (Fig. 453, B). Bassini uses silk which has been boiled in glycerin. Most American operators use kangaroo-tendon or chromic catgut. The sutures nearest to the pubes are inserted first. The first suture—and sometimes also the second—includes part of the rectus sheath and rectus muscle. Each stitch includes the internal oblique and transversalis

muscle in the upper edge and the shelf of Poupart's ligament below the lower margin, and from four to six stitches are passed behind the cord. The last stitch narrows the internal ring so that it fits tightly around the cord (E. Wyllys Andrews, "Med. Record," Oct. 28, 1899). Coley's rule for passing this suture is to insert it so "that it just touches the lower border of the cord when the latter is brought vertically to the plane of the abdomen" ("Annals of Surgery," June, 1903). Coley always places a suture above the cord, and believes it tends to prevent relapse (Fig. 454). The sutures are tied from above downward. The cord is laid upon this new floor and the aponeurosis of the external oblique is sutured over it. Coley uses a continuous suture of fine kangaroo-tendon and closes the skin with interrupted sutures of catgut. Drainage is not used. The wound is covered with a roll of

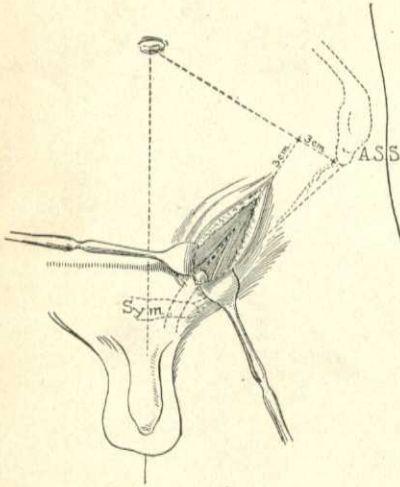


Fig. 455.—The skin incision, retractors in the lower angle of the wound dislocating the opening in the skin and subcutaneous fat downward, exposing the aponeurosis of the external oblique and external ring. The dotted line within the wound represents the direction of the division of aponeurosis of external oblique (Bloodgood).

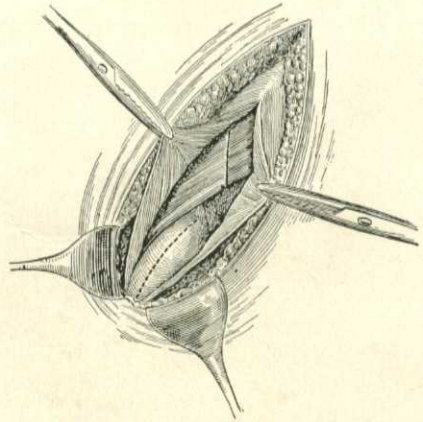


Fig. 456.—The aponeurosis of external oblique has been divided and retracted, uncovering the internal oblique muscle and inguinal canal. The lines on the muscle represent the direction and extent of the division. The dotted line in the inguinal canal is the direction and extent of the division of the coverings of sac (Bloodgood).

iodoform gauze and some pieces of sterile gauze, and compression is made by strips of adhesive plaster, and a piece of adhesive plaster run from one thigh to the other acts as a shelf for the testicles to rest upon. The adhesive plaster is overlaid with dry gauze, and this is covered with absorbent cotton and the dressing is retained in place by a firm spica of the groin (Coley's dressing). The wound is dressed on the seventh day and the patient is kept in bed for two weeks and is allowed to get about in two and one-half weeks to three weeks, wearing a bandage until four weeks after operation.

In this operation some surgeons treat the sac as in Macewen's operation, carrying out the rest of the procedure as directed above. In a pure Bassini operation the funnel-shaped depression in the peritoneum as the point of emergence of the cord may remain and predispose to hernia, but the use of Macewen's plan for treating the sac obviates this.

Halsted's Operation (as described by J. C. Bloodgood, in "Johns Hopkins Hosp. Reports," vol. vii).—The skin incision is not parallel to Poupart's ligament, but at an angle of 25 degrees to it (Fig. 455). Poupart's ligament is well exposed to within 2 cm. of the pubic spine. The aponeurosis of the external oblique muscle is divided. Free the lower border of the internal oblique muscle and divide the edge of the muscle at a right angle to its fibers (Fig. 456), and as far as possible from the linea semilunaris. The coverings of the sac near the neck are picked up with mouse-toothed forceps and are divided. The division of the fasciæ is continued from the neck of the sac downward toward the pubes. The sac is then lifted from the inguinal canal and it brings with it "the larger bundle of veins and the vas deferens" (Fig. 457). The sac is separated from the veins and the vas with a knife or scissors, and the separation is carried

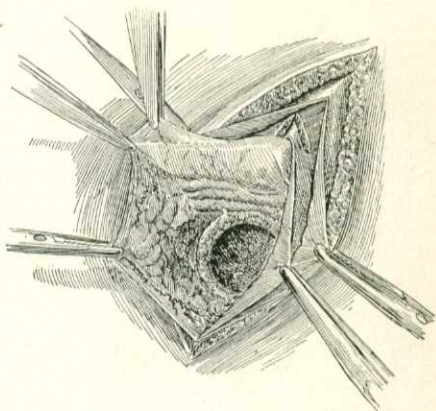


Fig. 457.—The internal oblique muscle and the coverings of the sac have been divided, the sac with the veins and vas deferens are drawn out of the wound preparatory to the excision of the sac and the ligation and excision of the veins (Bloodgood).

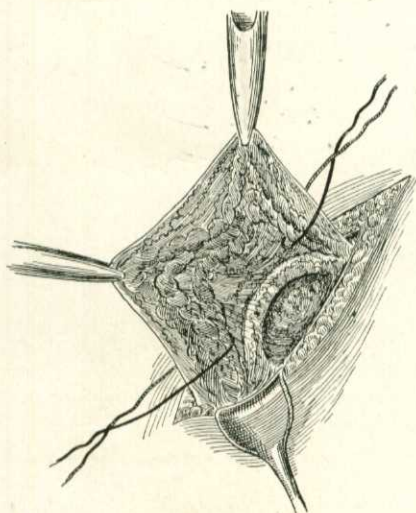


Fig. 458.—The method of excision of veins in operations for hernia and varicocele. The vas deferens and its "immediate" vessels and the mesocord have not been disturbed (Bloodgood).

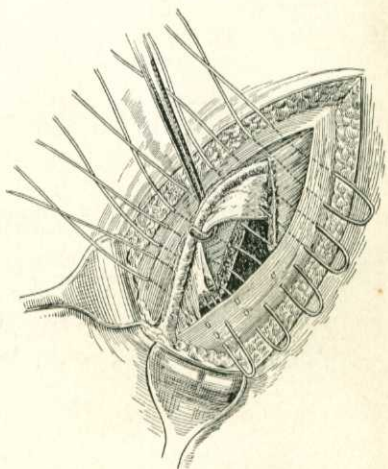


Fig. 459.—The insertion of the deep silver wire sutures, one above and four below the cord. The veins have been ligated and excised. The mesocord has been torn gently in its center only (Bloodgood).

to and beyond the neck of the sac. In "certain cases the larger bundle of veins is separated from the vas deferens, ligated and excised" (Fig. 458). Whether

the veins are excised or not, the sac is opened, its contents reduced, the opening

into the peritoneal cavity closed with a continuous silk suture, and the excess of sac excised. During the entire operation the vas and its vessels "should be handled very little, and should not be torn from their bed in the inguinal canal." Every point of bleeding should be ligated. At this stage the vas is gently picked up and a blunt-pointed hook is used to tear the mesocord. The freed vas is lifted into the upper angle of the divided internal oblique muscle, and is held there until the sutures are inserted. The deep sutures of silver wire are next inserted. Usually five are needed. The upper one is passed first. These sutures are shown in Fig. 459. The cord emerges from the cut in the internal oblique muscle between the first and second sutures. Sutures No. 1 and No. 2 pierce the mesocord, but care is taken to see that they do not in-

jure the vas or its vessels. Each suture is drawn upon and twisted about six times. The cut twisted ends are caught with forceps and turned in. The skin-wound is closed with a subcuticular stitch of silver wire. It is covered with silver foil and dry gauze, and often a plaster-of-Paris bandage and splints are used, "the splints extending from just above the knee to near the costal margins."

