W. E. Faulkner,
5 Otis Pl.,
1901. Boston

HERNIA

HERNIA

ITS ETIOLOGY, SYMPTOMS AND TREATMENT

BY

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NEW YORK
WILLIAM WOOD & COMPANY
MDCCCC

DEDICATED

TO HIS MANY FRIENDS AMONG THE

PAST AND PRESENT STUDENTS

OF

ST. BARTHOLOMEW'S HOSPITAL MEDICAL SCHOOL,

BY THE AUTHOR.

PREFACE

THE aim of this book is not to present the history of the subject of hernia, whether from the point of view of etiology or treatment, but to submit a short account of the origin, symptoms and treatment of a lesion which by its very frequency is of considerable importance, and one that teems with practical suggestions.

No attempt has been made to deal exhaustively with any division of the theme, for this has been done in the excellent monographs that are extant, but special pains have been taken to chiefly consider the aspect of actual treatment.

It is hoped that the illustrations may serve to graphically supplement the letterpress. The larger number of them have been obtained by photography, and therefore delineate the precise details of the objects depicted.

For the drawings I have to thank my friend Mr. A. T. Compton, who has spared neither skill nor time in preparing them. The majority of the photographs have been taken by my friend Mr. H. F. Bassano, and do him great credit. For others I have to thank Mr. H. W. Stephens, Mr. J. Macready, and my brother, Dr. Annesley Eccles. If I have inadvertently omitted to acknowledge the source of any, I hope that the authors will accept my apology.

Further, I have to thank Mr. Soltau Eccles, my father, and Mr. A. B. Soltau for so kindly looking over proof-sheets; and last, but by no means least, my sincere thanks are due to my two colleagues, Mr. John Langton and Mr. J. Macready, without whose unvarying kindness and ever ready teaching this book would not have been published.

HARLEY STREET, W.
June, 1900

TABLE OF CONTENTS

CHAPTER		PAGE
I.	GENERAL CONSIDERATIONS OF HERNIA - -	1
II.	THE CAUSES OF HERNIA - - - -	12
III.	THE CLINICAL CONDITIONS OF HERNIA—THE SIGNS, SYMPTOMS, AND GENERAL TREATMENT OF REDUCIBLE HERNIA - - - - -	18
IV.	THE CAUSES, SIGNS, SYMPTOMS, AND GENERAL TREATMENT OF IRREDUCIBLE HERNIA, INFLAMED HERNIA, AND OBSTRUCTED HERNIA - - - -	26
V.	THE CAUSES, SYMPTOMS, SIGNS, DIAGNOSIS OF, AND PATHOLOGICAL CHANGES IN, STRANGULATED HERNIA	36
VI.	THE GENERAL TREATMENT OF STRANGULATED HERNIA	62
VII.	INGUINAL HERNIA: ITS ANATOMY, CAUSATION, SIGNS, SYMPTOMS, AND DIAGNOSIS - - - -	78
VIII.	INGUINAL HERNIA: ITS TREATMENT BY TRUSSES -	99
IX.	INGUINAL HERNIA: ITS TREATMENT BY OPERATION -	121
X.	INGUINAL HERNIA: ITS RARER FORMS AND THEIR TREATMENT - - - - - -	145
XI.	FEMORAL HERNIA: ITS ANATOMY, CAUSATION, SIGNS, SYMPTOMS, AND DIAGNOSIS - - - -	153
XII.	FEMORAL HERNIA: ITS TREATMENT BY TRUSSES -	162
XIII.	FEMORAL HERNIA: ITS TREATMENT BY OPERATION -	168
XIV.	UMBILICAL HERNIA: ITS ANATOMY, CAUSATION, SIGNS, SYMPTOMS AND TREATMENT - - -	174
XV.	VENTRAL, OBTURATOR, AND LUMBAR HERNIÆ -	190

CHAPTER PAGE

XVI. SCIATIC, PERINEAL, ISCHIO-RECTAL, VAGINAL, AND DIAPHRAGMATIC HERNIÆ - - - - 199

XVII. HERNIA OF THE BLADDER, VERMIFORM APPENDIX, AND OVARY - - - - - - 204

XVIII. HERNIA IN ITS RELATION TO LIFE ASSURANCE, ACCIDENT INSURANCE, THE PUBLIC SERVICES, CLUBS, THE COLONIES, ETC. - - - 217

INDEX - - - - - - 226

LIST OF ILLUSTRATIONS

FIG.		PAGE
1.	THE PARTS OF A HERNIAL SAC	5
2.	A BI-LOCULAR SAC	6
3.	HOUR-GLASS CONTRACTION OF SAC	7
4.	HYDROCELE OF A HERNIAL SAC	10
5.	TRIPLE BULGING OF THE ABDOMINAL WALL	14
6.	FORM OF THE ABDOMEN IN PROLAPSE OF THE MESENTERY	15
7.	A MOC-MAIN TRUSS	23
8.	A TRUSS WITH A SEMICIRCULAR SPRING	23
9.	A TRUSS WITH A SPRING WHICH IS MORE THAN A SEMI-CIRCLE	24
10.	ADHESION OF CONTENTS TO SAC-WALL	29
11.	ADHESION OF CONTENTS TO THEMSELVES	29
12.	ADHESION OF TWO PARTS OF SAC-WALL	29
13.	PERIPHERAL AND AXIAL STREAMS	40
14.	DIAGRAM OF A HERNIAL SAC AND ITS CONTENTS	66
15.	FIRST VARIETY OF 'REDUCTION EN MASSE'	67
16.	SECOND VARIETY OF 'REDUCTION EN MASSE'	68
17.	THIRD VARIETY OF 'REDUCTION EN MASSE'	68
18.	THE USUAL INSTRUMENTS REQUIRED FOR HERNIOTOMY	*To face* 70
19.	THE PERITONEAL FOSSÆ	79
20.	HESSELBACH'S TRIANGLE	80

FIG. PAGE

21. INGUINAL CANAL - - - - - - - 81
22. THE SUPERFICIAL ABDOMINAL RING - - - - 84
23. LEFT INDIRECT INGUINAL HERNIA, EARLY STAGE *To face* 84
24. RIGHT INGUINO-SCROTAL HERNIA - - „ 84
25. LEFT SCROTAL HERNIA - - - - - „ 86
26. DIRECT INGUINAL HERNIA ON RIGHT, EARLY INDIRECT INGUINAL HERNIA (BUBONOCELE) ON LEFT *To face* 86
27. A LEFT VARICOCELE - - - - - „ 90
28. AN ORDINARY RUBBER-COVERED INGUINAL TRUSS FOR AN INFANT - - - - - - - - 100
29. APPLICATION OF A SKEIN OF WOOL TRUSS - - - 101
30. A RUBBER-COVERED RAT-TAIL TRUSS - - - - 103
31. A RIGHT-TAIL AND LEFT ORDINARY PAD - - - 103
32. AN ORDINARY LEFT INGUINAL TRUSS - - - - 105
33. PROPER CURVE OF SPRING - - - - - 106
34. IMPROPER CURVE OF SPRING - - - - - 107
35. A DOUBLE ORDINARY INGUINAL TRUSS - - - 108
36. HOW TO MEASURE FOR AN INGUINAL OR A FEMORAL TRUSS *To face* 108
37. A SINGLE ORDINARY INGUINAL TRUSS ADJUSTED „ 110
38. A DOUBLE ORDINARY INGUINAL TRUSS PROPERLY ADJUSTED *To face* 110
39. A DOUBLE ORDINARY INGUINAL TRUSS IMPROPERLY ADJUSTED, BEING PLACED AT TOO LOW A LEVEL - *To face* 110
40. A RAT-TAIL TRUSS OF PROPER PATTERN - - - 111
41. A RAT-TAIL TRUSS OF IMPROPER PATTERN - - - 112
42. A RAT-TAIL TRUSS ADJUSTED - - - *To face* 112
43. A RIGHT FORKED-TONGUE TRUSS - - - - 113
44. A SINGLE FORKED-TONGUE TRUSS ADJUSTED - *To face* 112
45. A DOUBLE FORKED-TONGUE TRUSS - - - - 114
46. A DOUBLE FORKED-TONGUE TRUSS ADJUSTED *To face* 114
47. A RIGHT SCROTAL HERNIA WITH A LEFT BUBONOCELE „ 114
48. A DOUBLE FORKED-TONGUE TRUSS ADJUSTED TO SAME CASE *To face* 114
49. A LIFTING-STRAP ADJUSTED - - - *To face* 114
50. A TRUSS WITH AN ORDINARY FEMORAL PAD ON RIGHT, TOGETHER WITH AN ORDINARY INGUINAL PAD ON LEFT 115

FIG. PAGE

51. A TRUSS WITH AN ORDINARY FEMORAL AND AN ORDINARY INGUINAL PAD ADJUSTED - - - *To face* 116
52. A TRUSS WITH AN ORDINARY FEMORAL PAD ON THE RIGHT AND A FORKED-TONGUE ON THE LEFT - - - 116
53. A TRUSS WITH AN ORDINARY FEMORAL PAD ON THE LEFT AND A FORKED-TONGUE ON THE RIGHT, ADJUSTED *To face* 116
54. A RIGHT FEMORAL WITH THIGH-BELT AND A LEFT FORKED-TONGUE TRUSS - - - - *To face* 116
55. A RIGHT FEMORAL WITH THIGH-BELT AND A LEFT FORKED-TONGUE TRUSS ADJUSTED - - - *To face* 116
56. A TRUSS WITH A RIGHT FEMORAL PAD, WITH A THIGH-BELT AND INGUINAL FULNESS, TOGETHER WITH A LEFT FORKED-TONGUE - - - - - *To face* 116
57. A TRUSS WITH A RIGHT FEMORAL PAD, WITH A THIGH-BELT AND INGUINAL FULNESS, TOGETHER WITH A LEFT FORKED-TONGUE, ADJUSTED - - - - *To face* 116
58. A LEFT HINGED-CUP TRUSS - - - - - 118
59. A LEFT HINGED-CUP TRUSS ADJUSTED - *To face* 118
60. A BAG-TRUSS ADJUSTED - - - - - - „ 118
61. THE INSTRUMENTS REQUIRED FOR A RADICAL OPERATION UPON A HERNIA - - - - *To face* 126
62. LINES OF INCISIONS FOR OPERATIONS UPON A LEFT OBLIQUE INGUINAL HERNIA, AND UPON A RIGHT FEMORAL HERNIA *To face* 128
63. METHOD OF LIGATURING OMENTUM - - - - 131
64. CLOSURE OF THE INGUINAL CANAL - - - - 136
65. A DIRECT INGUINAL HERNIA - - - *To face* 146
66. FIRST VARIETY OF INTERSTITIAL HERNIA - - - 148
67. A RIGHT INTERSTITIAL INGUINAL HERNIA, WITH, IN ADDITION, THE LEFT TESTIS AT THE SITE OF THE DEEP ABDOMINAL RING - - - - *To face* 148
68. SECOND VARIETY OF INTERSTITIAL HERNIA - - - 149
69. A TRUSS WITH AN INTERSTITIAL PLATE - - - 150
70. A TRUSS WITH AN INTERSTITIAL PLATE ON THE RIGHT AND AN ORDINARY INGUINAL PAD ON THE LEFT, ADJUSTED *To face* 150
71. PRO-PERITONEAL HERNIA - - - - - 151
72. THE FEMORAL RING - - - - - - 154

