but in cases where this layer is thin I have found the modification easy of performance, and giving a perfect result. The loops should be applied at distances of one-third of an inch from each other, and should so pierce the fascia as to bring together a corresponding width of fascia on both sides. Removal is easy; one thread of each loop is divided close to the skin beside the gauze pad; pulling on the other end quickly releases it, and it is drawn out. When once all the loops are free, the secondary thread is easily withdrawn, whether slightly kinked or not. Care must be taken in all cases to carry the suturing for at least half an inch at each extremity beyond the line of fascial division, so as to produce a fold in the yet undivided tissue.

By the use of one or other of these plans it will be evident that we possess means by which the all-important tendinous expansion known as the deep fascia may be reunited safely and permanently, and that the latter methods also enable us when organic union is firm to remove all foreign material from the interior of the wound.

Something more might be said as to the different behaviour of the tissues in different parts of the abdominal wall; especially as to the difficulty experienced in the reunion of peritoneum near the epigastrium as compared with the ease of this manoeuvre below the umbilicus, and certain modifications which thereby become necessary, but this paper is already too long, and they must be left for future statement.

When a large hernia has to be closed, and the fascial edges are widely separated, the method adopted by both Dr. Macnaughton-Jones and Mr. Rutherford Morison of placing stay sutures so as to embrace the whole rectus muscle, and so obtain a firmer and more comprehensive grip of the tendon on either side, is an admirable one, but does not, in my opinion, dispense with the necessity for obtaining a broad union of the actual opposing portions of this tendon such as is produced by the Noble method. It is an accessory of very great use, but not the primary requisite. Dr. Macnaughton-Jones uses strong silver wire; Mr. Rutherford Morison strong chromicized gut. After all, these are measures for the cure, not for the prevention of post-operative hernia.

A Clinical Demonstration

ON

THE RADICAL CURE OF HERNIA.

Given at the Post graduate College and Polyclinic, London.

By MAYO COLLIER, M.S.Lond., F.R.C.S.Eng.,
Senior Surgeon, North-West London Hospital.

GENTLEMEN,—I have brought for inspection to-day two cases both quite simple of diagnosis, but about which there are many points to discuss and much to say.

RADICAL CURE OF HERNIA.

The patient, as you see, is apparently a strong, healthy fellow, who comes to the hospital with the most absolute belief and faith that I can perform some simple operation on what he says is a rupture in the left groin, so that he will never have to wear a truss again, and never be troubled with a return of his complaint. In short, he wants me to perform the radical cure in the belief that the radical cure will do all for him that he thinks.

This is the general belief among the lay public on the subject of the operations for the relief of rupture. I need hardly tell you that this view is incorrect; and the approximate truth on the subject of the radical cure for hernia I shall endeavour to put before you to-day.

Now, the first question you must be prepared to answer is this, Why an operation at all? Why not a comfortable and well-fitting truss? This question must be answered from several points of view, and first, there are seven classes of cases where a truss cannot be relied upon and an operation is most certainly indicated, namely:

1. Cases of irreducible hernia.
2. Cases of strangulated hernia.
3. Cases where the hernia is not controlled by a truss.
4. Cases of hernia with ectopia testis.
5. Cases where rupture unfits for the public service.
6. Hernias in incompetent and ignorant people.
7. Very large hernias hampering the movements of the patients, and threatening personal comfort seriously.

In all these cases it would be your duty to prefer and advise an operation rather than outside mechanical supports.

In other cases it is quite certain that hundreds of thousands of persons pass through their lives with comfort and safety with the assistance of a well-fitting truss, but I most certainly would not refuse to perform the radical cure for a person who was anxious to be relieved of his truss, and who, from a sentimental point of view, objected to the mechanical support.

Now before you could honestly take upon yourself the responsibility of advising and operating on a patient for the cure of hernia, you must satisfy yourself and your patient in some cases as to the following facts, and you must be prepared with more or less exact knowledge on the subject.

1. And first of all. Can you assure him that the operation is a safe operation so far as his life is concerned, as well as his testicle.

2. Secondly, does the term "radical cure" mean radical cure in the sense of permanency of cure? Is the operation a real cure or only a temporary palliative?

3. Should very young people be operated upon, and if not, at what age should the operation be performed?

4. Should a truss be worn after the operation, and if so, for how long, and if not, should any support or precaution be taken to prevent return?