Halsted's Operation plus Bloodgood's Method of Transplanting the Rectus Muscle.—(See Jos. C. Bloodgood, in "Johns Hopkins Hosp. Reports," vol. vii.) When the conjoined tendon is very thin or obliterated, the ordinary operation is not enough. Insufficiency of the conjoined tendon is known to exist when a finger does not meet any obstruction after passing through the external abdominal ring, but can be in-

jured the vas or its vessels. Each suture is drawn upon and twisted about six times. The cut twisted ends are caught with forceps and turned in. The skin-wound is closed with a subcuticular stitch of silver wire. It is covered with silver foil and dry gauze, and often a plaster-of-Paris bandage and splints are used, "the splints extending from just above the knee to near the costal margins."

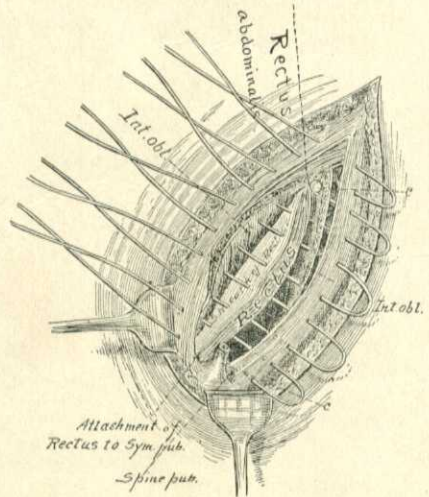


Fig. 461.—The transplanted rectus included by the deep sutures. In this illustration the cord has been excised in order to demonstrate the operation more clearly (Bloodgood).

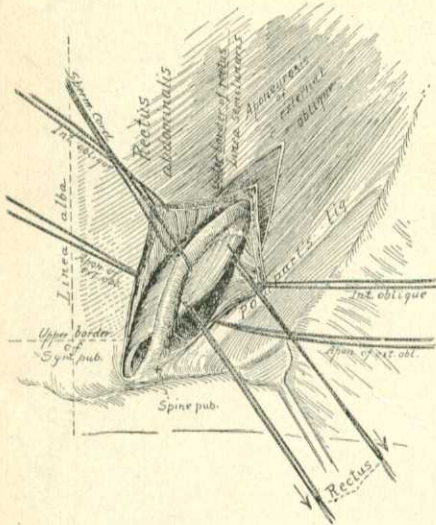


Fig. 460.—The method of transplanting the rectus muscle. The sac has been excised and the peritoneal cavity closed; internal oblique muscle has been divided, the rectus exposed and transplanted; at this stage the wound is ready for the deep sutures. This illustration shows how perfectly the transplanted rectus muscle lines the lower half of the wound (Bloodgood).

troduced for some distance into the abdominal cavity (Bloodgood). To meet this condition of affairs, Bloodgood devised "a plastic operation on the rectus muscle, bringing this muscle down and suturing it with the other available tissue to Poupart's ligament and to the aponeurosis of the external oblique from the arch of the pubis up to the position of the transplanted cord" (Bloodgood, in previously mentioned report). The first steps of the operation are identical with those previously described, but before the insertion of the deep stitches the rectus sheath is exposed and divided in the direction of the muscle-fibers, from the pubic insertion upward for 5 cm. The muscle bulges from the cut and is caught with silk sutures (Fig. 460). Deep sutures are now introduced as in Halsted's operation, except that they include the rectus and its sheath (Fig. 461). The operation is completed as is Halsted's. I have performed this operation a number of times with entire satisfaction.

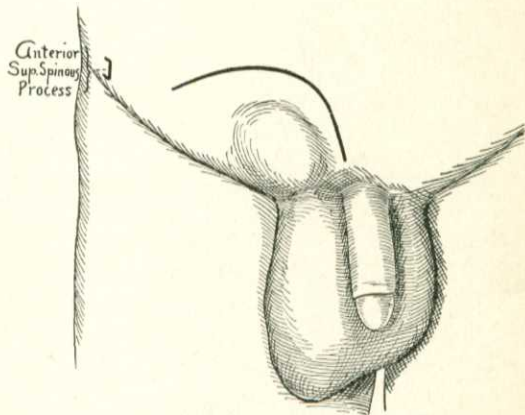


Fig. 462.—Ferguson's operation: The semilunar skin incision (" Jour. Am. Med. Assoc.").

Kocher's Operation.—Kocher exposes the aponeurosis of the external oblique, makes a small incision through the aponeurosis above and external to the internal ring, and draws the sac through this incision and sutures it in place.

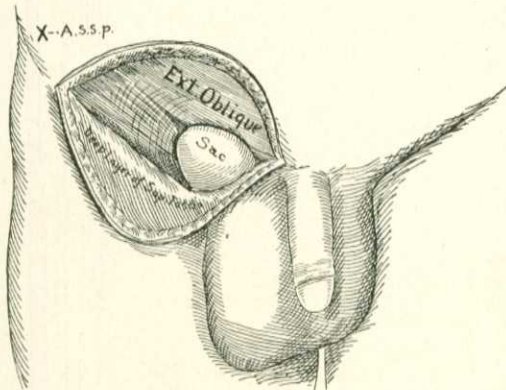


Fig. 463.—Ferguson's operation: Flap turned back exposing the aponeurosis and the sac of the hernia (" Jour. Am. Med. Assoc.").

Fowler's operation is as follows: an incision is made parallel with Poupart's ligament from the spine of the pubis to the level of the internal ring, and a flap is turned up. The inguinal canal is opened and the sac and cord isolated. The sac is opened, its contents reduced, it is cut off, and

its edges grasped with forceps. The deep epigastric artery and vein are sought for, each is tied in two places and divided between the ligatures. The index-finger is introduced into the belly, and on this as a guide the floor of the canal is divided (transversalis fascia, subserous tissue, and peritoneum). The cord is placed in the peritoneal cavity. The edges of the opening are

sutured so that broad serous surfaces are approximated, through-and-through sutures being passed from side to side. The cord is brought out at the inner end of the incision, the lower angle of the cut being at such a level that the cord curves upward and forward as it leaves the abdomen. The inguinal canal, the gap in the aponeurosis, and the skin-wound are closed.*

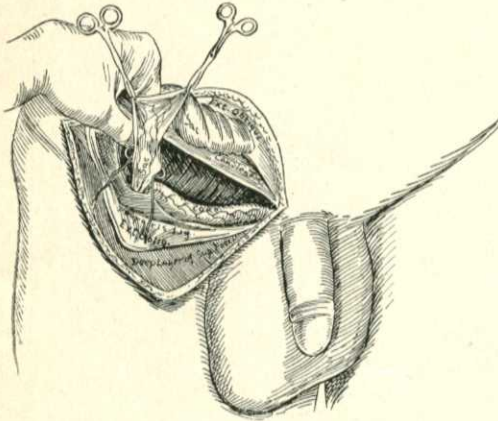


Fig. 464.—Ferguson's operation: Dealing with the sac and its contents ("Jour. Am. Med. Assoc.").