FIG. PAGE

73. A RIGHT FEMORAL HERNIA OF THE USUAL FORM, TOGETHER WITH DOUBLE INGUINAL HERNIÆ OF SMALL SIZE, THE LINE OF POUPART'S LIGAMENT SEPARATING THE RIGHT INGUINAL FROM THE RIGHT FEMORAL - *To face* 158
74. A RIGHT FEMORAL HERNIA PASSING DOWN THE THIGH, TOGETHER WITH A LEFT INGUINO-SCROTAL HERNIA *To face* 158
75. A RIGHT FEMORAL HERNIA MOUNTING UP IN FRONT OF THE INNER END OF POUPART'S LIGAMENT - *To face* 158
76. A LEFT VARICOSE SAPHENA VEIN - - - „ 160
77. A RIGHT ORDINARY FEMORAL TRUSS - - - - 162
78. A RIGHT ORDINARY FEMORAL TRUSS ADJUSTED *To face* 162
79. A DOUBLE ORDINARY FEMORAL TRUSS - - - 163
80. A DOUBLE ORDINARY FEMORAL TRUSS ADJUSTED *To face* 162
81. A FEMORAL TRUSS WITH A THIGH-BELT - - - 164
82. A FEMORAL TRUSS WITH A THIGH-BELT ADJUSTED *To face* 164
83. A FEMORAL TRUSS WITH A THIGH-BELT AND AN INGUINAL FULNESS ON THE LEFT SIDE - - - - - 165
84. A RIGHT FEMORAL TRUSS WITH A THIGH-BELT AND AN INGUINAL FULNESS ADJUSTED TO SAME CASE AS IN FIG. 75 *To face* 164
85. A FEMORAL TRUSS WITH A HOLLOW PAD - - - 166
86. CLOSURE OF THE FEMORAL RING - - - - 171
87. A CONGENITAL UMBILICAL HERNIA - - - - 175
88. AN INFANTILE UMBILICAL HERNIA - - - - 178
89. AN UMBILICAL TRUSS FOR AN INFANT - - - 180
90. AN UMBILICAL TRUSS FOR AN ADULT - - - - 183
91. AN UMBILICAL TRUSS ADJUSTED - - *To face* 183
92. A SALMON AND ODY UMBILICAL TRUSS - - - 184
93. A RIM-PLATE UMBILICAL TRUSS - - - - 185
94. VENTRAL HERNIA IN THE LINEA ALBA ABOVE THE UMBILICUS 191
95. AN UMBILICAL TRUSS WITH THE LOWER EDGE CUT STRAIGHT 194
96. OBTURATOR HERNIA - - - - - - 196
97. A RIGHT LUMBAR HERNIA - - - - - 198

HERNIA:

ITS ETIOLOGY, SYMPTOMS AND TREATMENT.

CHAPTER I.

GENERAL CONSIDERATIONS OF HERNIA.

A **hernia** is the protrusion of any viscus from the cavity within which it is normally contained. Thus, a portion of brain substance may pass through an opening in the bony cranium, constituting a hernia cerebri. Again, the testis may fungate through the scrotal wall, producing a hernia, or fungus, testis; the lung may transgress the confines of the thoracic cavity, causing a hernia of the lung; or a muscle may escape from its sheath, giving rise to a hernia of muscular fibres.

But the protrusion of an abdominal viscus from its position in the abdominal cavity is so decidedly more common than the extrusion of other viscera, that the term 'hernia,' even when employed without the qualifying adjective 'abdominal,' is generally meant to signify the protrusion of an abdominal viscus.

The word '**rupture,**' although no doubt used to denote protrusions through the abdominal wall, is open to the very serious objection that it implies—at any rate, in the lay mind—an altogether mistaken idea of the cause of the swelling.

In the majority of cases a hernia is of gradual and slow formation, and this without any tearing or breaking of

tissue, such as is clearly indicated in the use of the word 'rupture.'

Moreover, if it be agreed that the use of the term 'hernia' should be limited (as its derivation from the Greek ἔρνος, a 'young sprout,' indicates) to an actual protrusion from a cavity, then the expression 'internal hernia' should not be employed. When a piece of intestine within the abdomen slips through an aperture in the mesentery or into a peritoneal fossa, and is thereby nipped, then 'internal strangulation' is the phrase which ought to be used.

The affection known as hernia generally causes considerable, and, it may be, serious, inconvenience, even when it exists without complication; but if it become strangulated, a condition which may supervene at any moment, it will endanger the patient's life.

The Varieties of Abdominal Herniæ.—Hernial protrusions may occur through very many different regions of the abdominal wall—in fact, no part of the parietes of the abdomen can be said to be proof against a protrusion. However, some parts of the wall are much less resistant than others, and where a natural opening actually exists, the tendency to protrusion is certainly the greatest.

Herniæ may be:

1. Inguinal.
2. Femoral.
3. Umbilical.
4. Ventral.
5. Obturator.
6. Sciatic.
7. Lumbar.
8. Perineal.
9. Vaginal.
10. Diaphragmatic.

Inguinal herniæ are those which protrude in the inguinal region, and most commonly through the deep abdominal or inguinal ring.

Femoral herniæ escape by the crural ring and femoral canal, on the inner side of the femoral vein, into the upper part of the thigh.

Umbilical herniæ pass through the aperture at the navel.

Ventral herniæ may occur through any point of the anterior abdominal wall except the three openings just named. They are, however, most common in the middle line.

Obturator herniæ leave the pelvis through the obturator foramen, and enter the thigh.

Sciatic herniæ are protrusions through the great sacro-sciatic notch.

Lumbar herniæ appear in the space between the last rib and the crest of the ilium.

Perineal herniæ are in reality protrusions through the pelvic floor.

Vaginal herniæ are those which have the vaginal wall as a covering.

Diaphragmatic herniæ pass through the diaphragm and project into the thoracic cavity.

The Comparative Frequency of the Several Varieties of Herniæ.—Some of the above forms of protrusions occur much more frequently than others, and of all, inguinal hernia stands first, then femoral, and afterwards umbilical.

From a large number of cases it would seem that the percentages of these three varieties of hernia—inguinal, femoral, and umbilical—taking both the sexes and all ages together, are as follows: Inguinal, 73·41; femoral, 18·0; umbilical, 8·47. The fraction left—0·12 per cent.—suffices for all other varieties.

The following table shows the comparative frequency for each sex:

	Inguinal.	Femoral.	Umbilical.
Males	96·33	2·53	1·14
Females	50·6	33·5	15·9

Ventral herniæ constitute the next largest section, but are very much fewer in number than any of the three common varieties.

Obturator herniæ come afterwards on the list, but are very rare.

The other forms are but seldom met with.

A diaphragmatic hernia is not actually an 'external hernia'—that is to say, one which can be seen or palpated externally.

It, however, much more closely resembles this type of protrusion from the abdominal cavity than the so-called 'internal hernia,' which is not, in truth, a hernia at all.

The Parts constituting a Hernia. — A fully-formed hernia consists of: (1) A sac; and (2) its contents.

Hernia =
- 1. Sac:
  - (*a*) Mouth.
  - (*b*) Neck.
  - (*c*) Body.
- 2. Contents:
  - (*a*) Omentum.
  - (*b*) Intestine.
  - (*c*) Other Viscera.
  - (*d*) Fluid.

1. **The Sac of a Hernia.**—This is formed by a protrusion of parietal peritoneum. It is made up of three parts, viz., The mouth of the sac, the neck, and the body.

The **mouth** of the sac is the aperture by which its interior communicates with the peritoneal cavity. In the early stages of the formation of the sac the mouth is the widest part, but as the process of peritoneum is further and further protruded, so the mouth becomes smaller and narrower in comparison with the rest of the sac.

The **neck** of the sac is the constricted portion which is between the mouth and the body. It is for the most part found lying in the tissues of the abdominal wall. In the beginning of the formation of the sac the portion constituting its neck will be probably thrown into folds.

The **body** of the sac is that expanded portion which protrudes beyond the aperture in the abdominal wall. The body, which is often termed the fundus, may be pyriform or globular in shape, and it varies very much in size. The sac is said to have vessels ramifying over it in an arborescent manner; but it must be confessed that these vessels are often but very poorly marked.

The formation of the sac of an acquired hernia is somewhat difficult to satisfactorily account for. In the very early periods of its development, on account of the intra-abdominal pressure being suddenly increased, a slight bulging may occur in the region of a weak spot in the abdominal wall.

This is more easily seen than palpated. On the pressure being removed, the parietal peritoneum returns to its normal relations. If, however, the same conditions be many times repeated, there comes a period when the membrane will have yielded so much as to remain permanently bulged. The process of peritoneum thus formed may be caused partly by displacement of peritoneum, or partly by the gradual stretching of the portion of the membrane involved. At first there is but little adhesion of the sac to the tissues into which it is protruded, and it may be occasionally possible to dislocate it from its surroundings and return it within the abdominal wall. Very rapidly, however, the sac-wall tends to become

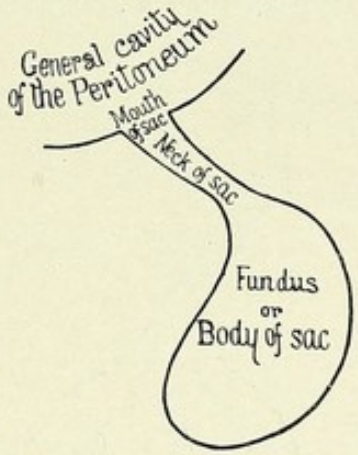

FIG. 1.—THE PARTS OF A HERNIAL SAC.

firmly fixed in its new bed, and tedious dissection will be necessary to separate it from the structures outside it.

