

present. After the bath the patient must be most carefully dried, and immediately, in the bathroom, rubbed with gray ointment.

During the entire treatment it is advisable to allow the patient to drink the warm waters; two or three glasses should be drunk in the morning, and a similar quantity in the evening also. In winter and cold weather the waters should be taken in bed; during the summer and on warm days, while walking about. Nevertheless, we must carefully notice whether the internal employment of the waters disturbs the digestion, whether it takes away the appetite and thus interferes with the fulfilment of a very weighty indication, namely, the nourishment of the body.

For removing debility Dr. Brandis relies not on the use of the waters, but on the abundant drinking of warm milk, a measure the merits of which have not been sufficiently appreciated.

Vapor baths, followed by copious sweating, are indicated when the mercury no longer exercises a beneficial effect upon the healing process. As a rule, patients are directed, possibly after the twentieth inunction, to take a vapor bath on three consecutive days, and then subsequently after each tenth inunction.

As to the method of performing the inunctions, Sigmund's instructions are observed. It is essential that competent rubbers do the work.

Both hands must be employed in rubbing in the ointment. The use of gloves and pads is prohibited, as they absorb too much of the ointment. Mercurial poisoning in the rubbers has not been observed. Every rubbing is to last fully twenty minutes, ten minutes for each half of the dose.

The further instructions of Sigmund are as follows: On the first day rub both legs; on the second, both thighs; on the third, the abdomen and the breast; on the fourth, the back; and on the fifth, both arms.

Many patients, however, cannot endure the rubbing of the abdomen and breast; in such persons the rubbing is applied to the sides of the body and the nates. The daily dose varies with the body-weight and the susceptibility of the patient—between four and five grammes for adults, and from one to two grammes for children.

2. During a course of treatment the body must be maintained in good condition; the patient must take exercise in the open air, he must occupy a spacious bedroom, and he must have good food in plenty.

The treatment of the mucous membrane of the mouth is of great importance, for it is in this way that much can be done to prevent mercurial stomatitis.

Dr. Brandis employs as a mouth wash a preparation made according to the following recipe:

R Pulveris aluminis,  
Plumbi acetatis . . . . . 30.0  
Aque destillate . . . . . 300.0  
Misce et filtra.

This solution may be used by diluting it either with pure water or with some aromatic water, in the proportion of about two dessertspoonfuls to the glass of water. The mouth must be regularly rinsed, from the beginning of treatment, ten or twelve times a day, or even oftener. Even when taking walks the patient must carry a small bottle of the liquid; and in urgent cases he must use it repeatedly, even at night. After each meal the teeth must be brushed with a mixture of prepared chalk and camphor.

Dr. Brandis states that by carrying out these measures very carefully the patient will, as a rule, escape salivation; but occasionally it happens that the physician is obliged to order a temporary suspension of the inunctions. One thing more is to be observed—namely, we may accustom even highly sensitive patients to tolerate mercury. If we know beforehand that we have to deal with such, we should begin with small doses of the mercurial ointment, and gradually increase to larger. Or if

we have the misfortune to induce stomatitis, and are obliged to suspend treatment, we must postpone resuming it until all these symptoms have disappeared; we then begin again with small doses, and gradually rise to larger. A practical suggestion relates to ulcerative processes, so frequently observed in the course of syphilis. It is not always an easy matter to distinguish mercurial from syphilitic ulcerations; they both occur in the most various parts of the mucous membrane of the mouth, and may look very like each other. Above all, this holds good of those mercurial ulcerations which occasionally appear on the tonsils and on the soft palate. Here frequently only long-continued observation can decide the matter; if, however, we remain in doubt, the inunctions must be suspended; the mercurial ulcers will then heal, whereas the syphilitic ulcers will be aggravated. They also behave differently when cauterized with nitrate of silver. The mercurial sore stands an energetic cauterization very well; in fact, its healing is furthered by it; whereas the contrary is generally the case with the venereal ulcer. Increased secretion of saliva may also occasion doubt, for at times syphilitic disorders which affect the cavity of the mouth directly produce salivation. Another disagreeable result of the inunction treatment is mercurial diarrhoea. This symptom sets in suddenly; the evacuations follow one another rapidly, there is pain and tenesmus, and the stools are scanty and show mucus and blood. Treatment by opiates is indicated, while the inunctions must at once be interrupted.

Healthy persons lose in weight if subjected to mercurialization. In contradistinction to this, syphilitic patients gain in weight as soon as they enter the stage of convalescence. This applies to recent cases as well as to those of long standing.

The inunctions must be employed for a sufficiently long time. As our task consists in healing the symptoms of the disease, and as much as possible in averting relapses, the earlier the syphilitically infected person is brought under mercurial treatment, the milder will be the course of the disease.