Ferguson's Operation.—In studying a number of recurrences after operation, A. H. Ferguson observed that a hernial protrusion is apt to return at the upper and outer portion of the scar, above the cord and near Poupart's ligament. When he operated upon relapsed cases, he discovered a slit of the aponeurosis of the external abdominal wall, through which the sac and some fat protruded. In order

to determine the cause of the failure of these operations, he thought it proper to make a semilunar incision, and raise a flap of skin, fascia, and aponeurosis of the external oblique. On doing this, he was surprised to find an angle between the lower border of the internal oblique muscle and the inner aspect of Poupart's ligament absolutely unprotected by the internal oblique or the transversalis muscle.

In some cases this angle extended upward and outward to the anterior superior iliac spine. He therefore determined positively that the cause of a rupture's returning in this angle after an operation for radical cure is deficient origin of the internal oblique muscle and of the transversalis muscle at Poupart's ligament. He is now persuaded that in all cases of hernia there is a deficient origin of these

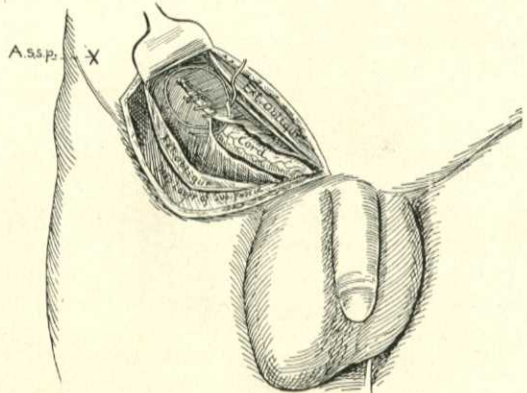


Fig. 465.—Ferguson's operation: Suture of the slack in the transversalis fascia ("Jour. Am. Med. Assoc.").

muscles, and he has demonstrated the same thing in a series of dissections in the inguinal region. Ferguson describes his operation as follows ("Jour. Am. Med. Assoc.," July 1, 1899): He begins his incision over Poupart's

* Annals of Surgery, Nov., 1897.

ligament, an inch and a half below the anterior superior iliac spine, carries it inward and downward in a semilunar curve, and terminates it over the conjoined tendon, near the pubic bone. This incision goes down to the aponeurosis of the external oblique, and the flap, with its fat and fascia, is turned downward and outward (Figs. 462 and 463). The next step is to incise the external abdominal ring to the intercolumar fascia and separate the longitudinal fibers of the external oblique over the inguinal canal to beyond the internal ring, at a point nearly opposite the anterior superior spine of the ilium. Any transverse fibers that may be encountered are severed. The separated aponeurosis of the external oblique muscle is then retracted. One has then brought into view the contents of the inguinal canal, the hernial sac and its adhesions, the spermatic cord, the ilio-inguinal nerve, the internal abdominal ring, the subserous fat, the cremaster muscle, the conjoined tendon, the internal oblique and its deficient origin at Poupart's ligament, the transversalis fascia, and the internal surface of Poupart's ligament. The sac is now dissected from the cord and the internal ring. It is opened and its contents are inspected and properly dealt with. It is tied high up and cut off, and the stump is dropped into the abdomen (Fig. 464). If the sac is congenital it is divided into two parts; the distal portion is used to make a tunic for the testicle, and the proximal portion is treated as above directed. The cord is not disturbed, and it is beyond doubt that Ferguson is right in saying that the testicle frequently comes to harm after operations that disturb the cord. The veins in the cord should

not be touched, unless a varicocele also exists. Any excessive quantity of subserous adipose tissue should be removed. The next step in the operation is to restore the structures to their normal position; and one should remember that in the transversalis fascia is the internal ring. In hernia the internal ring is large and the transversalis fascia bulges outward; one must, therefore, take up the slack in this fascia and make a well-fitting ring for the cord, by means of a catgut suture, either interrupted or continuous (Fig. 465). After this has been accomplished, the internal oblique and transversalis muscle are sutured to the internal aspect of Poupart's ligament, after the lower borders of the muscles have been freshened and Poupart's ligament has been scarified. The sutures must be carried two-thirds of the way down Poupart's ligament, which is about the normal origin of this muscle in the female (Fig. 466). The next step is to suture the edges of the divided aponeurosis of the external oblique; this restores the external abdominal ring. The skin-flap is then carefully sutured.

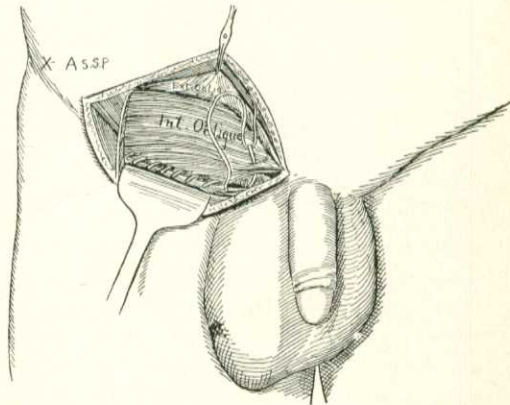


Fig. 466.—Ferguson's operation: Suture of the internal oblique and of the transversalis muscle to the internal aspect of Poupart's ligament (" Jour. Am. Med. Assoc.").

be touched, unless a varicocele also exists. Any excessive quantity of subserous adipose tissue should be removed. The next step in the operation is to restore the structures to their normal position; and one should remember that in the transversalis fascia is the internal ring. In hernia the internal ring is large and the transversalis fascia bulges outward; one must, therefore, take up the slack in this fascia and make a well-fitting ring for the cord, by means of a catgut suture, either interrupted or continuous (Fig. 465). After this has been accomplished, the internal oblique and transversalis muscle are sutured to the internal aspect of Poupart's ligament, after the lower borders of the muscles have been freshened and Poupart's ligament has been scarified. The sutures must be carried two-thirds of the way down Poupart's ligament, which is about the normal origin of this muscle in the female (Fig. 466). The next step is to suture the edges of the divided aponeurosis of the external oblique; this restores the external abdominal ring. The skin-flap is then carefully sutured.