Thus it will be seen that the formation of the sac of a hernia is a slow process, for the parietal peritoneum will neither stretch nor prolapse sufficiently to produce a sac in a day, or even a week or two; in fact, it usually takes months for the sac to be really apparent. It therefore follows, seeing that a hernial sac is not formed suddenly, that a fully-developed acquired hernia, consisting as it does of a sac and its contents, cannot be created in a few hours. An exception to this statement, however, must be made in those cases of congenital inguinal herniæ in which there is a previously formed sac—the processus vaginalis—into which viscera may at any time descend so long as the process remains patent. The peritoneum of the sac-wall may be complete, that is to

say, there is no breach of its surface. In other cases it may be only partial, either because the viscus which has descended is one which has but an incomplete covering of peritoneum, or, in consequence of the sac-wall being much stretched, it may become so thinned that apertures occur, and thus the contents of the sac come in contact with the tissues outside. This latter form of sac is termed 'fenestrated.' Occasionally the sac may become loculated, a condition which may be brought about in several ways. The sac may be so pressed upon from without by bands of tissue as to be almost separated into compartments. This appears to be most common in femoral herniæ.

Again, one part of the sac may yield before the distending

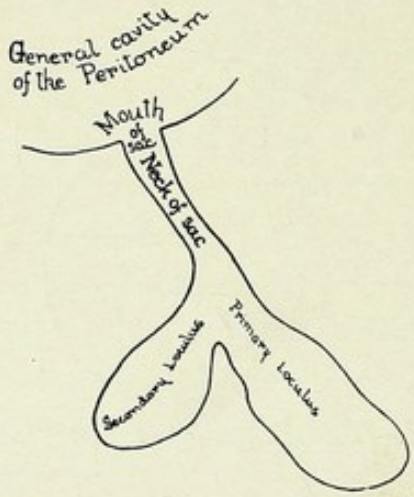

FIG. 2.—A BI-LOCULAR SAC.

force more readily than another, and thus a sacculus may be produced. Still more rarely septa form within the sac, probably as the outcome of inflammation causing adhesions; possibly, also, pouches may be caused by improper taxis.

At first the appearance of the peritoneum forming the sac, as well as its thickness, may be identical with that of the normal parietal peritoneum of the abdomen. If, however, the hernia be of long standing, there is a tendency for the sac-wall to become somewhat opaque, denser, and thicker, and this without any marked inflammatory process having been in evidence. As the outcome of inflammation, especially if there have been repeated attacks, much thickening may occur, often in localized patches, or in plates. Such indura-

tion is most commonly met with about the neck of the sac. Rarely a calcareous deposit may be formed in the thickened sac-wall. The tissues outside the sac constituting its coverings may become very dense and matted together; but these must not be mistaken for the peritoneum forming the sac itself.

In the majority of cases the sac is uniform in outline, but, as already noted, it may have pouches projecting from its surface, due to the greater yielding of the sac-wall at spots of less resistance. Hour-glass contraction of the sac may be present. The theory of its formation is that the mouth of the sac having become much narrowed, viscera are prevented from passing easily through it; but the intra-abdominal

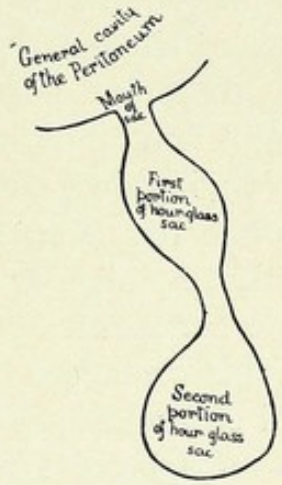

FIG. 3.—HOUR-GLASS CONTRACTION OF SAC.

pressure has caused the protrusion of another portion of parietal peritoneum, which pushes the original part of the sac in front of it. Sometimes a freshly-formed peritoneal pouch may be driven into the cavity of an ancient sac which had become closed at its mouth.

2. **The Contents of a Hernial Sac.**—Every viscus of the abdomen has been found in a hernial sac. The more freely movable an organ, the greater the frequency with which it becomes protruded into a hernial sac. Thus the omentum and the small intestine descend most often, and of the latter the ileum more frequently than the other parts.

The jejunum, sigmoid, cæcum, and the transverse colon follow next in order. Owing to the imperfect development

of the omentum in young subjects, it is but rarely found in a hernial sac of those of tender age, intestine being the usual contents. Omentum and intestine are by no means infrequently present together in the sac, and usually bear the same relation to one another as they do in the abdomen, namely, the omentum descends first and lies in front of the bowel. In a certain small number of cases omentum may be posterior to the gut, and in rare instances it may even form a pseudo-sac around the intestine within the peritoneal sac.

When intestine alone is present, the swelling is often styled an 'enterocele' (ἔντερον = intestine, and κηλη = tumour); when omentum alone is protruded, then the term 'epiplocele' may be used (ἐπίπλοον = omentum). If both omentum and bowel are contained in the sac, the expression 'epiplo-enterocele,' or 'entero-epiplocele,' has been employed. Pure epiploceles seldom attain any great size, never reaching that which may result when both gut and omentum are present.

In some cases of both inguinal and femoral herniæ, the vermiform appendix alone has been found in the sac, and occasionally an appendix epiploica, or Meckel's diverticulum, has constituted the sole occupant. If only part of the circumference of the bowel is prolapsed into a sac, the condition is spoken of as a partial enterocele, or Richter's hernia. The less common contents of a hernial sac may be the urinary bladder, the ovaries, the uterus, the stomach, the liver, and the spleen. Other viscera are extremely rarely found in herniæ. When intestine is protruded its presence may be recognised by the fact that the swelling is distinctly elastic to the touch, that gurgling will probably be felt or heard when manipulation is employed, particularly if the contents can be reduced, that percussion usually elicits a resonant note, and that intestinal sounds may be heard on auscultation. The sudden return of reducible intestine when taxis is employed is worthy of notice.

The presence of **omentum**, on the other hand, can be surmised by palpation, the tumour being soft and doughy, by the fact that no gurgling can be produced, and by the swelling having a dull note. The diagnosis of the presence of some of the other viscera mentioned is discussed later.

The changes which protruded viscera undergo after their entrance into a hernial sac are various, and must be carefully considered, even though briefly. The protruded omentum may form adhesions either to the sac-wall, to other parts of itself, or occasionally to intestine within the sac. Such adhesions occurring about the neck of the sac may entirely shut off its cavity from the peritoneal cavity. The omentum in the sac may become indurated, the site of the deposit of additional fat, of tubercle, of sarcoma, of carcinoma, and in some rare cases cysts may develop, or calcification may occur. In other instances, again, the omentum may lose the fat it ordinarily contains, and become more fibrous than normal, especially in the region of the neck of the sac.

The **intestine** when protruded may, like the omentum, form adhesions, but not so readily as the latter structure, since the bowel is more easily reducible. The muscular portion of the intestinal wall may be considerably thickened. The mesentery may be affected in much the same way as the omentum when protruded into a hernial pouch.

Fluid is not uncommonly found in hernial sacs. It may either be of the normal character, such as is secreted by the peritoneum, or it may be abnormal in kind and amount. Local inflammation of the peritoneum forming the sac will give rise to an excess of fluid from which deposits of lymph are apt to occur. Ascitic fluid from the general peritoneal cavity may also descend into a hernial sac, and it may here be remarked that when this condition complicates a hernia, it is equally impossible, as a rule, to keep either the viscera or fluid reduced.

Hydrocele of a Hernial Sac.—It happens at times that a hernial sac becomes shut off from the general peritoneal cavity by adhesions, or by a plug of omentum, by the vermiform appendix, or even the Fallopian tube, blocking the mouth of the sac, and subsequently fluid collects in the body of the sac. This accumulation is spoken of as a hydrocele of the hernial sac. It will have no impulse on cough, will be irreducible, will fluctuate and be dull on percussion. Such hydroceles generally occur in connection with long-standing

herniæ, and most usually in the femoral region. In a few instances a very large amount of fluid has been found.

Other cysts may develop in association with a hernial sac. They arise in some cases from inflammatory changes, especially about the omentum within the sac, in others from appendices epiploicæ. Hydatid cysts have been in a few rare instances met with, and in one case at least a dermoid cyst. A prolapsed ovary has become cystic, and, further,

FIG. 4.—HYDROCELE OF A HERNIAL SAC.

Meckel's diverticulum or the vermiform appendix may be the source of a cyst.

Loose bodies are now and then discovered in hernial sacs. In origin they may be detached appendices epiploicæ.

The adhesions which may be found in a hernial sac are of three varieties :

1. Agglutinative adhesions.
2. Fibrous adhesions.
3. Fleshy adhesions.

When inflammation occurs in a hernial sac, and but little fluid is thrown out, plastic lymph will form on the opposed surfaces of the contents and glue them together. This is the agglutinative adhesion, and can be easily broken down by the finger. The fibrous adhesion may occur in several forms: as long fine threads, as short thick bands, and

as firm rounded cords. Such adhesions may effectually prevent reduction by taxis, may give rise to strangulation within the sac, but may be so long in some cases as to allow reduction of the contents, which are still held attached to the inner surface of the sac. The fleshy adhesion is one in which the parts have become almost one, so close is the union, and it is with difficulty that separation can be effected by dissection—in fact, it may be quite impossible.

Adhesions, moreover, form between the contents of the sac and the sac-wall, or between different parts of the contents themselves, or between various portions of the sac-wall itself.

CHAPTER II.

THE CAUSES OF HERNIA.

As to the causes of hernia, it must be confessed that even yet but little is known on this subject which may be considered as definite.

The usual factors at work in the production of a hernial protrusion may be divided into (I.) predisposing, (II.) exciting, though it must be admitted that it is difficult to be certain into which division some of the causes mentioned should fall.

I. (*a*) **Predisposing Causes in General.** — There are many factors which may possibly be placed in this category :

1. Heredity.
2. Age.
3. Sex.
4. Form of the abdomen.
5. Length of the mesentery.
6. Prolapse of the mesentery.

1. **Heredity.**—The question of a direct inheritance of a predisposition to hernia in the offspring of parents suffering from the affection is by no means an easy one to settle. Only in about 25 per cent. of all cases of hernia can a definite history of a protrusion in one or more progenitors be obtained. This being so, it is only quite within the domain of fairness to assume that even in these cases the very large number of other causes of hernia may be actively at work, and that therefore inheritance is really playing but a small part in the production of their herniæ. Still, the fact that one-

fourth of all persons the subjects of hernia do give the history of either parents or grandparents having had a protrusion must be taken into account. From statistics, therefore, it would seem that heredity is a factor in the causation of hernia. Some further examination appears also to warrant the belief that a father having hernia tends to transmit a predisposition to hernia more marked in the case of his sons than of his daughters, and a mother who is afflicted with hernia more to her female children than her male; and, moreover, a fact which is very interesting, she seems to predispose more to femoral herniæ in both males as well as females.