3. Above all things, Brandis insists that we must not too soon dismiss the patient from treatment—indeed, not until all symptoms have disappeared, to the last vestige; and also, that even the slightest attacks must be energetically treated from the outset. If experience shows us, on the one hand, that inadequate treatment fails to remove completely the existing symptoms, or, after apparently curing them, is not competent to prevent later relapses, it also, on the other hand, demonstrates the fact that a long and energetic mercurial treatment will generally accomplish the desired object.

In all ordinary cases the inunctions are prolonged eight or ten days beyond the time of healing of visible lesions; the thermal baths need not be given for a longer period.

In this country the Hot Springs of Arkansas is perhaps the most renowned place for the treatment of syphilis, and so far as the waters are concerned, it offers essentially the same advantages as Aachen.

Edward O. Otis.

**ABDOMEN. (ANATOMICAL.)**—The abdomen is the region of the body lying between the thorax and the pelvis. It includes the abdominal wall, the abdominal cavity, and its contents, the latter comprising almost the whole of the digestive apparatus and a part of the urinary. Above, the abdominal wall is separated from the thorax by the costal arch. Below, it is continued into the pelvis and thighs, the lines of separation being the iliac crests laterally and Poupart's ligaments mesially. These superficial boundaries of the wall are not coextensive with those of the cavity, for it extends above into the vault of the diaphragm, corresponding superficially to the fourth intercostal space on the right side and the fifth on the left. Below, it passes into the pelvic cavity, the line of separation between abdomen and pelvis being the linea ilio-pectinea. Here the lower limit

is the upper surface of the levator ani and coccygeus muscles.

The form and external appearance of the abdomen vary with sex, age, and the condition of the abdominal wall and underlying organs. In infancy, as the pelvis is undeveloped and the organs in the upper part of the cavity are relatively large, the abdomen is cone-shaped, the apex of the cone being directed downward. In adult males the region is cylindrical and slightly flattened from before backward. In females it is again cone-shaped, but the apex of the cone is above, as the diameter of the lower circumference of the thorax is always less than that of the pelvis.

The ABDOMINAL WALL presents antero-lateral and posterior aspects. It differs from the walls of other cavities in being, for the most part, devoid of skeleton, which, with the elastic character of the tissues composing it, allows the cavity to vary in capacity according to the size of the contained viscera. At all times it exerts upon them a gentle pressure, supporting them, and causing the more solid to impress the softer. This pressure may be appreciated in any laparotomy wound, when the omentum and more movable intestines are retained with difficulty. The antero-lateral wall is composed of the following layers of tissue, which must be considered in detail:—

Skin,  
Superficial fascia } superficial layer  
                          } deep layer,  
External oblique muscle,  
Internal oblique muscle,  
Transversalis muscle,  
Rectus muscle,  
Transversalis fascia,  
Properitoneal tissue,  
Parietal peritoneum.

In addition to this general description, certain regions which are commonly the seat of hernia must receive especial study. These are:—

The inguinal region,  
The inguino-femoral region.

The *Skin* of the abdominal wall is thin and movable except in the region of the navel, where it is attached to the underlying tissue. Corresponding to the linea alba is a furrow which indicates the space between the recti muscles. Two transverse flexion folds are usually present, one at the level of the umbilicus, a second, one inch above the pubis. This latter marks the summit of the moderately distended bladder. In pregnancy, or during the growth of large intra-abdominal tumors, the stretching of the skin may give rise to a series of longitudinal lines, called striae gravidarum.

**Superficial Fascia.**—Of this there are two layers. The superficial layer varies in thickness according to the amount of fat deposited in it. Both above and below it is continuous with the corresponding layer of tissue in adjacent regions. In the pubic region it passes into the scrotum, losing the fat, and, joining the deep layer, it assists in the formation of the dartos. At the posterior border of the scrotum it becomes continuous with the same layer of the perineum. The amount of fat deposited in this layer, together with that in the omentum and mesenteries, is the principal factor in determining the external appearance of the abdomen. Accordingly, all gradations occur, from the thin concave abdomen of the emaciated to the thick pendulous one of the obese. These variations become of importance in examinations of abdominal organs or in operations upon them. The thick wall renders the task more difficult.

The deep layer is thin and more fibrous in structure. It can be separated distinctly only in the lower half of the wall; above, it is lost in the superficial layer. Below, externally, it is connected with the iliac crests; anteriorly, it passes over Poupart's ligaments, to be attached to the fascia lata half an inch below them. In the pubic region,

together with the superficial layer it passes into the scrotum to form the dartos. At the posterior border of the scrotum the layers again separate, the deeper one forming the corresponding fascia of the perineum. This latter fascia is attached on each side to the rami of the pubis and ischium, and turning around the posterior border of the transverse perineal muscles, it becomes continuous with the deep perineal fascia. It is beneath this layer of tissue that urine or an infection is guided from the perineum through the scrotum upon the abdomen. The attachment of the fascia to the bony margin of the pelvis prevents the spread into the thighs on their inner sides, while the attachment to the fascia lata prevents a similar spread from in front. The deep superficial fascia is separated from the aponeurosis of the external oblique by loose areolar tissue except along the linea alba, where the attachment is more intimate.