5. You must satisfy yourself as to the best material for suture, and lastly, but assuredly not least, the best form of operation to perform.

You see from the list of questions that you must either answer to the patient or yourself that the procedure is not quite so simple as the public believe, and not quite so lightly to be undertaken as some would teach.

Safety of the Operation.

I think we may most certainly answer this question in the affirmative and say "the operation is perfectly safe, provided it is done by a skilled, competent operator with experience." Out of 104 cases in one practice there were only 2 deaths, both from zymotic diseases, and in America Dr. Coley lost 1 case out of 160 operations from pneumonia. These are just a few examples illustrating the freedom from trouble after this operation.

Is the Testis in any Danger from the Operation?

It most certainly is in the hands of the unskilled surgeon who endeavours to pull and drag and then the layers of fascia covering the hernial sac, instead of cutting straight down to the sac and gently peeling it from its nearest covering.

Atrophy of the testis and inflammation with abscess and sloughing have followed this operation in careless hands.

How Far does the Operation bring about a Complete or Radical and Permanent Cure?

Please always safeguard your own reputation and that of surgery in general by telling your patients that many of the best and most promising cases lapse, that the hernia returns and requires a second operation or a truss. Tell your patient that only in some cases does the patient never require further assistance or treatment, but also tell your patient that "an operation will most certainly improve matters, and that after an operation a patient is better off than he was before, and that most certainly it gives immunity to a certain number for a certain time."

As a matter of fact, it is fair to say that in 25 per cent. of the cases operated on the hernia returns and requires a second operation or the assistance of a truss before eight years.

What is the Earliest Age at which an Operation should be Undertaken?

It is a matter of common knowledge that quite a number of male children below 1 year have inguinal hernia, and that quite a large percentage of these get well with the use of properly-fitting trusses. On these grounds a truss should in most cases be recommended in preference to an operation up to, we will say, the 4th year, and in some cases longer. Of course, complicated cases where there are no contraindications should be submitted to operation as early as 2 years.

The Use of a Truss After Operation.

This recommendation will depend not only on the state of the patient before operation, but on his condition and duties after the operation. Speaking generally, favourable cases with small sacs, sound tissues, and well-formed abdominal walls, if allowed to rest for at least two or three months after operation, will not require a truss. *Per contra*, large sacs, weak abdominal walls, pendulous abdomens with much fat

are better supported with a broad, flat truss. The same applies to all patients who after operation will have to perform heavy and arduous work, or who suffer from chronic bronchitis, asthma, or chronic engorgement of the portal system. Again, patients going abroad where skilled surgical assistance is not available are better if provided with the safeguard of a light, broad, well-fitting truss to be worn on all occasions when in the erect position.

A point of considerable importance in the after-care of patients who have undergone the radical cure has been completely overlooked, so far as I know, by all writers on this subject. It is this: The method and position and preparation for the act of defaecation. "Straining at stool." How often have we who have been house-surgeons, or those in large practices, heard this suggested by the patient afflicted with rupture as the cause of the accident. The act of defaecation as Nature intended us to perform it is performed in the natural position, with the extremities and trunk all flexed to an acute angle; the thighs flexed on the abdomen so that the knees shall be in contact with the chest; the back of the leg touching the ham and the arms folded round the knees. No pressure that was ever exerted in this attitude could affect the inguinal or femoral openings. They are completely shut off and supported. The modern artistic watercloset imposes the necessity of sitting with the body erect and the thighs at a right angle to the trunk. In this attitude the inguinal and femoral openings stand the whole pressure of the abdominal contents in straining during defaecation.

Therefore, after, if not before, the operation for radical cure, direct your patient to return, so far as the act of defaecation is concerned, to *fera natura*. There is no doubt that the civilized position of the act of defaecation is responsible for a large percentage of ruptures. I most certainly should advise all persons who have a tendency to hernia or weak abdominal walls to stand upon the seat of the watercloset, not sit upon it—this is a point of the utmost importance in the prevention and cure of hernia.

What is the best Material for Suture and Ligature?

Every surgeon of any experience must have been disappointed to find some five or six weeks after the operation that his patient presents himself with a small discharging sinus in the site of the ligature surrounding the neck of the sac. This is the recorded experience of some of the best surgeons of the day when prepared silk has been used.