Lastly, it would seem that both father and mother nearly equally transmit. It may be taken, then, that inheritance does play a part as a predisposing cause of hernia.

2. **Age.**—In connection with this factor it must be clearly borne in mind that it is the age at which the hernia first appeared that is being dealt with. The examination of a large number of cases goes to show as a general rule that the incidence of hernia is most frequent during the years in which life is most active, and tends to decline with advancing years.

More details as to the influence of age on the production of hernia will be found in the chapters where the special herniæ are considered.

3. **Sex.**—The male sex is more prone to hernia than the female, but this may in reality be the result of the fact that the exciting causes of these protrusions are more frequent in the former than in the latter.

Taking all ages and all varieties of hernia, the proportion between the two sexes is probably about six males with hernia to one female.

4. **Certain Peculiarities in the Conformation of the Abdomen.**—The examination of a large number of persons afflicted with hernia tends to bring out the fact that there are peculiar types of the form of the abdomen associated with protrusions of the viscera. These probably antedate the occurrence of the hernia, though of course they may in some instances be a result rather than a cause of the protrusion. There is one form of the shape of the abdomen, as far as it concerns the

anterior abdominal wall, which is not very infrequently seen in cases of inguinal hernia in male subjects, usually after thirty years of age. This variety was described by Malgaigne as that of 'triple bulging.' The median bulging is formed by the linea alba and the recti abdominis, and is vertical and funnel-shaped, with its narrowest part at the crests and symphysis of the pubic bones. The two lateral bulgings correspond with the oblique muscles, and are placed with their axes downwards and inwards, and are somewhat sausage-shaped, with their lower portion constituting a pocket above

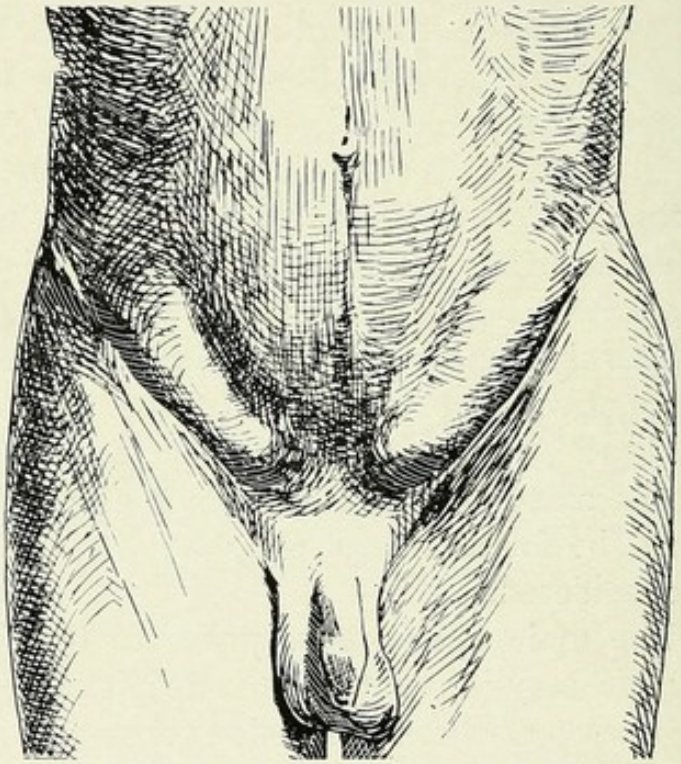

FIG. 5.—TRIPLE BULGING OF THE ABDOMINAL WALL.

Poupart's ligament. These three protuberances are best seen when a recumbent patient attempts to raise the head and shoulders from the horizontal position. Persons having an anterior abdominal wall of such a character may be expected to develop before long a hernial protrusion, if they be not already the subjects of this affection, and this particularly so if the subject be under forty years of age. Attention has been lately again drawn to a somewhat rare form of abdomen which it is believed is associated with a prolapse of the mesentery, namely, that in which there is a sinking in of

the upper part of the abdominal wall, due probably to the very frequent contraction of the transversalis abdominis muscle above the level of the umbilicus.

5. **The Length of the Mesentery.**—The average length of the mesentery in healthy adult subjects is some 6 inches to 7 inches, and is sufficient in itself to allow the small intestine to be drawn through the hernial rings. This being so, it is difficult to see how the length of the mesentery is of much importance in the production of hernia. Possibly, however, if the mesentery becomes from some cause abnormally

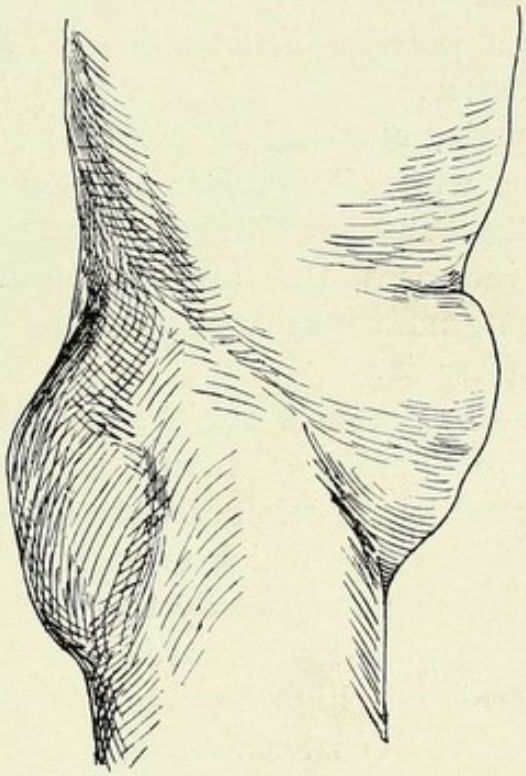

FIG. 6.—FORM OF THE ABDOMEN IN PROLAPSE OF THE MESENTERY.

lengthened, then a predisposition to hernia may thereby be induced.

6. **Prolapse of the Mesentery.**—By this is meant a sinking of the attachment of the mesentery to the posterior wall of the abdomen. Ptosis of the abdominal organs is becoming a well-recognised condition, and is being sought after as a cause of many evils. Some cases seem to present a general falling of all the organs toward the lower part of the abdomen (Glénard's disease), but in others only certain individual viscera have become prolapsed. The small intestine, with its mesen-

tery, may thus sink alone, or in company with other viscera. The mesentery is normally found attached obliquely across the abdomen from the left side of the second lumbar vertebra to the right sacro-iliac synchondrosis. Alterations in its position may affect only the upper (left) part of its attachment. At this spot there is a fibro-muscular expansion, which descends from the diaphragm near the œsophageal opening to the last part of the duodenum, and beyond it to the mesentery of the flexure between the duodenum and the jejunum. Elongation of this will of necessity allow the attachment of the mesentery to slip down to a lower level, and then bring a portion of the small intestine nearer the left hernial apertures.

(*b*) **The predisposing causes** of the several varieties of hernia is dealt with later when these forms are referred to.

II. **The Exciting Causes of Hernia in General.**—Any circumstance which increases the intra-abdominal tension, or diminishes the internal capacity of the abdomen, is a directly exciting cause of hernia.

1. **Occupation.**—In the male subject the influence of occupation on the production of hernia will be found to be marked. Work which necessitates strain in the stooping position seems to be that which is most prone to cause a protrusion; thus stokers, especially those who work in gas-works, coal-heavers, plate-layers, gardeners, etc., are all liable to suffer from hernia in a high degree. So also are itinerant vendors (hawkers and costermongers), who are generally exposed to conditions favouring lung affections, who are often ill-fed, and who strain themselves by shouting out their goods and pushing their barrows. Bakers seem peculiarly liable to hernia, and that in particular of the femoral variety; gardeners are also prone to have femoral protrusions.

2. **Pregnancy and Parturition** in the female is another potent exciting cause of hernia, and repeated pregnancies tend to produce a greater liability than does a single gestation. On the other hand, a hernia may disappear, or become much less during the actual period of gestation.

3. **Diseases of the Lungs** which induce coughing sufficient to cause pressure on the abdominal parietes.

4. **Crying in Infants.**

5. **Straining during Micturition,** due to stricture, phimosis, etc.

6. **Straining during Defæcation.**

7. **Tight-lacing.**

8. **Ascites.**

9. **Increase of Bulk of Abdominal Viscera,** as from deposits of fat in the omentum, new growths, etc.

Herniæ are described as being **congenital** and **acquired.** Congenital herniæ, usually of the inguinal variety, are those which are the outcome of some developmental defect persisting after birth. Acquired herniæ are those which are found as a new lesion, altogether apart from any congenital condition. They may be the outcome of traumatism, and are then spoken of as traumatic, or they may depend upon any of the causes given above.

CHAPTER III.

THE CLINICAL CONDITIONS OF HERNIA. THE SIGNS, SYMPTOMS, AND GENERAL TREATMENT OF REDUCIBLE HERNIA.

THE **clinical conditions** of any given hernia may conveniently be classified as follows:

1. Reducible.
2. Irreducible.
3. Inflamed.
4. Obstructed.
5. Strangulated.

A **reducible hernia** may cause but little inconvenience to the subject of it, but it must always be remembered that at any time it may become strangulated, which is an intensely dangerous condition. On the other hand, a reducible hernia may be an intolerable nuisance.

A **simple irreducible hernia** may, again, be of but slight annoyance to the one who has the affection; but such a condition usually causes considerably more disturbance than many a reducible hernia. An irreducible hernia is also liable to become the seat of inflammation, of incarceration, or of strangulation.

REDUCIBLE HERNIA.

A **reducible hernia** may be defined as one in which the contents of the sac can be returned to the abdomen. As a rule, the sac of a hernia is fixed to the surrounding tissue, and cannot be displaced except by dissection. Most herniæ

in their early stages are reducible. Such a return may come about either spontaneously when the patient assumes the horizontal position, or it may not occur until pressure is applied in the form of taxis on the part of the patient or surgeon. When reduction is accomplished by taxis, the feeling of a solid body slipping away from the fingers is very apparent. If intestine form part of the contents of the sac, its reduction may moreover be accompanied by a very distinct gurgling sound or sensation.

The contents of the sac met with in a reducible hernia may be varied, but bowel—and that usually small intestine—or omentum of recent descent, are the most common viscera to be found within the sac.

The Signs and Symptoms of a Reducible Hernia.