**External Oblique Muscle** (Figs. 1 and 2).—This, the strongest and most superficial of the abdominal muscles, arises by fleshy digitations from the eight lower ribs, interdigitating in the upper half with the serratus magnus, in the lower with the latissimus dorsi. The fibres are directed downward, forward, and inward, those from the last two ribs almost vertically downward to their insertion in the anterior two-thirds of the external lip of the iliac crest. The remaining fibres, more oblique in direction, terminate in a broad aponeurosis, which at the mid-line joins with the aponeurosis of the remaining muscles in the linea alba. The following structures in the aponeurosis of the external oblique require especial mention:—

**Poupart's Ligament**, formed by the thickened lower border of the aponeurosis, stretched between the anterior superior iliac spine and the pubic spine. Attached to it below is the fascia lata, which gives to the ligament an outline, convex downward. The flexor muscles of the thigh, the femoral vessels, and the anterior crural nerve pass behind the ligament in their course downward.

**Gimbernat's Ligament** (Fig. 5).—Reflected from the pubic end of Poupart's ligament to the linea ilio-pectinea for about three-quarters of an inch, is a triangular layer of fibrous tissue termed Gimbernat's ligament. It has upper and lower free surfaces, and a concave external border, bounding the femoral ring internally.

**External Abdominal or Inguinal Ring** (Fig. 2).—Situated in the lower and inner part of the aponeurosis is an oval opening, formed by the separation of the fibres composing this part of the aponeurosis from the fibres of Poupart's ligament. The long axis of the ring corresponds in direction to that of the fibres of the aponeurosis. Its base is formed by the pubic crest, its sides by the diverging fibres, which are called the pillars of the ring. The superior or internal pillar, thin and flat, is attached to the anterior surface of the symphysis pubis, while the inferior or external, thick and prismatic, essentially the inner end of Poupart's ligament, curves inward to terminate at the pubic spine. Further facts concerning the external ring will be mentioned in the special description of the inguinal region.

**Intercolumnar Fascia.**—Binding together the fibres of the aponeurosis above the inguinal opening is a set of fibres which arch transversely inward from the outer half of Poupart's ligament, thus closing the angular interval left between the diverging pillars. At the margins of the opening these fibres are continued over the spermatic cord and testicle as a fine fascia, the intercolumnar or spermatic fascia.

**Internal Oblique Muscle** (Fig. 1).—The general direction of the fibres composing this muscle is the opposite of that of the external oblique. It arises below, from the outer half or two-thirds of Poupart's ligament, from the anterior two-thirds of the middle lip of the crest of the ilium, and from the lumbar fascia in the angle between the crest of the ilium and the outer border of the erector spinae muscle. From this origin the fibres ascend over the side of the abdomen to be disposed of as follows: the most posterior fibres pass upward to be inserted into the outer surfaces

of the three lower ribs; those from the crest anteriorly, the spine, and Poupart's ligament end in a broad aponeurosis which extends from the thorax to the pubis, and at the outer border of the rectus divides into two layers, to enclose this muscle, uniting again at the linea alba. The anterior layer is inseparably united with the aponeurosis of the external oblique, the posterior with that of the transversalis, and above with the seventh and eighth