Radical Cure of Umbilical Hernia.—The results of operations for umbilical herniæ have not been satisfactory. Recurrences are frequent. This

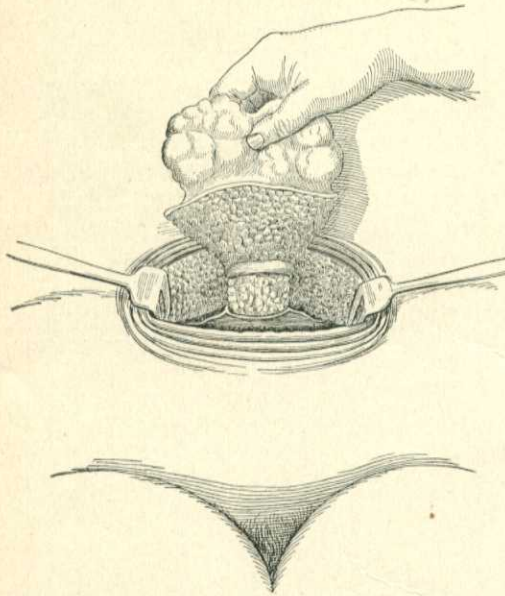


Fig. 467.—Mayo's operation for the radical cure of umbilical hernia. Exposure of hernia and lateral incisions.

is probably due to the fact that most of the subjects are fat, and that the muscles are thin and flabby. The usual operation may be thus described: Make an elliptical incision through the skin around the mass. Endeavor to separate the sac from the superficial tissues. If this cannot be done, open the sac and separate it from the contents. Even if the sac can be stripped from the skin, always open it and separate the contents. Return any bowel which may be present, and do not forget that there may be a small portion of bowel completely encased in omentum. Tie into segments and cut off the superfluous omentum and return the stump into the belly. Excise the umbilicus (omphalectomy). Suture the peritoneum with a continuous catgut suture. Close the musculofascial wall with two layers of interrupted kangaroo-tendon sutures or one layer of silver wire mattress sutures. Close the skin by interrupted sutures of silkworm-gut or a subcuticular stitch.

Mayo's Operation.—This is a distinct improvement on the older operation. Mayo believes that the defect in the old operation is that the recti muscles are naturally separated at the level of the umbilicus and in bringing the recti together we have virtually performed muscle transplantation, and these thin muscles are of no great value in preventing relapse, and in a large hernia it is not even possible to cover the gap by muscle. Mayo now operates as follows: Transverse elliptical incisions are made around the umbilicus and hernia and the base of the protrusion is exposed (Fig. 467). The surface

is probably due to the fact that most of the subjects are fat, and that the muscles are thin and flabby. The usual operation may be thus described: Make an elliptical incision through the skin around the mass. Endeavor to separate the sac from the superficial tissues. If this cannot be done, open the sac and separate it from the contents. Even if the sac can be stripped from the skin, always open it and separate the contents. Return any bowel which may be present, and do not forget that there may be a small portion of bowel completely encased in omentum. Tie into segments and cut off the

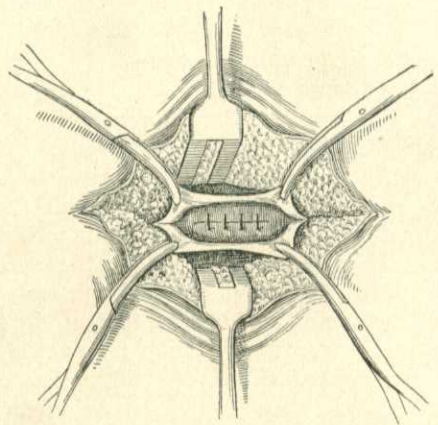


Fig. 468.—Mayo's operation for the radical cure of umbilical hernia. Peritoneum sutured.

of the aponeurosis is cleared for one and one-half inches around the neck of the sac. The fibrous and peritoneal coverings of the hernia are divided by a circular incision around the neck of the sac. Intestine is freed from

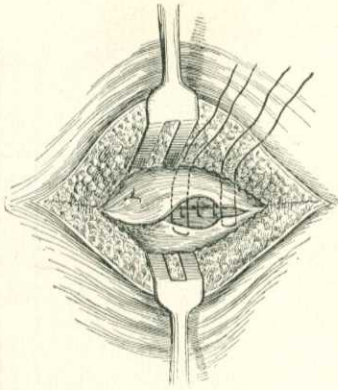


Fig. 469.—Mayo's operation for the radical cure of umbilical hernia. Aponeurosis sutured.

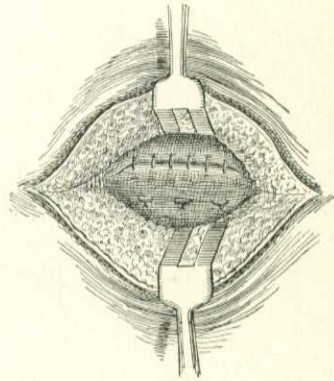


Fig. 470.—Mayo's operation for the radical cure of umbilical hernia. Aponeurosis sutured second time with gut sutures.

adhesions and placed within the abdomen. Omentum is ligated and removed with the sac. The margins of the ring are grasped and overlapped in order to indicate in which way it can be most easily done. Thus

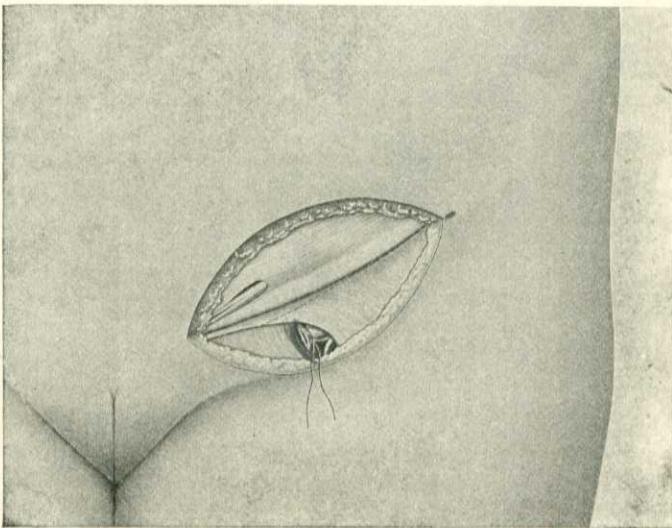


Fig. 471.—Fabricius's operation for the radical cure of femoral hernia. Neck of sac shown. Sac cut away. Dotted line shows line of separation of Poupart's ligament and fascia lata (Fowler).

is the direction of the closure indicated. An incision is made through the fibrous and peritoneal coverings of the ring, one inch or more transversely on each side, and the peritoneum is stripped from the under surface of the

upper flap. Several mattress sutures of silver wire are introduced one inch above the edge of the upper flap and are carried through the margin of the

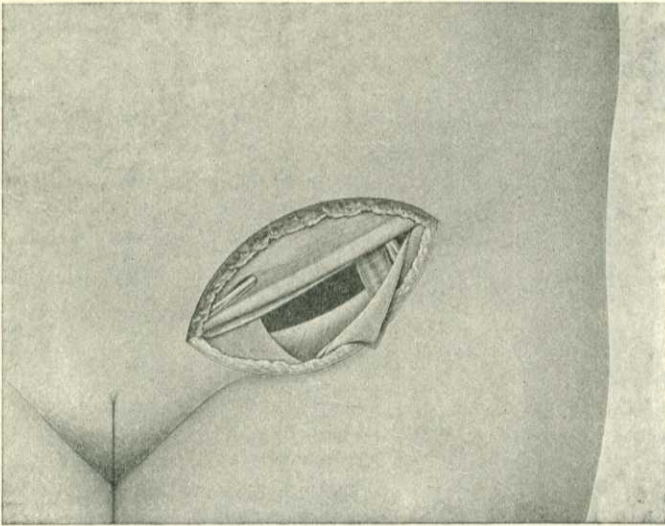


Fig. 472.—Fabricius's operation for femoral hernia. Fascia lata turned back, exposing crural sheath and origin of pectineus muscle (Fowler).