Signs.—1. There is a **swelling** in a hernial region. This may be very small or truly enormous. In the majority of cases there is a definite history of this disappearing sooner or later when the patient lies down, but reappearing either immediately or gradually when the erect position is again taken.

2. There is an **expansile impulse** in the swelling on coughing or crying. The cause of such an impulse may be twofold: either that an increase of the visceral protrusion is brought about, or that, when the sac contains intestine, there is an extra flow of intestinal contents into that part of the bowel lying within the sac.

Sometimes, especially in quite the early stages of a hernia, the expansile nature of the swelling can be better appreciated by sight than by touch. Such an impulse is quite different from that obtained over all parts of the healthy abdominal wall when sudden straining efforts are made. The latter may be termed a forward rather than an expansile impulse.

3. The swelling is **soft**, somewhat **elastic**.

4. It yields a **resonant note** if it contains intestine, but a dull one when only omentum is protruded.

5. Auscultation may reveal **gurgling** if gut is present.

6. **Reduction** is in itself an important sign of a reducible hernia.

Symptoms.—1. **Pain.**—Probably by far the larger number of herniæ are accompanied by pain ; in fact, pain—very real to the sufferer—may be the earliest indication of a protrusion. This pain is most usually felt at the site of the hernia itself, but may also be referred to the interior of the abdomen, or to the back. If patients are asked where they feel the most pain, they will nearly always indicate the spot as being over one of the weak places in the abdominal wall where protrusions are wont to occur. Thus in inguinal herniæ the region of the deep abdominal ring is often most accurately localized.

The pain experienced may be either an acute, sharp, cutting, or burning pain, or a dull, heavy, aching pain. It is remarkable how many of the vague abdominal pains complained of by patients the subjects of herniæ are entirely effaced by the application of a suitable truss. The pain referred to the back is perhaps more commonly felt in cases of strangulated than in those of reducible herniæ.

Pain, moreover, is most complained of when the viscera are either descending into the sac or returning into the abdomen. It is necessary to state, however, that there may be no pain whatever produced by a given hernia.

2. Besides actual pain, there may be a **sense of weakness** at the hernial site ; and this feeling often renders existence very uncomfortable from the fear the sufferer has of causing any strain of his abdominal wall, as in coughing, sneezing, defæcation, etc.

3. When the abdominal viscera are not retained within the abdomen, the patient may be the subject of **indigestion,** accompanied by flatulency, colic, nausea, or actual vomiting. Constipation is apt to be a symptom, and, naturally enough, does not tend to alleviate the condition. Such symptoms as these may be very slight or well marked, and are very liable to occur in paroxysms, with intervals in which little or no distress is experienced.

The Prognosis of a Reducible Hernia.

A hernial protrusion is always a serious matter. The prognosis of a simple reducible hernia is grave, not in itself, but because it is a condition which may at any moment

plunge the sufferer into dire extremity by the occurrence of strangulation.

Many cases are seen in which an undiscovered or neglected hernia has led to intestinal obstruction and death, on account of the bowel it contained becoming nipped. In life assurance a reducible hernia which is properly controlled by a suitable truss is not usually taken as an indication for a premium on a higher scale; but in some instances it would be advisable to suggest that a radical operation should be performed before passing the life for the granting of a policy. This subject is dealt with more fully in the last chapter.

The General Treatment of a Reducible Hernia.

The general treatment of a reducible hernia may be considered under two headings—(1) **Palliative**; (2) **Operative.**

1. **The Palliative Treatment of a Reducible Hernia.**—The contents of the sac having been replaced within the abdominal cavity, either spontaneously or by suitable taxis, it is necessary to apply some form of apparatus which will tend to keep the abdominal viscera within their proper domain. Such an instrument is spoken of as a **truss.** An ideal truss must give its wearer the least possible discomfort with the maximum of safety.

It is often said that a thoroughly comfortable truss is one which acts with the least efficiency, and no doubt this is true in many cases. On the other hand, a suitable truss will do its work without the patient being continually reminded of its existence. Some patients become so habituated to the use of their truss that they have no uneasy knowledge of its presence, but very soon feel the discomfort caused by its becoming inefficient through wear, or by their neglecting to adjust it on rising.

For a truss to be satisfactory it requires to be of the right construction as to the materials from which it is made, the form which it takes, and to be of the right size for the individual to whom it is to be applied; and, further, to be accurately adjusted in the proper position for the particular hernia from which the patient is suffering. A truss, therefore, may be inefficient owing to improper construction, to

improper size, and, last but not least, owing to improper adjustment.

In order to maintain a satisfactory control over the escape of viscera from the abdominal cavity into that of the hernial sac, it is necessary to cause some pressure in the proper direction on the site where the initial protrusion takes place.

The full pressure of the spring should not be constant, but should only come into play during straining and expulsive efforts on the part of the wearer. It is almost impossible to construct a truss which will absolutely fulfil this important detail in a perfect manner.

In order to secure pressure, a pad to fit over the hernial aperture and a metal spring are necessary. There are three forms of spring available for use, viz.:

1. That which is wholly within the pad itself.
2. The semicircular spring.
3. The spring which is more than a semicircle.

The truss which is formed of a circlet of leather or other fairly stiff material and a pad, with or without a spring situated within it, is an instrument which has but little to recommend it, and many points which might be urged against it. It may perhaps under ordinary circumstances suffice to retain the contents of the hernia within the abdomen, provided they have not much tendency to escape; but it is liable to allow them to slip past under very little strain. Moreover, it is wholly inefficient in certain postures, and is at one time too tight and at another too loose, owing to the varying conditions of abdominal distension. The most typical example of this form of truss is the ordinary 'mocmain,' and it should be considered very uncertain and not to be recommended. The second form of spring is the semicircular, or in many cases it is the one which is a little more than half a circle. Such a truss requires a strap to pass round between the point of pressure behind and that in front. This form of instrument, often known as the Salmon and Ody variety, is possibly an improvement on the first described, but it has so many objections as to be almost worthless except in a few special cases. In it there is a

tendency for the pad to easily shift its position, which is a great disadvantage; and in addition to this the needful strap causes much discomfort, and becomes sooner or later so stretched as to be practically useless. Thus it is that the

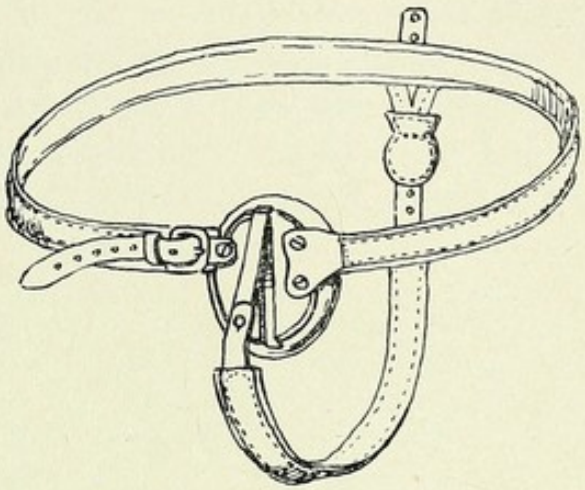

FIG. 7.—A MOC-MAIN TRUSS.

truss with a spring considerably longer than a semicircle is in the end the most suitable for the majority of herniæ. One advantage gained by the long spring is that the counter-

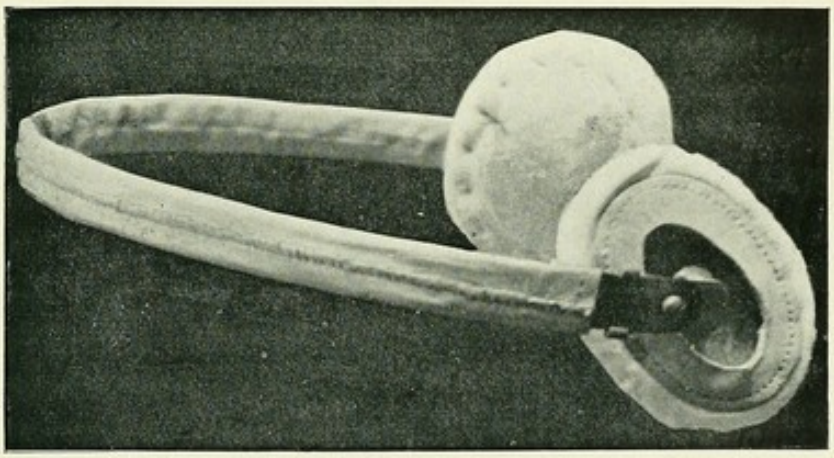

FIG. 8.—A TRUSS WITH SEMICIRCULAR SPRING.

pressure is distributed over a wider area than when it is derived merely from one spot, as in the semicircular spring. Another advantage is that the length of spring gives a greater steadiness to the truss.

The spring should be made of finely-tempered ribbon steel, of a proper breadth, about three-quarters of an inch in a truss for an adult, and of suitable thickness. A great difficulty is experienced in preventing the rusting of this metal by perspiration. It would be a great boon if a non-corroding metal fit for forming the spring of a truss could be discovered. Up to the present no aluminium or other alloy has been found to meet the requirements of the case. The spring should be covered with some material which tends to protect it from the moisture of the body. Over this

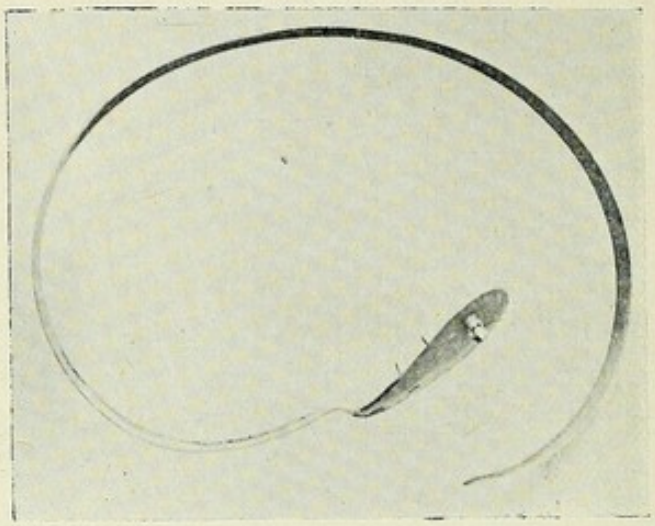

FIG. 9.—A SPRING WHICH IS MORE THAN A SEMICIRCLE.

there must be some soft felt for a padding, and then chamois leather, which will come in contact with the skin.