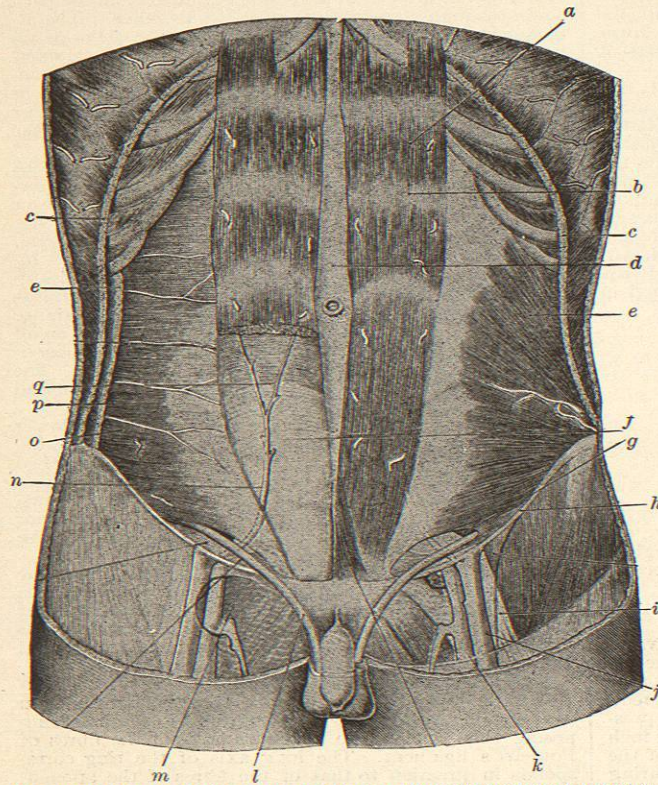


Fig. 1.—On the left side, the external oblique and the anterior layer of the rectus sheath are removed; on the right side, the external and internal oblique and the lower half of the rectus. The deep epigastric artery is shown through the wall. (Joessel.) a, Rectus abdominis; b, inscriptio tendinea; c, external oblique; d, linea alba; e, internal oblique; f, fascia transversalis; g, internal abdominal ring; h, Poupart's ligament; i, anterior crural nerve; j, femoral artery; k, femoral vein; l, spermatic cord; m, fossa ovalis; n, deep epigastric artery, shown through abdominal wall; o, transversalis muscle; p, linea semilunaris; q, semilunar fold of Douglas.

costal cartilages and the ensiform process. This arrangement obtains only in the upper two-thirds of the aponeurosis. In the lower third there is no division into layers, both internal oblique and transversalis passing in front of the rectus with the external oblique. The deficiency resulting in the sheath of the rectus is marked above by a semilunar edge, known as the semilunar fold of Douglas. The lowest fibres which arise from Poupart's ligament arch downward and inward, and, joining similar fibres from the transversalis, form the conjoined tendon of these two muscles, by which they are inserted into the anterior surface of the pubis and the inner part of the ilio-pectineal line, behind Gimbernat's ligament.

The *Transversalis Muscle* (Fig. 1), situated beneath the internal oblique, arises from the inner surfaces of the six lower ribs, from the transverse processes of the lumbar vertebrae by an aponeurosis, and from the anterior two-thirds of the inner lip of the crest of the ilium. Passing

horizontally inward, the fibres terminate in an aponeurosis about an inch external to the border of the rectus, except at the upper extremity, where the fibres pass behind the rectus almost to the middle line. The arrangement of the aponeurosis was described with that of the internal oblique.

*Rectus Abdominis Muscle* (Fig. 1).—This muscle consists of vertical fibres lying within the sheath formed by the internal oblique as described above. Situated on either side of the mid-line of the abdomen, it arises from the anterior surface and crest of the pubis. Expanding and becoming thinner as it ascends, it is inserted into the cartilages of the fifth, sixth, and seventh ribs, as well as the bone of the fifth. The fibres of the muscle are interrupted by three or more tendinous intersections, inscriptions tendineae, placed, the first at the umbilicus, the second at the lower end of the ensiform process, the third midway between them. They are confined chiefly to its anterior fibres and are firmly united to the anterior wall of the muscle sheath. When additional transverse lines occur, they are usually incomplete and are placed below the umbilicus.

The *Linea Alba*, formed by the union of the aponeuroses of the two oblique and transverse muscles, extends in the mid-line from the ensiform process to the pubis. A little below the middle it is widened into a circular space, in the centre of which is the umbilicus. Above the umbilicus the recti muscles diverge and the linea alba broadens. Below the umbilicus the recti muscles converge and the linea becomes narrower and passes in front of the conjoined inner heads of the recti muscles to the pubis. Passing from the linea, behind the conjoined heads, is a small band of longitudinal fibres, the *admiculum lineae albae*, which spreads out below into a triangular expansion attached to the upper border of the pubis behind the external head of the rectus. During pregnancy, or when the abdomen is distended by disease, the linea alba is much increased in breadth.

The *Linea Semilunaris*, situated along the outer border of the rectus muscle, is a curved linear depression corresponding to the narrow portion of the aponeurosis of the internal oblique, between the termination of the muscular fibres and the division of the aponeurosis to form the rectus sheath.

The *Fascia Transversalis*.—This thin layer of fascia lines the posterior surface of the transversalis muscle and is continued on to the under surface of the diaphragm. Above the umbilical line it is exceedingly thin, but below, especially in the inguinal region, it is more strongly developed and is attached to Poupart's ligament. Laterally, it is attached to the inner lip of the crest of the ilium and is continuous with the

iliac fascia. An opening in the transversalis, the internal abdominal ring, will be described below.

*Properitoneal Tissue and Parietal Peritoneum*.—The properitoneal tissue is a variable layer which is situated between the transversalis fascia and the peritoneum, and is more highly developed in the inguinal regions. Farther up on the abdominal wall it is frequently absent. In this layer are situated the most important blood-vessels of the abdominal wall. The parietal peritoneum will be more especially noted below. For the most part it is separated from the fascia transversalis by the properitoneal tissue, but along the linea alba and the umbilical region the two are united.