Many substances have been recommended—catgut, kangaroo tail, silkworm's gut, silver wire, and Chinese plaited silk, such as is used for fishing lines. The ideal ligature of course is one that is perfectly reliable, strong, easily rendered aseptic, that will be innocuous and non-irritating to the tissues.

Each of the above in turn has been tried and each has its advocates, but for general use, ease of application, freedom from becoming undone, and reliability, plaited Chinese silk seems to be the favourite.

American surgeons speak most highly of kangaroo tail, others use silver wire, and many colonial surgeons prefer catgut. The feeling of security that Chinese silk affords at the time of operation, as well as the experience of its use in other parts of the body, more especially in the suture of tendons, has lent some considerable support to its use in this operation, but still this ligature is constantly the cause of suppuration weeks and months after the operation, delaying convalescence and bringing discredit on the operation and the surgeon who performs it. The cause of this is not apparent.

The same ligature placed on a tendon or round the femoral artery would not suppurate. It may be due to the site of the ligature in its relation to the larger bowel, where foul gases may exhale and pass into the tissues, rendering this lifeless ligature septic where a living structure would resist the infection. To sum up, this accident is liable to occur, and in the operation a perfect ligature has yet to be found.

Of the other ligatures, kangaroo tail is difficult to obtain, catgut is liable to soften too easily and be absorbed too soon, and wire cuts through and is liable to be painful and irritating.

The Choice of Operation.

You will either admire the ingenuity of man or deplore the unsettled state of surgical opinion when I tell you that there are at least ten well-recognized surgical procedures for the relief of rupture in the inguinal regions.

You will one and all pardon the liberty I am taking when I say that no man who is not perfectly at home with, and acquainted with, the anatomy of this region in every detail should undertake this operation.

With your permission, I will just remind you of a few salient points in the anatomy of this region. And first of all this rupture is situated in the inguinal canal. Now what is the inguinal canal? It is an oblique passage in the layers of the abdominal wall situated at the lower and inner part of the abdomen. It extends for some $2\frac{1}{2}$ in. to 3 in., and is bounded externally and internally by what are known as the external and internal abdominal rings—the upper and lower limits of the canal. The internal ring is situated midway between the anterior superior spinous process of the ileum and the spine of the pubes, 1 in. above Poupart's ligament. It is oval in shape, and extends for about $\frac{3}{4}$ in. from above downward, and $\frac{1}{2}$ in. from side to side. This ring in its essence is formed by the margin of junction of the infundibuliform fascia with the transversalis fascia exactly in the same way as where the finger of a glove joins the body of the glove. It is covered over on its inner aspect by peritoneum with subperitoneal fat, and gives passage to the cord with its arteries, veins, and nerves, these being of course outside the peritoneum. The outer limit of the inguinal canal is the external abdominal ring. This is situated immediately above the spine of the pubes. It is triangular in shape, with its base below, and its apex pointing upwards and outwards. It is about $1\frac{1}{4}$ in. from base to apex, and about 1 in. across its base. The two sides of the triangle are known as the pillars of the ring.

In order properly to understand the anatomy of the pillars of the ring, an exact knowledge of the formation and attachment of Poupart's ligament is requisite. Poupart's ligament is the lower thickened border of the aponeurosis of the external oblique. It is attached externally to the anterior superior spinous process of the ileum, and internally has three attachments, which please note carefully, as the key to the surgery of both femoral and inguinal hernia rests with a knowledge of these. The three attachments are:

1. To the spine of the pubes, forming the external pillar of the ring.
2. To the ilio-pectineal line for about $1\frac{1}{4}$ in., forming Gimbernat's ligament.
3. To the linea alba, forming the triangular ligament or fascia known as Coll's ligament.

Practically speaking, after Poupart's ligament has become attached to the spine of the pubes it spreads in two directions, horizontally to form Gimbernat's ligament, and vertically to form Coll's ligament.

Now we are in a position to refer again to the external abdominal ring with its pillars. The external pillar of the ring is formed by Poupart's ligament, it is round and cord-like and nearly horizontal in position. The internal pillar of the ring is thin and tendinous, straight and sharp, and is formed by fibres of the tendon of the external oblique that pass to the front of the pubes and here interlace with those of the opposite side. The base of the triangle is formed by the crest of the pubes and extends from the spine of the pubes to the symphysis pubis. The apex of the triangle is acute and traversed by well-marked fibres, passing from one pillar to the other, known as inter-columnar fibres.