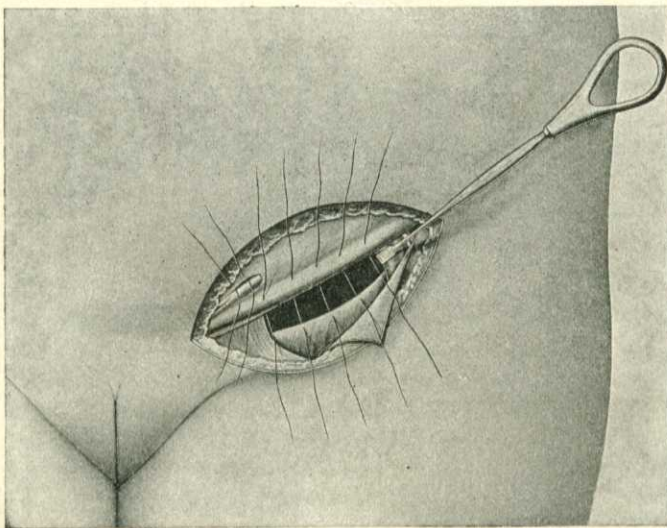


Fig. 473.—Fabricius's operation for femoral hernia. Crural sheath and vessels retracted and kangaroo-tendon sutures applied to Poupart's ligament and origin of pectineus, ready for tying. Two sutures are placed in position to approximate the pillars of the external ring (Fowler).

lower flap; sufficient traction is made to permit of the closing of the peritoneum with a continuous catgut suture (Fig. 468). When this has been accomplished, the silver wire sutures are drawn so as to slide the lower flap into

the pocket between the peritoneum and the under surface of the upper flap (Figs 469 and 470). The free margin of the upper flap is fixed by catgut sutures to the aponeurosis and the superficial incision is closed as usual.

Radical Cure of Femoral Hernia.—Cheyne ligates the neck of the sac, stitches the stump to the abdominal wall, dissects out a flap from the pectineus muscle, stitches this flap to Poupart's ligament and to the abdominal wall, and thus fills up the crural canal. Bassini makes an incision parallel with Poupart's ligament, ties the neck of the sac, cuts below the ligature, and returns the stump into the belly. He attaches by deep sutures Poupart's ligament to the pectineal aponeurosis as high up as the pectineal eminence, the cord or round ligament being drawn out of the way. Superficial sutures are passed between the pubic portion and the iliac portion of the fascia lata.

The Operation of Fabricius.—The operation of Fabricius is very satisfactory. It is performed as follows: An incision is begun over the pubic spine and is carried outward for five inches parallel with Poupart's ligament. The sac is exposed, isolated, and opened, and its contents are reduced, its neck is ligated, the sac is cut off, and the stump is dropped back (Fig. 471). An incision is now made below Poupart's ligament so as to separate this structure and the fascia lata, and the flap of fascia is turned down (Fig. 472). The crural sheath and the vessels are retracted outward. The surgeon is careful not to injure the obturator artery and vein. The origin of the pectineus muscle is sutured to Poupart's ligament. The lower stitches include the periosteum of the horizontal ramus of the pubes as well as the beginning of the muscle (Fig. 473). Care must be taken in passing some of them to avoid injuring the deep epigastric vessels. When these stitches are tied the femoral canal is obliterated. The flap of fascia lata is sutured to the aponeurosis of the external oblique, and the skin is sutured.

Irreducible Hernia.—The swelling in irreducible rupture presents the usual evidences of hernia, shows an impulse on coughing, but cannot be replaced in the abdomen. Sometimes a portion is reducible and a portion is irreducible. A hernia may become irreducible because of the size of the mass, because of adhesions, or because of excessive growth of omental fat. An irreducible hernia is liable to be bruised and to cause much distress and pain, and is always a menace to life because of the danger of obstruction and strangulation. It was formerly the custom to support a small irreducible hernia by a hollow padded truss, but at present operation is advised. A large hernia of this variety, if operation is refused, must be carried in a bag truss. The patient must not take very active exercise, must keep the bowels regular, and must live upon a plain diet. Most cases of irreducible hernia should be treated by operation.

Incarcerated or Obstructed Hernia.—Obstruction takes place by the damming of feces or of undigested food, the fecal current being arrested, but the blood-current in the wall of the bowel being undisturbed. Incarceration is commonest in irreducible hernia, umbilical hernia, and during the existence of constipation. The hernia enlarges and becomes tender, painful, and dull on percussion; pressure diminishes it in size; it is irreducible, but still presents impulse on coughing. The abdomen is somewhat distended and painful; there are nausea, constipation, and not unusually slight vomiting. Constitutional disturbance is trivial and constipation is not absolute,

gas at least usually passing. Vomiting is not fecal. The *treatment* is rest in bed in a position to relax the belly, an ice-bag over the hernia, and a little opium for pain. Do not give a particle of food for twenty-four hours; when the active symptoms subside give an enema, and after this acts a dose of castor oil. Do not employ taxis, as bruising the bowel may produce strangulation. If improvement does not rapidly occur, operate. Prompt operation saves the patient from the danger of strangulation and cures the hernia.

Inflamed Hernia.—Inflammation of a hernia is local peritonitis due to injury of an irreducible hernia. The mass becomes tender, painful, and hot. In enterocele much fluid forms; in epiplocele the mass becomes hard. The hernia cannot be reduced; there is constipation, often vomiting, usually fever, but the mass still shows impulse on coughing. Vomiting is not fecal. Some gas is usually passed through the bowels. Constitutional symptoms are slight. The *treatment* usually recommended is rest in bed with abdominal relaxation, an ice-bag to the tumor, a small amount of opium by the mouth if pain is severe, an enema, and, after this acts, a saline. In an inflamed hernia there is great danger of strangulation, and operation should be performed in preference to relying upon the conservative plan.

Strangulated hernia is a condition in which, if the hernia contains bowel, not only is the fecal circulation arrested, but the circulation of blood in the bowel-wall is also arrested. The bowel is irreducible and obstructed, and the blood ceases to circulate. If the hernia contains omentum, the omental vessels are tightly constricted. Strangulation is commonest in old inguinal ruptures in active, middle-aged men, and is more frequent in enteroceles than in epiploceles. It may be due to entry into the sac of more intestine or omentum, which has been forced down by sudden movement or violent effort. It may be due to active peristalsis or to congestion, and it may arise from inflammation or from incarceration. The constriction is usually at the neck of the sac, in the outside tissues, or even in the sac itself. In an hour-glass hernia the constriction is in the body of the sac. Adhesions within the sac may cause strangulation. Spasmodic contraction of the tissues about the neck of the sac is an exploded hypothesis. When strangulation once begins the hernia swells, a furrow forms on the bowel at the seat of constriction, the bowel and omentum below the constriction become deeply congested and edematous, and, finally, the hernia passes into a state of moist gangrene. The gangrene may be in spots or the entire mass may be gangrenous. The sac is apt to inflame, and inflammation furnishes fluid and lymph; serum accumulates in the sac, being first clear, then bloody, and finally brown and foul. When gangrene is once established the bowel is in danger of rupturing. At the point of contraction there may be a line of ulceration. A strangulated femoral hernia becomes gangrenous more rapidly than does a strangulated inguinal hernia.