*Blood-Vessels of the Anterior Abdominal Wall*.—The *Arteries* of the abdominal wall are in two sets, superficial and deep. The superficial vessels are situated in the superficial fascia. They are the superficial epigastric and the superficial circumflex iliac, derived from the femoral.

The deep set comprises the six lower intercostals, the lumbar, the deep circumflex iliac, the superior epigastric, and the deep epigastric artery. Of these, the latter requires especial description.

Arising from the distal end of the external iliac, the deep epigastric artery passes upward and inward across the rear wall of the inguinal canal to the posterior surface of the rectus; entering the sheath of the rectus it continues its course upward to anastomose with the superior epigastric, a branch of the internal mammary. It lies between the fascia transversalis and the parietal peritoneum in the properitoneal tissue. In the beginning of its course it encircles the lower and internal boundaries of the internal inguinal ring.

Two small branches arise from the deep epigastric artery: the cremasteric, which accompanies the spermatic cord, and the pubic branch, which ramifies on the superior surface of Gimbernat's ligament and the posterior surface of the pubic bone. On the surface of the abdomen the course of the artery may be indicated by a line drawn from the junction of the inner third with the outer two-thirds of Poupart's ligament, obliquely upward to the umbilicus.

The *veins* are likewise divisible into a superficial and a deep set. The superficial include the superficial epigastric, the superficial circumflex iliac, and the vena tegumentosa. The latter connects the axillary with either the superficial epigastric or the femoral veins.

The deep veins accompany the corresponding arteries and are double. They anastomose with one another, and also with the superficial veins on one side and with the portal system on the other, through the para-umbilical veins which run in the falciform ligament of the liver. In pathological states which interfere with the circulation in either the vena cava inferior or the portal system, the superficial veins may be much more prominent than is usual. In the former case, the blood current is upward, toward the umbilicus, the veins assisting in the formation of a collateral circulation. In the latter case the current is downward, away from the umbilicus, and the dilatation is due to direct stasis.

Above the umbilicus the *superficial lymphatics* empty into the axillary glands; below it, into the inguinal glands. The deep lymphatic vessels empty into the sternal glands above and into the iliac glands below.

*Nerves*.—The abdominal muscles are supplied by the six lower intercostal nerves; the skin of the abdomen, by cutaneous branches of the same together with the ilio-hypogastric and the ilio-inguinal from the first lumbar. The nerves are situated between the transversalis and the internal oblique, and pursue a course corresponding to the intercostal space, from which they emerge as far as the sheath of the rectus, which they pierce to become cutaneous. Laterally, between the origins of the external oblique, the latissimus dorsi, and the serratus magnus, arises a series of

lateral cutaneous branches which supply the skin of the lateral aspect of the abdomen.

In this connection it is interesting to note the relationship existing between the nerve supply of the abdominal wall on the one hand, and that of the abdominal viscera and peritoneum on the other. The viscera derive their principal nerve supply from the three splanchnics, which are formed by the union of the rami communicantes of the six lower intercostals. Therefore the abdominal viscera and the abdominal walls are all connected with the same segments of the central nervous system.

In disease these nerve connections may serve to explain many of the symptoms and signs, such as reflected pains and rigid abdominal muscles in acute inflammatory states.

The surgeon is frequently called upon to open the abdominal cavity through the anterolateral wall. The incisions should be carefully planned, first, to give ample room for the necessary intra-abdominal manipulations; second, to do the least possible injury to the abdominal wall, thus reducing to a minimum the liability of a subsequent ventral hernia.

The most common line of incision is through the linea alba, this route being chosen in most pelvic operations, in those upon the intestines in general, and in many of those upon the stomach. The line is easily followed above the umbilicus, where the linea alba is broad, but below, where it is narrow, the line is followed with difficulty. In incisions above the umbilicus the position of the falciform ligament of the liver should be remembered.