Besides the spring of a truss, there is the pad. The basis of the pad must always be of rigid material; soft iron is the best for the purpose. This is faced with some substance towards the abdominal wall, and oftentimes this consists of a convex-shaped piece of cork. The smaller a pad is, consistent with efficiency, the more comfortable it will be when in use. The shape of the pad naturally differs with the variety of the hernia it has to control. It is important in the majority of cases that the pad be immovably fixed to the spring.

A truss should be worn at all times when the patient is in the erect position, but it may be discarded when he is lying down, unless there is some condition present, such as lung

disease producing a cough, which indicates the continuance of its application at night.

If a hernia be constantly and thoroughly retained by a truss, there is a marked tendency for the hernial aperture to become very much contracted. The sac, however, in most cases remains, but in a few instances adhesions may form so as to partially or completely obliterate its cavity. Spontaneous cure by trusses, except in the case of infants, is very exceptional, so that a truss will usually have to be worn for the rest of a patient's lifetime. A patient up to middle life who is the subject of a reducible hernia and is wearing a truss should always endeavour to keep his or her muscular system in a healthy tone. The adoption of exercises to increase the vigour of the abdominal muscles is of the utmost importance.

2. **The Operative Treatment of a Reducible Hernia.**—Speaking generally, an operation on a reducible hernia with a view to cure may be undertaken for the following conditions, provided always that the patient is otherwise fit for an operation :

1. A reducible hernia which cannot be controlled by a suitable and properly adjusted truss.
2. A reducible hernia in a patient who desires to enter one of the public services, or to obtain a life assurance policy, or who is about to proceed to districts where medical aid in the case of emergency is unobtainable.

The principles involved in a radical operation for a hernial protrusion are to completely remove all trace of the sac at its neck, and to close as far as possible the aperture through which the hernia escapes.

Some surgeons prohibit entirely the use of a truss after these radical operations ; others advise that such should be worn for a variable period after convalescence ; while others, again, insist that the truss should be continued throughout the rest of life.

The details of the various operations and after-treatment applicable to the different forms of hernia will be found under their respective headings.

CHAPTER IV.

THE CAUSES, SIGNS, SYMPTOMS, AND GENERAL TREATMENT OF IRREDUCIBLE HERNIA, INFLAMED HERNIA, AND OBSTRUCTED HERNIA.

An **irreducible hernia** may be defined as one in which the contents of the sac cannot be returned into the abdomen. This definition, however, must be taken with some expansion, in order that the clinical state of the hernia may be fully understood. It is well to remember that the term 'irreducibility' is at the best only a comparative one, for a hernia which is irreducible so far as the patient's own efforts at taxis are concerned may be completely reducible when a surgeon applies similar pressure in a proper manner.

Again, part of the contents of a sac may be reducible and part irreducible, and yet this form is usually considered under the heading of 'irreducible.' That the contents of a hernial sac are incapable of being reduced to-day does not necessarily imply that return may not be easily effected to-morrow or some time later. In fact, it should be very clearly understood that irreducibility is in the greater number of cases a purely temporary clinical condition of the hernia. It is the fact only of irreducibility that is now being considered. There is no inflammation, strangulation, interference with blood-supply, or any other abnormal condition present beyond that of mere irreducibility. Therefore, a better definition perhaps of an irreducible hernia would be one in which the contents of the sac for the time being cannot be returned into the abdomen, but at the same time they are

in no other way affected, their functions remaining normal. This condition may be termed 'simple irreducibility.'

THE CAUSES OF IRREDUCIBLE HERNIA.

1. Predisposing.

(*a*) **Age.** — Irreducibility is decidedly rare in children. Probably this is to be chiefly accounted for by the fact that omentum is but occasionally found in the hernial sac of young subjects, and that the bowel protruded has but little tendency to form adhesions. When the contents of an inguinal sac in children are irreducible, there is sometimes found to be present a congenital cæcal hernia, for the cæcum cannot be returned because of adhesions, the outcome of its original imperfect peritoneal covering.

Irreducibility begins to be more frequent after twenty-five years of age, but is most usual between thirty and fifty.

(*b*) **Sex.**—Females suffer more often than males from irreducibility, chiefly owing to their being more commonly afflicted with femoral hernia.

(*c*) **Class and Habit of Subject.**—Irreducibility is certainly more often met with among the labouring classes than among those whose occupation is lighter, and this in a greater degree than would be accounted for by the larger proportion of instances of hernia generally found in the former status of society. Again, a subject who is habitually careless as to the condition of his hernia is very liable to be sooner or later afflicted with irreducibility of the same.

(*d*) **Variety of Hernia.** — The variety of hernia present exercises a considerable influence over the likelihood of its becoming an irreducible one. Of the three common forms of hernia, femoral herniæ give the largest number of irreducible protrusions, then umbilical, and lastly inguinal. Femoral herniæ appear to be liable to become irreducible ten times more frequently than inguinal. Roughly, about 15 per cent. of all femoral herniæ are at one time or another irreducible, 10 per cent. of umbilical, and 2 per cent. of inguinal.

2. Exciting.

These may be conveniently divided into three classes:

(*a*) Those acting from without the sac.
(*b*) Those acting in the wall of the sac.
(*c*) Those acting from within the sac.

(*a*) **Those Acting from without the Sac.**—1. Mere contraction of the tissues through which the neck of the sac passes, although not sufficient in amount or so sudden in onset as to produce strangulation, may yet so narrow the lumen of the cervical passage that the contents for the time being may become irreducible.

2. This external pressure, moreover, may lead to some considerable atrophy of that part of the contents which occupies the neck of the sac, and further pressure may cause narrowing of the neck itself. Thus, the contents of the fundus of the sac, being in no way altered as regards their bulk, will no longer be reducible. This is particularly liable to occur when omentum is present, and such a condition is probably by no means an infrequent cause of irreducibility.

In such cases the omentum is said to have a narrow neck, and reduction may be obtained to the extent that in inguinal hernia viscera are pushed back into the canal, but no further.

(*b*) **Those Acting in the Wall of the Sac.**—1. The most important of these is undoubtedly the thickening and contraction of the peritoneum forming the neck of the sac. This change may be the outcome of external pressure, as has just been mentioned, or it may be the result of attacks of inflammation, possibly produced in some instances by improper or ill-adjusted trusses.

2. In a few cases an hour-glass contraction of the sac occurs at the superficial ring, sometimes as the result of partial obliteration of the processus vaginalis in a congenital inguinal hernia. As a consequence of this contraction, the contents of the lower part of the sac may remain irreducible.

(*c*) **Those Acting from within the Sac.**—1. Increase in the bulk of the contents of a hernial sac after they have been

protruded. Such enlargement is most commonly in the omentum which has prolapsed. There is a great tendency to the deposition of fatty tissue in this part of the contents, and its size will consequently become greater, and therefore

FIG. 10.—ADHESION OF CONTENTS TO SAC-WALL.

offer a bar to reduction. A similar accumulation of fat may occur, though much less often, in the mesentery, mesocolon, or even appendices epiploicæ. Increase of size may also be caused by a development of fibrous tissue, the outcome of chronic congestion, or repeated attacks of inflammation of the protruded omentum.

FIG. 11.—ADHESION OF CONTENTS TO THEMSELVES.

FIG. 12.—ADHESION OF TWO PARTS OF SAC-WALL.

In a few cases tuberculous disease of the mesenteric glands within the sac, or the occurrence of malignant disease of the omentum or intestine, may lead to enlargement sufficient to bring about irreducibility.

2. Adhesions may form, and thus prevent return. They may occur—

(*a*) Between the contents and the inner surface of the sac-wall.

(*b*) Between different parts of the contents themselves.

(*c*) Between one part of the sac-wall itself and another part.

The Contents of the Sac in Irreducible Herniæ.

Omentum is the chief component of the contents of an irreducible hernia. After omentum the large intestine is more likely to become irreducible than the small intestine. Thus it is that in old umbilical herniæ which are irreducible the colon is not infrequently found imprisoned in the sac, though not necessarily adherent there. The bladder, ovary, and cæcum are perhaps more usually irreducible than reducible.

Fluid occasionally accumulates in the sac of a hernia where the contents are irreducible, and constitutes one form of hydrocele of a hernial sac.

THE SIGNS AND SYMPTOMS OF AN IRREDUCIBLE HERNIA.

As in a reducible hernia, there is a swelling in a hernial region when an irreducible hernia is present. This, however, does not spontaneously disappear when the horizontal position is assumed by the patient, nor even on gentle taxis.

The swelling has a distinct impulse on coughing, which is expansile in nature. The reason of this sign being present is that, although a part or the whole of the contents cannot be returned within the abdomen, yet there is, as a rule, nothing to prevent more from descending from above.

The liability which irreducible herniæ have to strangulation is to be principally attributed to this fact: the mouth of the sac is, as it were, kept open by the irreducible viscera lying in it, and so the organs in the abdomen are tempted to protrude and become nipped.

Sometimes there may be no symptoms whatever caused by an irreducible hernia, especially in the case of a small

femoral protrusion; but more usually a sense of weight in the part, flatulency, attacks of colic, now and then nausea, and other digestive disturbances, may be in evidence.

If the omentum in the sac drag upon the stomach or transverse colon, symptoms somewhat resembling those of strangulated hernia, or rather of intestinal obstruction, may come on. Inflammation may easily be set up by blows, pressure, rubbing of a badly-fitting or wrongly-adjusted truss. These complications are dealt with later.

THE DIAGNOSIS OF AN IRREDUCIBLE HERNIA.

The differential diagnosis of an irreducible hernia is considered under the heading of each form of special hernia.

THE PROGNOSIS OF AN IRREDUCIBLE HERNIA.

Any form of hernia must be looked upon as being a dangerous lesion—at least, in a potential sense, but an irreducible one more so than a reducible one. All irreducible herniæ, as has been stated, are particularly liable to inflammation, and certain of them to obstruction. Strangulation is by no means uncommon in non-reducible protrusions, but not with the frequency with which it might be expected to occur. Probably, other things being equal, the younger the patient the more serious an irreducible hernia in reality is.

THE GENERAL TREATMENT OF AN IRREDUCIBLE HERNIA.

The general measures which may be adopted in the treatment of irreducible herniæ will be reviewed here, the methods of applying them to the individual varieties of hernia being dealt with under the heading of each form of protrusion.

Seeing that in the large majority of instances of irreducible herniæ the irreducibility is only a temporary condition, the rational treatment of such a protrusion is to attempt to bring about the reduction of the contents of the sac. An intelligent appreciation of the various conditions which lead to the contents of a hernial sac becoming irreducible will

greatly aid in the endeavour to bring about their return to the abdomen.