Symptoms.—This condition is sometimes preceded by diarrhea and uneasiness or pain about the hernial orifice. When strangulation begins, the victim is seized with pain in and about the hernia and with violent colicky pain about the umbilicus, and the paroxysms of colic become more and more frequent, until finally the pain may become continuous. The hernia is found to be irreducible; larger than usual, tender, painful, dull on per-

cussion, without impulse on coughing, and the skin above it may be reddened. Eructations of gas are frequent and generally uncontrollable vomiting and prostration come on. Vomiting, as a rule, is an early symptom, and one which increases in severity. Occasionally it only follows the swallowing of liquids. Not unusually there is retching rather than vomiting. In rare cases vomiting does not begin for twenty-four to forty-eight hours. During the course of a strangulation vomiting may cease for a day or more, and it not unusually ceases toward the end, when prostration is profound. The early vomiting is due to reflex causes; the later vomiting is due to waves of peristalsis which produce regurgitation (Macready). The vomiting is first of the alimentary contents of the stomach, next of mucus and bilious matter, and finally of the contents of the small bowel (fecal or stercoraceous vomiting). Stercoraceous vomiting rarely arises until strangulation has lasted forty-eight hours, and may not appear until much later. "It is seldom met with in inguinal, more often in femoral, and more often still in obturator hernia" (Macready). Prostration is a marked symptom of a strangulated hernia, and it increases hour by hour and goes on to collapse. Early in the case there may be some elevation of temperature, but later it becomes normal or subnormal. The pulse is small, irregular, rapid, and very weak; the extremities cold; the face Hippocratic. Constipation is absolute, no gas even being passed, though in the very beginning there may be some diarrheal passages from below the constriction. The urine is scanty and high-colored, and contains only a small amount of the chlorids; the tongue becomes dry and brown; the thirst is torturing; and the patient often has an urgent desire to go to stool. Pains in the abdomen and in the hernia become more and more violent, and collapse rapidly increases. When gangrene begins the symptoms apparently lessen in violence: there is a "delusive calm." Vomiting usually ceases, though regurgitation may take its place; hiccough begins; the pain abates or disappears; the pulse becomes very feeble and intermittent; collapse deepens, and delirium is usual. It is a safe clinical rule that in strangulated hernia cessation of pain without the relief of constriction, the disappearance of the lump, or the use of opiates means that gangrene has begun. In some cases of strangulation there are muscular cramps in the legs (Berger). In children convulsions are not unusual. In a pure omental hernia strangulation produces similar but less decided symptoms. It may be that only a portion of the circumference of the bowel is caught and constricted in a hernial orifice. Such a condition is encountered occasionally in the femoral ring, and is called partial enterocele or Richter's hernia. The name Littre's hernia is often wrongly given to this condition. What Littre described was a hernia of Meckel's diverticulum. In a strangulated Richter's hernia constipation is rarely absolute and a protrusion is often undiscovered.

Treatment.—In treating strangulated hernia place the patient upon his back, bend the knees over a pillow, and rigidly interdict the administration of food. An attempt is to be made to effect reduction by gentle manipulation or taxis. In applying taxis to a femoral or inguinal hernia, flex and adduct the thigh of the affected side. In applying taxis to an umbilical hernia, both thighs should be flexed upon the abdomen. Always lower the shoulders and head and raise the pelvis, and accomplish this by lifting the foot of the

bed and placing pillows under the pelvis. In some cases raise the entire body and lower the head. Grasp the neck of the sac with the fingers and thumb of one hand, and employ the other hand to squeeze the hernia and urge it toward the belly. In direct inguinal hernia the pressure should be backward and a little upward; in umbilical hernia it should be backward; in oblique inguinal hernia it should be upward, outward, and backward; in femoral hernia it should be downward until the hernia enters the saphenous opening, and then "backward toward the pubic spine" (McCormac). If the bowel is reduced, it passes from the hand with a sudden slip and enters the belly with an audible gurgle; omentum, when reduced, slowly glides back without gurgling. Taxis is never to be continued long, and it is not even to be attempted in cases of great acuteness, in cases where strangulation has lasted for several days, in cases known to have been previously irreducible, in cases associated with stercoraceous vomiting, or in inflamed or gangrenous hernia.

If taxis fails, obtain the patient's permission to operate. Anesthetize; try taxis again while ether is being dropped upon the hernia to cause cold; if reduction fails, at once perform herniotomy. Taxis possesses certain dangers: It may rupture the bowel; it may rupture the neck of the sac and force the bowel through the rent; it may strip the peritoneum from around the hernial orifice and force the bowel between the detached peritoneum and the abdominal wall; it may reduce a hernia into the belly when the bowel is still strangulated by adhesions; it may reduce the hernia *en masse* or *en bloc*, the sac and strictured bowel being forced together through the internal ring. By reduction *en bissac* is meant the forcing of a congenital hernia into a congenital pouch or diverticulum. In any of the above accidents strangulation may persist after apparent reduction by taxis, and this condition calls for instant laparotomy—in most instances through the hernial aperture. If taxis is successful, put the patient to bed, apply a pad and bandage, allow no food until vomiting ceases, merely permit him to suck bits of ice, and keep him on a liquid diet for several days. At the end of the first week give solid food. Do not disturb the bowels for a few days, but if they have not acted when four or five days have elapsed since the operation, give a saline cathartic and an enema.

Herniotomy.—If there has been stercoraceous vomiting, the stomach must be washed out before giving the anesthetic, and during the administration of the anesthetic the head should be turned upon its side. In most cases a general anesthetic can be given, but in some desperate cases it is not justifiable to give ether or chloroform, and a local anesthetic must be used (eucain, cocain, or Schleich's fluid). Wrap the patient up in blankets. In most cases try gentle taxis for a brief time after the patient has been anesthetized, and while ether is being dropped upon the hernia to cause cold. Never try taxis if stercoraceous vomiting has occurred. If taxis fails, at once sterilize the parts and operate. The instruments required in herniotomy are a scalpel, a hernia knife and director (Fig. 450, B), hemostatic and dissecting forceps, blunt hooks, scissors, a dry dissector, partly curved needle, a needle-holder, and Murphy buttons. Drainage-tubes should be ready. In the *operation* the patient lies upon his back with the shoulders raised, the surgeon standing to the patient's right side. In *oblique inguinal*

hernia it has been the custom since the days of Scultetus to raise a fold of skin at a right angle to the axis of the external ring and transfix it, the wound which results being extended until it becomes three inches in length. This incision possesses no special merit. It is better to cut from without inward, and to make the same incision as for the performance of a radical cure in a non-strangulated case. The superficial tissues are divided until the sac is reached, and no attempt is made to specially identify them. The sac must be identified and it is known by the fat which usually covers it, by the arborescent arrangement of its vessels, by the fact that it can be pinched up between the finger and thumb, and the layers rolled over each other, and by the fluid within the sac. Should the sac be opened? In very recent cases it may not be actually unnecessary, but if there is any doubt as to the condition of the bowel, or if a radical cure is to be attempted, open the sac and be certain as to the condition of its contents. As there is always some doubt as to the condition of the contents, and as a radical cure is to be made, make it a rule to open the sac. The sac is opened and the contents examined for fecal odor (which is not unusual) and for gangrenous smell; the thickness of the bowel is estimated, and the color and luster are determined. In oblique inguinal hernia, nick the constriction upward and outward, as shown in Fig. 474. In direct inguinal hernia the cut is made upward and inward. Always pull the bowel down and examine the seat of constriction to see what damage has been inflicted at that point. If the bowel glistens, if the proper color comes back after irrigation with very hot water, and if there are no spots of gangrene, restore the bowel to the abdomen, and do a radical cure. If the bowel is in a doubtful condition, fasten it to the incision, apply a dressing, and watch the development