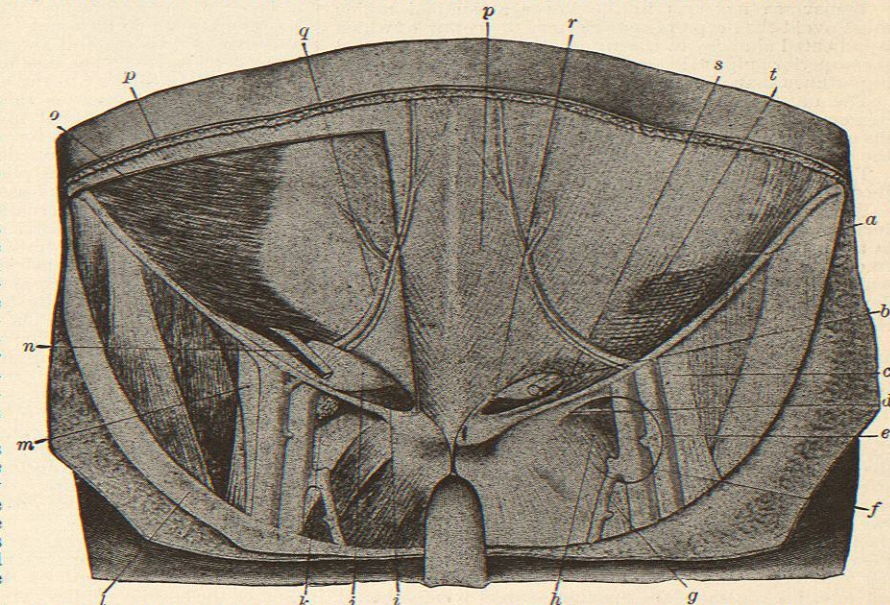


Fig. 2.—On the left side, the aponeurosis of the external oblique and the course of the deep epigastric artery on the rear surface of the abdominal wall are shown; on the right, the external oblique is removed, opening the inguinal canal. (Joessel.) a, Poupart's ligament; b, spermatic cord; c, anterior crural nerve; d, free edge of iliac portion of fascia lata; e, femoral artery; f, femoral vein; g, saphenous vein; h, fossa ovalis; i, reflected portion of Gimbernat's ligament; j, fascia transversalis; k, lymph gland in femoral canal; l, fascia lata; m, pubic portion of fascia lata; n, cremaster muscle; o, internal oblique; p, external oblique; q, deep epigastric vessels; r, superior pillar of the external ring; s, inferior pillar of the external ring; t, intercolumnar fascia.

Many surgeons prefer an incision slightly to one side of the linea,—one which opens the sheath of the rectus muscle and separates its fibres. They believe that such a wound heals more solidly than one that divides the linea alba, formed as it is by the interlacement of numerous aponeurotic layers. Certainly the linea has but one possible advantage, that is, avascularity. The rectus should be

separated only in its inner half, because of the position of the nerve trunks in its outer half. For this reason a transverse incision will do less damage than a longitudinal one in the outer half of the rectus.

In lateral incisions three points must be borne in mind: (1) The direction of muscular or aponeurotic fibres; (2) the course of nerves; (3) the course of blood-vessels.

All longitudinal or oblique incisions will divide one or more layers of muscular fibres which, in many instances, it is impossible to avoid. However, when possible the plan of McBurney should be followed—namely, that of separating each aponeurotic layer in the direction of its fibres. When the fibres of all the layers cannot be separated in this manner, it is advisable to separate those of the external oblique and divide the remaining layers. The separation of the fibres possesses many advantages—it is almost bloodless, no large nerves are injured, and the edges of the wound, instead of tending to separate, tend to approximate. It has the disadvantage of requiring a larger number of assistants and of not giving as free an opening as direct incision.

When it becomes necessary to incise the entire thickness of the abdominal wall, the incision should be planned with due regard to the nerves, remembering that they are continued forward from the intercostal spaces between the transversalis and the internal oblique. For this reason, lateral longitudinal incisions along the rectus are objectionable, division of the nerves being followed by more or less paralysis, which is an important predisposing factor in the development of a hernia.

Transverse incisions in the lower abdominal region must avoid the deep epigastric artery the course of which is indicated above. In the upper half they must avoid the superior epigastric artery, which, however, is of less importance than the deep vessel.

The INGUINAL REGION is bounded below by Poupart's ligament, internally by the median line indicated by the linea alba, and above by a horizontal line extending from the anterior superior iliac spine to the median line.

The tissue layers composing the wall are the same as those of the wall in general.

Piercing the region in an oblique direction from behind forward, downward, and inward is the spermatic cord in the male and the round ligament in the female. The track which the spermatic cord pursues in the abdominal wall is known as the inguinal canal, but it must be understood that a true canal exists only in a pathological state.

The canal presents for description an external opening, an internal opening, and four walls. As mentioned, the external opening is formed by the separation of the lower and the inner fibres of the aponeurosis of the external oblique. The ring is closed by the intercolumnar fascia, which is continued over the cord and testicle and must be teased from the cord before the ring is plainly visible. At the upper angle, it binds the columns together, thus strengthening the ring above. The external ring varies in size, depending upon the development of the intercolumnar fibres. Normally, the opening will admit the end of the finger, but this is modified by the position of the body. Flexion and external rotation of the thigh relax the opening, extension of the thigh or contraction of the abdominal muscles contracts the opening,—facts which should be remembered in the reduction of hernia by taxis. In corpulent persons and in women it is sometimes difficult to locate the ring, but it should be remembered that it is immediately above and external to the spine of the pubis. When the spine cannot be located, the tendon of the adductor longus will serve as a guide, as it lies immediately beneath the pubic spine and can in all cases be easily recognized.

The internal abdominal ring is situated half an inch above the middle of Poupart's ligament. Here, on the posterior surface of the transversalis fascia, the spermatic cord enters the inguinal canal, being invested throughout its entire length by a process of the fascia known as the processus vaginalis fasciæ transversalis or the infundibuliform fascia. Thus it is seen that the transversalis fascia

is not perforated by the cord, but is pushed forward as an investing membrane.