Having dealt with the two extremities of the passage we now come to the boundaries and structures forming this passage, and in order to do so I will just remind you how the abdominal muscles comport themselves in this region. You will remember the general disposition of these three muscles. Two are oblique and one is transverse. The external one is oblique from above downwards and the next in order is oblique from below upwards and inwards, and the innermost has its fibres passing almost transversely inwards. The upper attachment of these muscles does not concern us. We have seen how the external oblique bridges over the groin in the form of a thickened band of fibrous tissue known as Poupart's ligament, and how this is attached externally to the superior spinous process of the ileum, internally to the spine of the pubes and ilio-pectineal line and linea alba. The internal oblique also arches over the groin in the same way as the external oblique, but only towards the inner half of the groin from the inner third of Poupart's ligament to the ilio-pectineal line. Its outer fibres are thick and muscular, and are attached to the outer two-thirds of Poupart's ligament, and after covering the outer half of the inguinal canal dip downwards and inwards to be inserted into the ilio-pectineal line internal to Poupart's ligament, internal and posterior to the inner half of the inguinal canal. The internal oblique, then, is anterior to the canal in its outer half and posterior in its inner half. The transversalis muscle also arches at its lower border over the groin. It has much the same disposition as the internal oblique, but having a much

less extensive attachment to Poupart's ligament (only to its outer third), passes inwards and arches downwards to join the tendon of the internal oblique, and to be inserted with it into the ilio-pectineal line forming the conjoined tendon, about which you will hear so much during the operation for the radical cure of hernia. The transversalis, passing above the internal ring, has no anterior relation to the inguinal canal, but in passing to its attachment as the conjoined tendon is in a position posterior to the inner half of the canal.

Internal to the transversalis muscle we have the general lining membrane of the abdomen just as an egg has its general fibrous lining. This membrane receives various names in various places; when lining the transversalis muscle it is known as the transversalis fascia. In the pelvis it is known as the pelvic fascia, and when lining the diaphragm would be known as the diaphragmatic fascia. The internal ring is an opening in this fascia caused by the bag-like pouch that is carried down by the testicle on leaving the abdominal cavity. The very term "hernia" is derived from the Greek word *ἕρνος*, which means a branch, and it is this protrusion forwards through the abdominal wall by the testis that favours the subsequent protrusion of the peritoneal wall and the formation of hernia.

We are now completely in possession of the facts in the anatomy of these parts that relate to the operation, and we know that the canal has only in front of it external and internal oblique muscles and behind the internal oblique muscle and transversalis muscle as conjoined tendon, and behind this the transversalis fascia. You know also that the deep epigastric artery runs upwards and inwards from the iliac artery and passing between the transversalis fascia and peritoneum, skirts close to the inner margin of the internal ring. In operating you must always keep the exact position of the artery in mind.

An oblique inguinal hernia, then, is a protrusion of any of the abdominal contents through the entire length of the inguinal canal, and would have for its covering representatives of each of the normal layers of the abdominal wall in anterior relation to the canal. First, we should have skin, and then superficial fascia, the external oblique representative or intercolumnar fascia, then internal oblique or its representative cremasteric fascia, then transversalis or infundibuliform fascia, and lastly subperitoneal fat and peritoneum. The transversalis muscle, not being in anterior relation to the canal, escapes being pushed in front of the descending testis.

The few anatomical facts having just refreshed our memories we are now in a position to undertake the operation for the radical cure of hernia.

Now of the ten surgical procedures I foreshadowed to you all have the same object in view, namely, to get rid of the sac of peritoneum up to and as far as the internal abdominal opening, and to close the passage in the layers of the abdominal wall by readjusting these.

These objects are attained by various methods. [The lecturer then related and described the ten operations for the radical cure of inguinal hernia and expressed a predilection for Mr. Barker's operation.]

MASTOID ABSCESS AND ADENOIDS.

The next case that was exhibited was that of a boy, aged 18, with a discharging sinus in the right mastoid region in the site of a scar of a previous operation. It was a case of suppuration in the tympanomastoid cavities that had been operated on some years ago. The trouble in the mastoid had recurred, and no wonder.

If those present would examine the patient they would see that the boy was afflicted with adenoids as well and most pronounced nasal occlusion, and it was quite hopeless to expect to cure the mastoid disease before clearing the post-nasal space and ventilating the nose. The *fons et origo mali* was still there. The antrum had been opened and drained, but it was quite impossible to clear out all the corners and recesses and bring the parts into a healthy condition, unless the passage of the Eustachian tube was freely maintained and the other tissues kept free from congestion.