No hernia can be said to be irreducible for the time being unless an attempt has been made to reduce it by taxis applied in a proper manner. It must never be forgotten that when dealing with a simple irreducible hernia taxis may be used with a degree of force which would be perfectly unjustifiable in the case of a strangulated hernia, for in the latter the contents of the sac are by no means in a normal condition. There is no doubt that repeated trials of taxis may in the end produce reduction.

Rest in the recumbent position is often strongly advocated as a means of inducing the return of the imprisoned contents. This is especially useful when combined with continuous pressure, and the method has the advantage of being without danger; but its uncertainty, combined with its tediousness, militates greatly against its use. When a patient has an excess of adipose tissue, it may be well to try and diminish its amount, and thus lessen the bulk of the contents of the sac. Truss pressure is eminently satisfactory in a large number of cases. Herniotomy, on the other hand, in many cases provides the only radical and lasting mode of treatment. The subjects who are best suited for operative measures are those who are comparatively young, who are not corpulent, and who have small irreducible herniæ. The aged, bronchitic, stout, or weakly subjects, especially when they have large herniæ, are wholly unsuitable patients for operations. Their herniæ should be treated by the palliative methods given above. It was before mentioned that an irreducible hernia is liable to become inflamed. By this it must not be taken that inflammation is confined to irreducible herniæ, since it is true that a reducible hernia may become the site of inflammation.

An **Inflamed Hernia** may be merely a local peritonitis when it is the sac-wall which is the tissue chiefly inflamed. Beyond this the contents of the sac may also share in the process, which is particularly liable to affect the omentum before the bowel.

Inflammation is due to many causes, among which may

be mentioned: (1) external injury, as from the improper pressure of an ill-fitting truss or one which has been badly applied. Again, blows upon the swelling, or prolonged and too severe taxis, will also tend to cause an inflammatory attack. (2) Acute strangulation. (3) Acute inflammation spreading from the interior of the intestine. All the above give rise to an acute inflammatory process, but in addition (4) tubercle, new growths, etc., may affect the sac, and so lead to a chronic inflammation of the parts.

All forms of inflammation of a hernial sac may bring about the formation of adhesions, and thus produce irreducibility of the contents of the sac. Inflammation is most common in femoral herniæ, then in umbilical, and, lastly, in inguinal.

The **Symptoms** present in an acutely inflamed hernia are well marked, viz., redness, pain, increased size of the swelling, with œdema and tenderness over it. There will be no loss of the expansile impulse, and the consistency of the protrusion is not much, if at all, altered. Sometimes, however, there is a distinctly increased tension, owing to the effusion of fluid into the sac. There will probably be a somewhat raised general temperature, and although there may be nausea, perhaps even vomiting, together with constipation, yet there are no very pronounced signs of intestinal obstruction, as in the case of a strangulated hernia. The inflammation is usually confined to the hernial protrusion itself, but occasionally it spreads to the abdominal cavity.

The **Prognosis** of an inflamed hernia is generally good, since there is but little danger to life; but in the aged it is sometimes a decidedly grave condition. As has been said, it may lead to the formation of adhesions, and rarely to a hydrocele of the hernial sac.

The **Treatment** of an inflamed hernia consists in keeping the patient at rest, in obtaining free action of the bowels, and in applying hot or cold compresses to the swelling. If the inflammation persist, or if there be indications of suppuration having occurred, or if there be any suspicion that more than mere inflammation exists, then an exploratory incision should promptly be made.

An **Obstructed** (or **Incarcerated**) **Hernia** is one which contains intestine the lumen of which is obstructed from within, but there is no interference with the circulation of blood through the vessels of the bowel wall.

Obstruction may occur in both reducible and irreducible herniæ, but it is more common in the latter. The material causing the blockage of the lumen of the intestine is usually firm fæces; occasionally, however, intestinal gas, foreign bodies, or undigested food have produced the obstruction. Since umbilical herniæ very frequently contain large intestine, and are often irreducible, it is these protrusions which are most prone to be the seat of obstruction, and that particularly so in women after middle life. On the other hand, males who are the subjects of large inguinal herniæ may be attacked with obstruction, especially if their herniæ are irreducible and contain the cæcum or sigmoid flexure.

The **Symptoms** produced by the lumen of the bowel becoming occluded by blockage from within vary very much. In their slighter forms they may not be recognised as having their origin in the hernial sac, and in their more severe degrees they may be very difficult to distinguish from those of strangulation. All the symptoms develop gradually, a fact which is of importance in the diagnosis. The hernial protrusion, if reducible before, becomes irreducible, and is generally of larger size than usual. There may be only slight pain in the swelling, which becomes of firmer consistence than before, though it can hardly be said to be distinctly tense as it is in strangulation. Sometimes a 'doughy' sensation is obtained on palpation. Percussion usually yields a dull note, unless flatus is present. There is constipation, but it is not generally absolute. Vomiting may occur, but is not persistent or urgent, and but very seldom indeed becomes stercoraceous. The tongue is soon coated, the breath foul, the appetite completely disappears, and eructations are frequent. The abdomen may become distended, and intestinal colic will ensue. Although the protrusion is irreducible, yet it retains its expansile impulse on the patient coughing, but this may be much less marked than before the obstruction came on.

The Diagnosis between an Obstructed Hernia and a Strangulated Hernia.

Obstructed Hernia.	Strangulated Hernia.
1. Onset :	
Gradual.	Sudden.
2. Swelling :	
(*a*) Irreducible.	(*a*) Irreducible.
(*b*) Enlarged.	(*b*) Enlarged.
(*c*) Not much tenderness.	(*c*) Much pain and tenderness.
(*d*) 'Doughy,' or slightly firmer than usual.	(*d*) Very firm and tense.
(*e*) Impulse on cough.	(*e*) No impulse on cough.
3. Constipation :	
Not absolute.	Absolute.
4. Vomiting :	
But little marked.	Marked.
5. Constitutional disturbance :	
Slight, no collapse.	Severe, much collapse.

The Prognosis of an Obstructed Hernia.—When the diagnosis of obstruction is made, the prognosis is on the whole favourable, as if the bowels be got to act all the symptoms pass off very readily; but the condition may be serious in the aged, and may in some cases pass into that of strangulation.

The Treatment of an Obstructed Hernia.—If the diagnosis of obstruction is fairly certain, the treatment should be on the following lines: Copious enemata of soap and water, succeeded by gentle taxis, kneading of the sac and its contents. If the contents are thereby reduced, a mild aperient may subsequently be administered by the mouth. If, however, any doubt exists as to the exact condition of the viscera in the sac, an exploratory herniotomy should be undertaken unless the patient's general state absolutely negatives it. To prevent the recurrence of the obstruction, the patient should be warned to avoid all food which is liable to leave much detritus, and to be careful to maintain regular and efficient action of the bowels.

CHAPTER V.

THE CAUSES, SYMPTOMS, SIGNS, DIAGNOSIS OF, AND PATHOLOGICAL CHANGES IN, STRANGULATED HERNIA.

DEFINITION.

A **Strangulated Hernia** may be defined as one which contains intestine, the lumen and bloodvessels of which are obstructed by pressure from without.

This definition, it will be seen, is made up of three facts: First, the presence of gut in the sac; secondly, that the intestinal contents cannot pass onwards owing to the external pressure; and, thirdly, that the same compression endangers the circulation through the bloodvessels of the bowel wall.

It is also true that for the time being the contents of the sac of the hernia are not spontaneously reducible, and possibly not so by taxis.

It is well to clearly differentiate the three terms used in this chapter and the previous one.

'**Irreducible**' is used to imply simply the fact that the contents of the sac cannot be returned into the abdomen without indicating any other point concerning the hernia.

'**Obstructed**' (or 'incarcerated') is the word employed to denote the circumstance that the lumen of the protruded bowel is obstructed from within—that is, by its own contents.

'**Strangulated**' is the term used when there is interference with the circulation in the bowel wall, in addition to stoppage of the flow through its lumen, the result of pressure from without.

All herniæ which contain bowel are liable to strangulation. It is questionable whether a hernia the sac of which contains omentum alone can ever be said to become the site of a strangulated hernia; but this point is more fully discussed later (p. 51).

It is in strangulation that the chief danger of a hernia lies, and this strangulation may occur suddenly at any time, and without any previous warning. The onset of such a condition plunges the sufferer into a state of extreme danger. Many persons afflicted with hernia experience but little discomfort from the same, and are therefore apt to neglect the protrusion, with the consequence that at a wholly unexpected moment they are thrown into serious peril by the advent of strangulation.

THE CAUSATION OF STRANGULATION.

Many theories have been put forward as to the mechanism whereby strangulation is produced. Some of these are obviously untenable in the light of present knowledge, while others are the products of deductions from experiments on elastic tubes or portions of inanimate intestine, and these can scarcely be said to explain what in reality occurs in the living body.

Before any of these theories are dealt with, a statement of what is considered to be the actual sequence of events in strangulation may be given.

A hernial sac is present, either of acquired or of congenital origin, through the narrow mouth and neck of which is forced, by pressure acting from within the abdominal cavity, a loop or knuckle of intestine. While passing into the sac, the bowel will be kinked so that the two portions forming the loop must become nearly parallel with each other; but as soon as it reaches the more roomy space of the interior of the body of the sac, it tends to return to its normal curved outline.

Meanwhile the part of the gut caught in the mouth and neck of the sac is pressed upon by the more or less unyielding tissues external to the bowel. This pressure will have a marked influence on the return of blood through the thin-

walled veins of the intestinal wall. Thus great engorgement of these soon occurs unless there be a speedy removal of the constriction. The engorgement leads to exudation into the tissues of the bowel walls, with the result that they become much thickened, and thus still further pressure on the contents of the sac is caused by the parts outside its neck.

Interference with the normal circulation of blood in the intestinal wall gives rise to the development of gas within the lumen of the gut, which in itself will create more and more pressure.

Of the many theories as to the factors at work in the production of the compression of the intestine in a hernial sac with occlusion of its lumen, three only need to be dealt with here:

1. Elastic strangulation.
2. Fæcal occlusion.
3. Both of these causes acting together.

1. **Elastic Strangulation.**—If an elastic ring be taken, and any substance be forced through it which is somewhat larger than the circumference of the ring, it will be obvious that an elastic pressure must be exerted by the ring upon its contents. This is precisely what may happen in a hernia. A loop of bowel, by a violent expulsive effort, is suddenly forced through one of the hernial apertures, and becomes quickly subjected to pressure. Actually this form of strangulation may sometimes occur in a so-called congenital inguinal hernia. Much more commonly, however, a sac which already contains gut has more bowel or omentum driven into it, and thus dangerous pressure and subsequent strangulation are brought about. During the passage of the gut the ring will be stretched to its utmost, and then, when the extruding force ceases, the margins of the ring will grip its contents.