The anterior wall of the canal is formed by the aponeurosis of the external oblique, the fibres of which are here crossed by the intercolumnar fibres.

The posterior wall of the canal is composed of the aponeurosis of the internal oblique and the transversalis, and of the fascia transversalis. It is divisible into two parts: a lateral, formed by the transversalis fascia, and an inner, formed by the conjoined tendon of the internal oblique and the transversalis.

The upper wall of the canal is bounded by the lower fibres of the internal oblique and the transversalis. When the origin of these muscles from Poupart's ligament extends far inward, the cord runs for a short distance between them before taking its usual position in the canal. From the lower border of the internal oblique a series of loops of muscular fibres connected by fine fascia is again prolonged over the cord. The fibres form the cremasteric muscle and the connecting fascia is the cremasteric fascia.

The lower wall or floor of the canal is Poupart's ligament. The subserous fatty tissue in this region is well developed and forms one of the layers investing a hernia.

*Rear View of the Anterior Abdominal Wall in the Inguinal Region.*

The parietal peritoneum covering this region of the abdominal wall is thick and freely movable. It presents a median and two lateral longitudinal folds separating as many depressions. The median fold, extending from the summit of the bladder to the umbilicus, is caused by the urachus and is known as the plica urachi. On either side of it lies the internal inguinal fossa. Of the two lateral folds the median is formed by the lateral ligament of the bladder, the obliterated hypogastric artery of the foetus. It is known as the plica hypogastrica, and separates the internal inguinal fossa from a second, the middle inguinal fossa. The external of the lateral folds corresponds to the deep epigastric artery, and separates the middle inguinal fossa from a third, the external fossa. This fold is the plica epigastrica.

In the floor of the external inguinal fossa is situated the internal abdominal ring bounded internally by the deep epigastric artery. The floor of the middle inguinal fossa is the posterior wall of the inguinal canal. The floor of the internal inguinal fossa corresponds to a point in the abdominal wall immediately external to the outer border of the rectus muscle.

The floor of each fossa may be the exit of one of the varieties of inguinal hernia. The most important landmark of the above is the plica epigastrica, formed by the deep epigastric artery separating the external from the middle inguinal fossa. Two forms of inguinal hernia are described according to their relation to the deep epigastric artery.

Thus, a hernia emerging through the external inguinal fossa is an oblique or external inguinal hernia. It travels the entire length of the inguinal canal, and the neck of the hernial sac lies external to the deep epigastric artery.

A hernia emerging through the middle or internal inguinal fossa is an internal or direct inguinal hernia. Instead of traversing the entire length of the canal, it passes through the lower portion only, to emerge at the external ring. The deep epigastric artery is external to the neck of the sac. A hernia emerging through the internal inguinal fossa is rare and is described by Joessel as an internal oblique inguinal hernia. Quain, however, dismisses this variety with the simple statement that it is rare, and reserves the term internal oblique inguinal hernia for those cases of internal hernia which emerge between the conjoined tendon and the deep epigastric artery, and so traverse a considerable portion of the inguinal canal before reaching the external ring.

External or oblique inguinal hernia may be congenital or acquired. In describing the congenital variety, it is necessary to state that the testicle in its descent from the abdomen into the scrotum is accompanied by a pouch of peritoneum which, about the time of birth, is separated by the adhesion of its walls from the general peritoneal cavity. The obliteration extends normally from the internal abdominal ring to the epididymis, the lower portion of the pouch remaining as the tunica vaginalis testis, the upper portion being gradually converted into a fibrous cord. However, the obliteration may fail wholly or in part. Thus the pouch may be obliterated only at the internal ring or immediately above the testicle, or it may remain in complete communication with the general peritoneal cavity. When the latter condition obtains, it is an easy matter for a loop of intestine to enter the pro-

cessus vaginalis peritonei and so form a hernia. Such a hernia usually develops before or soon after birth, and is distinguished by the fact that the hernial contents are in direct relation with the testicle, and that the hernial sac is a preformed one. Again, such a hernia first shows itself in more adult age and may be suspected in rapidly developing cases. Thus it is seen that the term congenital applies rather to the conditions existing than to the time of life at which the hernia appears. Should the congenital hernia reach the scrotum, it passes below the testicle, surrounding it so that it is necessary to examine carefully in order to find this organ. This may serve to differentiate between congenital and acquired hernia. Should the obliteration fail in the upper portion of the processus vaginalis peritonei, but below form a normal tunica vaginalis, then the conditions are present which allow the development of a variety of hernia described as hernia into the funicular process. It resembles the congenital form in all particulars except in that of coming into direct contact with the testicle.