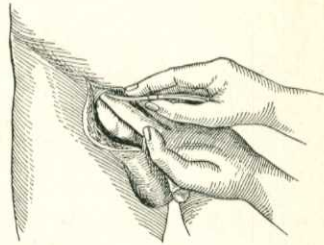


Fig. 474.—Herniotomy in inguinal hernia.

of events. If the bowel is gangrenous, our action depends upon the condition of the patient. If the patient is in good condition, resect the gangrenous portion, and perform end-to-end anastomosis by means of a Murphy button. If the patient's condition is bad, make an artificial anus, and at a later period perform anastomosis. An artificial anus can be made by the method of Bodine (page 818). In most cases in which it seems necessary to make an artificial anus prepare the bowel for the opening, but do not open at once, because the bowel may recover in a day or two, when it can be restored to the belly; or it may slough and form an artificial anus. In such doubtful cases fasten the bowel to the belly-wall with sutures, dust it with iodoform, dress it with hot antiseptic fomentations, and await future developments. Gangrenous omentum requires ligation and resection. If the bowel is fit to reduce, push it just inside the ring, irrigate the parts, insert a drain, and suture. In most cases perform a radical cure. In *femoral hernia* we can make the incision one inch internal to, and parallel with, the femoral vessels, and crossing the tumor and ligament (Barker); but it is better to make the incision of Fabricius for radical cure. Divide the constriction by cutting upward and a little inward. In *umbilical hernia* make a slightly curved incision a little to one

side of the middle of the tumor, open the sac, separate adhesions, and divide the constriction by cutting upward or downward, and sometimes also laterally.

After an operation for strangulated hernia put the patient to bed; bend the knees over a pillow; give no food by the mouth for thirty-six hours (MacCormac), only allowing bits of ice to suck, and give nutrient enemata containing brandy. Abdominal pain and tenderness call for the administration of saline cathartics and enemata containing turpentine or oil of rue. The enema rutæ is a favorite preparation in St. George's Hospital, London. It is made as follows: Take sixteen ounces of an infusion of chamomile, warm it, and pour it upon ʒiij of confection of senna (Sheild). If there is no abdominal pain and tenderness, the bowels need not be disturbed for a few days; but if at the end of four or five days they have not acted, give a saline cathartic and an enema. Remove the drainage-tube on the third day. At the end of about three weeks get the patient up. If a radical cure has not been attempted, apply a pad and a spica bandage to the groin, and later a truss. A truss should not be worn if a radical cure has been made.

Hernia in Childhood.—Hernia is extremely common in children, but it is an interesting fact that if one conducts a careful investigation of hernia in adults, it will be found that but 5 or 6 per cent. of them have suffered with the hernia in childhood. This fact seems to demonstrate positively that the majority of cases of hernia in childhood are recovered from. A. J. Ochsner ("Jour. Amer. Med. Assoc.," Dec. 22, 1900), in commenting upon the frequency of hernia in childhood, alludes to Malgaigne's statistics. Malgaigne estimated that during the first year of life one child in every twenty-one has hernia, and that this proportion is maintained until the age of six years. Then it diminishes rapidly until the age of thirteen, at which age there is one hernia in every seventy-seven children. It is therefore obvious that 75 per cent. of all herniæ in children of six years will heal spontaneously before the age of thirteen. Ochsner states that 95 per cent. of herniæ in children will be cured without operation. He points out that between the ages of thirteen and twenty hernia is fairly common among boys, but very rare among girls. The reason for this tendency to cure is somewhat uncertain. The view advocated by Thomas C. Martin is that, as the pelvis broadens, the parietal peritoneum enlarges. It does this at the expense of the mesentery, which is shortened, and the internal abdominal ring is displaced. In a very instructive analysis of this condition, Ochsner shows that in 25 per cent. of cases of hernia in childhood hereditary weakness exists; that the condition is commoner among the poorer classes than among the richer; that in many cases there is an undescended testicle; and that the chief cause is an excess of intra-abdominal pressure. This excess of intra-abdominal pressure may result from flatulent distention of the stomach and intestines, the product of bad feeding; constipation and straining; straining on urinating due to the existence of phimosis; vomiting, or cough. He thinks that, as a rule, indigestion causes flatulence and pain; that the child cries; that this increases the pressure; that the mother then feeds it, in order to keep it quiet; and that this makes it worse.

Treatment.—Strangulated herniæ, irreducible herniæ, herniæ with very large rings, cases in which trusses fail, and cases associated with reducible hydrocele require operation (Ochsner). Most cases are curable without

operation, the ring being guarded by a truss of rubber or a pad of lamb's wool. Ochsner believes that many cases can be cured by keeping the child recumbent, with the foot of the bed raised, from four to six weeks. If phimosis exists it should be operated upon, and any other causative condition should be treated (cough, vomiting, constipation, flatulent indigestion, etc.). An umbilical hernia can usually be cured by the use of a cork. The cork should be one inch in diameter and one and one-fourth inches in length, and shaped like a cone. The smaller end is pushed into the ring and the cork is held in place by adhesive plaster. In two weeks a smaller cork must be used, and in six or eight weeks it can usually be dispensed with.

Varieties of Hernia.—In *direct inguinal hernia* the bowel passes out through Hesselbach's triangle internal to the deep epigastric artery. It enters the inguinal canal low down, and passes outside the conjoined tendon or forces the conjoined tendon before it or splits through the tendon. The neck of the sac is internal to the deep epigastric artery. The coverings of this hernia, when it passes external to the conjoined tendon, are the same as those of an indirect inguinal hernia, except that the transversalis fascia instead of the infundibuliform process of the transversalis fascia is one of the layers. When a direct hernia pushes before it the conjoined tendon, its coverings are skin, superficial fascia, intercolumnar fascia, conjoined tendon, transversalis fascia, subserous tissue, and peritoneum.

In *indirect inguinal hernia* the bowel passes through the internal abdominal ring external to Hesselbach's triangle and external to the deep epigastric artery. It passes down the inguinal canal and emerges from the external ring; it may enter the scrotum or labium (scrotal or labial hernia), or it may not. The neck of the sac is external to the deep epigastric artery. Its coverings are skin, superficial fascia, intercolumnar fascia, cremaster muscle, infundibuliform fascia, subserous tissue, and peritoneum.

Congenital inguinal hernia is a portion of bowel within an unclosed vaginal process. The bowel in congenital hernia has one layer of peritoneum in front of it. The testicle is posterior and below (Fig. 475). Always remember that congenital hernia may not appear for several months after birth. Congenital hernia conceals or buries the testicle; acquired hernia does not. If a vaginal process open above and closed below contains a hernia, the condition is called *hernia into the funicular process*.