PUNCTURE OF RIGHT VENTRICLE.

Mr. Collier next exhibited a heart with a punctured wound of the right ventricle. It was a case of malignant endocarditis where the heart had become suddenly acutely dilated. This state had not been without reason mistaken for inflammation in the pericardium. An aspirating needle had been used and the ventricle punctured. The curious point was

that through so small a puncture 24 oz. of fluid passed in one minute, filling the pericardium to distension and causing the immediate death of the patient.

TRAUMATISM AND HERNIA.

By WILLIAM SHEEN, M.S.LOND., F.R.C.S.,
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Cardiff.

A WORKING man becomes the subject of hernia.¹ He refers it to some antecedent injury, such injury being either "straining" the abdominal muscles as in lifting a heavy weight² or being a blow upon, or squeeze of, the abdomen. The man, as a rule, is not attempting to deceive: the association of cause and effect is a natural one to him, particularly when he is introduced to that unfortunate term "rupture" by the first doctor who sees him.

Can a hernia result suddenly from a single trauma? and what are the conditions which must be fulfilled to associate the hernia with the trauma? If the hernia is wholly acquired (sac and contents), one cannot imagine it resulting suddenly from a single trauma, because the peritoneum will not stretch suddenly—it tears. This statement hardly requires amplifying. "Abrupt stretching of the membrane leads to certain rupture of it."³ Every abdominal surgeon knows how readily the peritoneum tears when traction has to be made upon it in closing a laparotomy wound. I have tested peritoneum from the living and dead body in various ways and find it very inextensible. Professor Haycraft has kindly tested its extensibility for me in the Physiological Laboratory, University College, Cardiff, on an apparatus of his own devising,⁴ and his conclusion is that peritoneum will not stand sudden extension.

Those, therefore, who regard a hernia as wholly acquired naturally agree with Tillmanns's view when he says: "The supposed sudden development of a true hernia is in my opinion always due to a mistake in observation."⁵ Even on the supposition of a wholly acquired origin there is, I think, one possible exception to this view, although a direct hernia would be a more likely result than the form under discussion, namely, sac and contents resulting suddenly from a "strain" in an individual who has been losing flesh rapidly and in whom there is weakness and atrophy with bulgings of the muscles of the lower part of the abdominal wall. Then, lax peritoneum and weakened abdominal wall might conceivably permit a portion of the peritoneum to be carried into the inguinal canal, probably not by a localized bulging but by a slipping down of the parietal peritoneum all round the widened internal ring. Such an event, however, would be impossible in an ordinary healthy adult with a normal musculature.

Under ordinary circumstances, then, the only explanation of the initial sudden appearance of a hernia lies in the existence of a preformed sac. Is this preformed sac congenital or acquired? As regards hernia in infants the view is gaining ground (Hamilton, Russell,⁶ Stiles,⁷ Deanesly⁸), that the hernia takes place into the processus vaginalis, which has become obliterated below, but not above. This view is borne out by the fact that the majority of these herniae in infants are on the right side,⁹ the side on which the funicular process is later in closing. Russell and Deanesly go further and consider that all oblique inguinal herniae (and in a later paper¹⁰ Russell extends the proposition to femoral herniae) depend for their existence upon the presence of a congenital sac. Other writers support this view, but not with the same thoroughness. For example, "Inguinal hernia . . . is due either to the congenital patency of the vaginal process . . . or to a secondary protrusion of the peritoneum."¹¹ "This hernia—that is, hernia into the funicular process—possibly forms the majority of the cases of inguinal hernia."¹²

Can we distinguish a congenital from an acquired sac? In my opinion, with a congenital sac the relations of the cord to the sac are more intimate than when the sac is acquired, and this appears to me to be the only difficulty in regarding the sac of an ordinary hernia as arising from the unobliterated funicular process. Sachs, however, quoted by Macready,¹³ says that there is so much variation in the relation of the vas deferens and the spermatic vessels to the posterior wall of the processus vaginalis that the position of these structures cannot be used as a test for hernia into the funicular process.

It is, however, I think, accepted—and such is my own experience—that in the ordinary "congenital" hernia, where the gut occupies the tunica vaginalis, considerable difficulty