In early childhood the inguinal canal pursues a very direct course through the abdominal wall, but as development proceeds, the pelvis widens and the canal acquires an oblique course, the internal ring receding from the external. This change in the direction of the canal may be followed by spontaneous healing of the hernia.

*Acquired External Inguinal Hernia.*—This variety, not having a congenital sac, provides itself with one from the parietal peritoneum. Entering the internal opening, it passes slowly along the canal to the external opening and follows the cord into the scrotum, being always separated from the testicle by its own sac and the outer layer of the tunica vaginalis. Such a hernia is of slow development and may remain for a long time within the canal before emerging from the outer opening and passing into the scrotum. During the first stages the canal retains its obliquity. As the hernia increases in size and weight the internal ring approaches the external, so that the sac passes almost directly through the abdominal wall.

However, the neck of the sac is still encircled on its inner side by the deep epigastric artery. As the hernia traverses the inguinal canal it is invested by the coverings given to the spermatic cord from the several layers of the abdominal wall. These coverings are: (1) skin, and superficial fascia; (2) fascia propria, composed of, first, intercolumnar fascia; second, cremasteric muscle and fascia; (3) infundibuliform fascia; (4) the properitoneal tissue and peritoneum composing the hernial sac. In congenital hernia this is the processus vaginalis peritonei, and may be distinguished from the acquired peritoneal coat by its relation to the testicle and its firm adherence to the fascia propria. The acquired sac is easily separated from the fascia propria, while the congenital is separated with difficulty. The acquired hernial sac, like the congenital, lies directly in front of and in contact

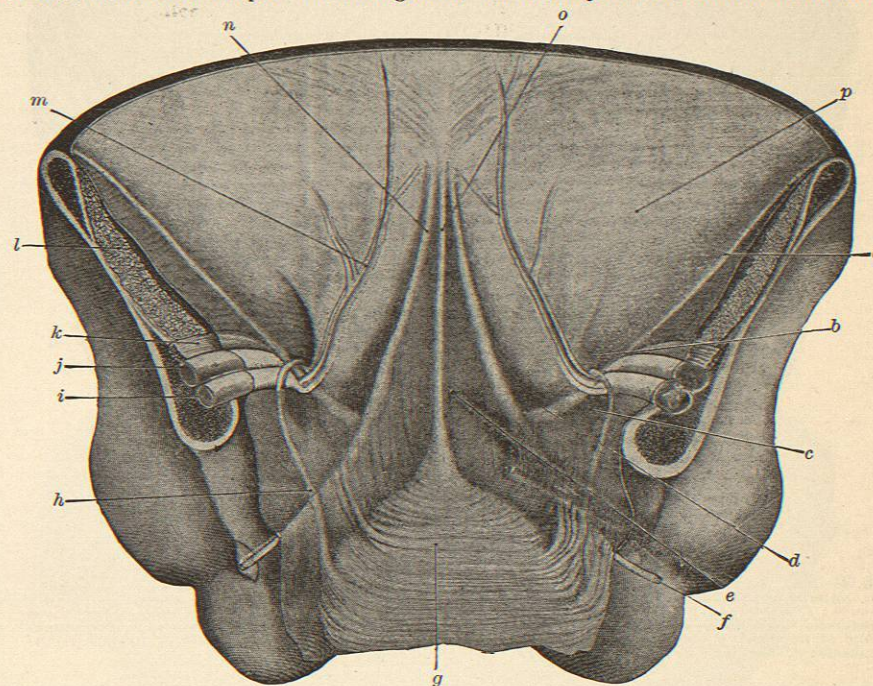


FIG. 3.—Rear View of the Anterior Abdominal Wall in the Inguinal Region. (Joessel.) a, Poupart's ligament; b, external inguinal fossa; c, femoral fossa; d, middle inguinal fossa; e, internal inguinal fossa; f, umbilical artery; g, bladder; h, vas deferens; i, external iliac vein; j, external iliac artery; k, anterior crural nerve; l, iliac muscle; m, plica epigastrica; n, plica hypogastrica; o, plica urachi; p, peritoneum.

with the vessels of the spermatic cord, but does not pass below the testicle.

Two additional forms of acquired external inguinal hernia are described, and though both are associated with incomplete obliteration of the processus vaginalis peritonei, they are not provided with a congenital sac. The first is the infantile variety, in which the processus vaginalis peritonei is obliterated only at the internal ring, leaving a large tunica vaginalis testis, behind which the newly formed hernial sac descends.

In the second form, that of encysted hernia, the condition of the processus vaginalis peritonei is the same; but the septum which is undergoing obliteration yields, and, passing down into the tunica vaginalis testis, invests the new sac. In a dissection of the first, three layers of peritoneum must be divided, in a dissection of the latter only two, before the hernial contents are exposed.

*Internal hernia* is of much less frequent occurrence and differs from the oblique variety, (1) in passing through the abdominal wall in the floor of the middle or internal in-