If the funicular process is closed at the abdominal end but not below, a hernia in a special sac may descend back of the vaginal tunic. This condition is known as *infantile hernia*. In infantile hernia there are three layers of peritoneum in front of the bowel, the two layers of the vaginal tunic and the one layer of sac. The testicle is in front (Fig. 476).

If the tunica vaginalis is closed above and not below, and a hernia pushes down the vaginal process and causes it to double on itself, the condition is known as *encysted infantile hernia* (Fig. 477).

In *femoral hernia* the bowel descends along the femoral canal, and the neck of the sac is at the femoral ring. The neck of a femoral rupture is always external to the pubic spine; the neck of an inguinal rupture is always internal to the pubic spine. Femoral hernia is never congenital. Its coverings are skin, superficial fascia, cribriform fascia, crural sheath, septum crurale, subserous tissue, and peritoneum.

Umbilical hernia may be congenital (the ventral plates having closed incompletely), infantile (the cicatrix of the umbilicus having stretched), or acquired.

Ventral hernia is a protrusion through any part of the anterior abdominal wall except at the umbilical or inguinal regions. A ventral hernia may be median (hernia of the linea alba) or lateral. The treatment is radical operation.

Epigastric hernia is a form of ventral hernia. In this condition there is a protrusion of the peritoneum in the space bounded by the ensiform cartilage, the ribs, and the umbilicus. The sac of peritoneum may be empty, may contain omentum, or omentum and bowel. The stomach very rarely passes into the sac. The protrusion is usually, but not invariably, through the linea alba.

Cecal hernia is very uncommon in women. It is usually preceded and caused by hernia of the small gut. Usually there is a complete sac, but sometimes the sac is partial. The appendix may be in the sac.

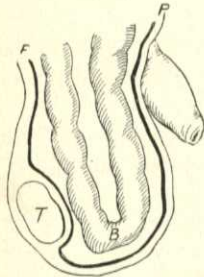


Fig. 475.—Congenital hernia: T, Testicle; F, P, funicular process; B, bowel.

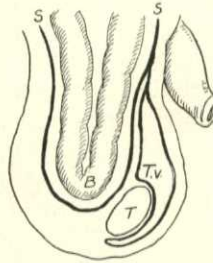


Fig. 476.—Infantile hernia: T, Testicle; T.v., tunica vaginalis; S, S, sac; B, bowel.

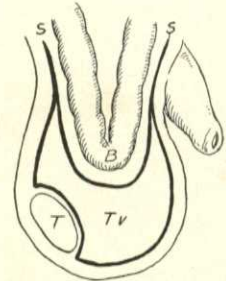


Fig. 477.—Encysted infantile hernia: T, Testicle; T.v., tunica vaginalis (represented as distended); S, S, sac; B, bowel.

In *properitoneal hernia* the sac is between the peritoneum and transversalis fascia. This form of hernia is sometimes produced by making taxis on an inguinal hernia, when the internal ring is small or is blocked by an undescended testicle. In properitoneal inguinal hernia, which is the most common form, there are two sacs detectable, one in the scrotum, the other parallel with Poupart's ligament, and as one sac is emptied the other distends (Breiter, of Zürich).

In *interstitial inguinal hernia* the hernia sac is between the transversalis muscle and fascia, or between the external and internal oblique muscles, or between the fibers of the internal oblique muscle or between the external oblique muscle and the transversalis fascia, the internal oblique and transversalis muscles being pushed aside (Sultan's "Atlas of Abdominal Hernias").

In *superficial inguinal hernia* the sac is between the aponeurosis of the external oblique muscle and the skin. This variety of hernia is always congenital and the testicle is invariably misplaced.

Obturator hernia passes through the obturator membrane or the obturator canal, and is felt below the horizontal ramus of the pubes, internal to the femoral vessels.

Lumbar hernia occurs at the edge of or through the quadratus lumborum muscle.

Sciatic or gluteal hernia passes through the great sacro-sciatic foramen, above or below the pyriformis muscle.

Pudendal hernia protrudes into the lower part of the labium, the bowel having descended between the ischial ramus and the vagina.

Perineal hernia presents in the perineum, between the rectum and the prostate gland or between the rectum and the vagina.

Internal, retroperitoneal, or intra-abdominal herniæ include hernia into the foramen of Winslow, hernia into the *retroduodenal fossæ*, the *retrocecal fossæ*, and the *intersigmoid fossa*.

Vaginal hernia is associated with uterine prolapse or ensues upon destruction of the vaginal wall.

Richter's hernia is the catching of a portion of the circumference of the bowel. It is also called *partial enterocele*. Strangulation of a partial enterocele does not produce stercoraceous vomiting or absolute constipation, and the protrusion is barely perceptible or cannot be palpated.

Littre's hernia is hernia of Meckel's diverticulum.

Rokitansky's diverticular herniæ are due to separation of the muscular fibers of the bowel permitting the sacculation of mucous membrane and peritoneum. These false diverticula may be no larger than peas or may be larger than walnuts, and there may be scores of them in one patient. They may produce no symptoms, or may lead to peritonitis or to symptoms of intestinal obstruction.

Hernia of the Bladder.—This is a protrusion of a portion of the bladder-wall through a hernial opening. The protrusion may or may not be covered with peritoneum.* It is most frequently met with in the inguinal region. Brunner describes three forms: (1) entirely without a peritoneal covering (extraperitoneal); (2) partly covered with peritoneum (paraperitoneal—the commonest form); (3) completely covered with peritoneum (intrapertoneal). The bladder may constitute the hernia, or there may be an ordinary hernia, and also a cystocele. In an inguinal hernia the bladder will be internal and somewhat behind the other constituent parts of the protrusion. Hernia of the bladder is much more common in men than in women.

A hernia of the bladder may become strangulated. In some cases a diagnosis of hernia of the bladder can be made by the fact that the protrusion lessens in size when the patient micturates and increases in size as urine gathers, or when the bladder is injected with fluid. The treatment should be operative. When the bladder is exposed, it is replaced with or without resection of a portion.

Diaphragmatic Hernia.—The majority of cases are congenital and in 90 per cent. of them there is no sac. The hernia may pass through a natural opening or through a gap due to congenital defect. The hernia is most common on the left side, and the stomach is the organ usually displaced. When the stomach passes suddenly through the left side of the diaphragm, there will be dyspnea, cyanosis, displacement of the heart to the right, pain in the upper abdomen, thirst, and in most cases rapid death. When the stomach has entered the left side of the thorax, there is a tympanitic note on percussing the

* Brunner, in *Deutsch. Zeitschr. f. Chir.*, 1898, vol. xlvii.

thorax, the heart is displaced to the right, and the side of the chest is unduly prominent. In 250 cases of traumatic diaphragmatic hernia collected by Leichtenstern the diagnosis was made before death in but 5 cases. Strangulation of a diaphragmatic hernia produces severe pain in the upper abdomen, violent vomiting, constipation, boat-shaped abdomen, great thirst, rapid wasting, and the excretion of a very small amount of urea (Mackenzie and Battle, "Lancet," Dec. 7, 1901).

Treatment.—Open the belly for exploration. If hernia is found, return it to abdomen; open the chest and suture the diaphragm. Mackenzie and Battle, Mikulicz, Humbert, and others have operated for this condition.