True or elastic strangulation is probably in the great majority of instances the real explanation of the mechanism of the nipping of the contents of a hernial sac. It will be noticed that this pressure is exerted from without, and, while acting by occluding the lumen of the bowel, at the same time necessarily and seriously affects the circulation through the vessels of the intestinal wall.

2. **Fæcal Occlusion** is a more modern theory, and at most not so apparent or so effective a cause of strangulation. By this term is meant that the pressure suddenly produced within the bowel lying just above or within the sac by the descent into it of a large amount of intestinal contents gives rise to pressure on the walls of the gut.

This causes more gut to be drawn into the sac, and with it more mesentery, thus producing sufficient nipping by the neck of the sac and outlying tissues to determine strangulation.

In elastic strangulation the bowel may be empty, and pressed upon from without as the primary effect, whereas in fæcal occlusion there must needs be a full intestine, and the pressure is secondary.

3. Lastly, it is not improbable that these two factors—**Elastic Strangulation and Fæcal Occlusion**—may act at one and the same time, the former producing the actual compression, while the latter brings about the obstruction.

SYMPTOMS AND SIGNS OF A STRANGULATED HERNIA.

It is useful for the purposes of description to subdivide the symptoms and signs caused by a strangulated hernia into those which are general and those which are local.

(*a*) The General Symptoms and Signs.

The chief of these are: Pain, vomiting, absolute constipation, and prostration, or collapse.

1. **Pain.**—This is of two varieties, and occurs at different spots. The first kind is a more or less severe colicky or griping pain, which comes on chiefly in paroxysms, and is felt for the most part in the region of the umbilicus, though sometimes it is referred to the spine. The second variety is a continuous dull ache, which usually supervenes on the acute griping pain, and, like it, is liable to exacerbations. It is felt chiefly at the seat of the hernia, but may also be located at the navel. Pain is hardly ever absent in a case of strangulation—at all events, in the early stages. If gangrene of the strangulated bowel ensues, then the local pain may

cease, and also a patient may pass into such a condition that, although perhaps feeling pain, he is incapable of giving evidence of his distress. A very similar result is produced by the administration of opium, a drug which will mask symptoms and do little good in a strangulated hernia.

2. **Vomiting.**—This is one of the most important of all the general signs of a strangulated hernia. Strangulation means intestinal obstruction, and obstruction produces vomiting. The emesis has the well-known characteristic of persistency, namely, that it continues in spite of all attempts to relieve it short of the liberation of the imprisoned contents of the sac.

FIG. 13.—PERIPHERAL AND AXIAL STREAMS.

It is not, moreover, usually accompanied by much, if any, nausea, but shows a peculiar gushing character. It is great in the amount of the ejected matters, and is but seldom absent as a symptom, although it may disappear if gangrene is present.

Considerable discussion has arisen at various times as to the causation of the vomiting in intestinal obstruction, and therefore in a case of strangulated hernia.

There are, however, four chief theories at which it will be well to look: (1) That the vomiting is of a purely reflex nature. (2) That it is due to reversed peristalsis. (3) That it is the outcome of an upward axial stream. (4) That it is the result of the stimulation of the vomiting centre in the medulla by toxic products.

That nervous influence will bring about vomiting when a piece of bowel is nipped is certain from experiments on animals, and, further, from the record of an instance where vomiting occurred as the consequence of a loop of bowel becoming strangulated below the site of an artificial anus.

The ejection of the contents of the stomach and the upper part of the small intestine is, in the early stages of the strangulation, almost certainly due to nervous influence, namely, reflexly through stimulation of the abdominal sympathetic.

The theory that inverted or reversed peristalsis produces vomiting has few, if any, facts in support of it.

The nipping of a loop of intestine is in itself a factor, by the stimulation that it causes, of the increased peristaltic action which ensues. This wave of intestinal movement is in the usual direction, namely, towards the anus. Thus a strong stream of intestinal contents is made to rush against the block which is present at the seat of the constriction. There the stream is reversed in its direction, and, assuming an axial disposition, returns to the stomach (Fig. 13).

In the later stages of strangulation decomposition of the contents of the bowel above the obstruction occurs, owing chiefly to the action of the colon bacillus. Toxins are then rapidly absorbed, with the result that the vomiting centre is in all probability stimulated.

It is extremely rare for vomiting to be absent throughout the whole extent of the period in which strangulation is in evidence, but it generally ceases if the bowel has been for long nipped, or if gangrene has commenced. If, therefore, the symptom of vomiting disappears, it should be taken as indicating a very grave crisis.

The vomited matters consist in the first place of the contents of the stomach, which may be the undigested material of the previous meal, or food which has been for a longer time in the viscus. Next, and that before long, the matters are made up of bile-stained mucus, and sometimes a small amount of blood.

If the strangulation continue unrelieved, sooner or later

a very characteristic material is ejected, which has been variously termed fæculent, fæculoid, stercoraceous, or fæcal.

This is a soft pultaceous substance of a deeply yellow colour, with a most disagreeable odour, which is not altogether like that of normal fæces, but which has only to be smelt once to be always easily recognised thereafter. The first appearance of this material is most usual about seventy to eighty hours after the onset of the strangulation, but it varies with the variety of hernia from which the patient is suffering.

Other things being equal, the higher up the constriction of the intestine, the earlier the time at which the stercoraceous vomit appears.

Even a partial enterocele (Richter's hernia) may give rise to fæculent vomiting. The term 'fæcal' applied to this form of vomit is hardly a correct one, for 'fæces' are not in true existence until the large intestine is reached, and for fæces to be vomited there must be a regurgitation through the ileo-cæcal valve, a circumstance which very rarely occurs.

3. **Constipation.**—As a general rule, strangulation leads to absolute constipation. This is the technical phrase used to imply that neither fæces nor flatus are passed *per anum*, owing to the bowel being so obstructed by pressure from without that its contents are entirely incapable of an onward passage. There is a tendency to regard this symptom of constipation as universally present and necessary in strangulation, but it must be borne in mind that if the strangulation occur in the small intestine, there is a possibility—in fact, even a probability—that the large intestine should empty itself of any fæcal matter that it contained at the moment of strangulation. This is particularly liable to happen if the patient is treated with enemata. Therefore, because there may be one or more actions of the bowels, the surgeon must not overlook the possible existence of intestinal obstruction. In rare cases a motion has been voided even some days after the stoppage commenced. In some other instances, moreover, instead of constipation being in evidence, the patient has actually had what may be termed diarrhœa, in spite of

the fact that there is a severe nipping of the gut. Possibly this looseness of the bowels may be due to an enteritis below the seat of the obstruction. Occasionally there is an incessant desire to go to stool, but without any result.

4. **Prostration.**—This is a very serious condition, and although it varies much in degree, yet it is but seldom entirely absent in a case of strangulated hernia. It is most marked in the acutely constricted cases, in feeble and young subjects, and where the patient has been subjected to very severe attempts at taxis. The prostration may be quite early in the affection, or not appear until some hours have elapsed.

It is manifested by languor, anxiety, sunken cheeks, together with a pinched expression, often termed *facies abdominis*. At a later stage the patient passes into what may be described as a 'typhoid' condition, perspiration breaks out, the tongue becomes dry and coated, the pulse weak and small, the extremities cold and livid, and the breathing shallow.

Sometimes the prostration will continue although reduction of the bowel has been obtained, or it may not manifest itself at all until the intestine is again within the abdomen. Probably such cases in reality depend upon the absorption from a paralyzed intestine of the products of decomposition, the result of bacterial action. It is this poisoning that is so dangerous a factor in all intestinal obstruction which has been allowed to continue unrelieved.

In addition to the above four prominent symptoms, there are several others of minor importance, which are, however, of use in diagnosis and in estimating the severity of the affection. Among these may be mentioned the following: The temperature is, as a rule, below the average, and in some cases of extreme prostration the fall is very great. In a few instances where the strangulation has not been very acute, and inflammation has supervened, the temperature may rise somewhat. All appetite is lost, and there is usually intense thirst, which is partly the outcome of the loss of fluid occasioned by the vomiting, and partly due to the dry condition of the tongue and fauces.

At the same time there is a diminution of the amount of urine secreted. This, again, is in part due to the vomiting, but also probably to some reflex inhibition of the secretory nerves of the kidneys. Probably this symptom cannot, nor even can that of retention of urine which in rare instances occurs, be taken to denote that there has been a perforation of the intestine.

Meteorism may be present. The lower down the site of the obstruction, the greater the liability to marked distension of the intestine, and thus of the abdomen, though it may be late in appearing. If peritonitis is in evidence, then the meteorism is likely to be increased.

Eructation and hiccough may be present, the former ushering in the symptoms, the latter attending the approaching decease of the patient. There may, in addition, be various nervous symptoms, general tremors, or even actual convulsions; cramps and other muscular phenomena may also show themselves. Delirium and coma may end the scene.

(*b*) The Local Symptoms and Signs.

These may be stated to be a swelling, tense, irreducible, with loss of impulse, but fluctuating, dull and dumb.

1. **Swelling.**—There will be a swelling in the region of a hernial site. If the swelling had been noticed previous to the onset of the strangulation, then its size may be discovered now to be somewhat larger than it was before. Even an irreducible hernia of some dimensions may, when it becomes strangulated, increase perceptibly in bulk. This enlargement in the protrusion when strangulation occurs is dependent partly upon the greater amount of the abdominal viscera which now lie within the sac, and partly to the exudation of fluid into its cavity.

It is true that in some cases the swelling produced by a strangulated hernia is so small and insignificant as not to be either easily seen or palpated, therefore a very careful examination should always be made.

2. **Tenseness.**—The swelling if it is handled will be found to be in the majority of cases very tense. This is owing to

the fluid which has been exuded into the sac from the vessels of the intestinal wall.

In some instances the tenseness is so marked that the swelling may be said to be of almost stony hardness. Patients themselves may remark on the change that has arisen in the consistency of their hernia.

There is no doubt that the tenseness of the sac is a very important sign of strangulation, and one that is but seldom absent.

3. **Irreducibility.**—If the hernia had previously been reducible, it now becomes irreducible—at any rate, spontaneously—and seeing that a very large number of strangulated herniæ were reducible before the constriction occurred, this sign of irreducibility is one of much value.

4. **Loss of the Expansile Impulse on Coughing.**—While the fingers are palpating the region of the swelling, the patient should be directed to cough if an adult, or made to cry if an infant.

The expulsive efforts thus induced by the contraction of the abdominal muscles will, in the larger number of cases where strangulation is present, cause nothing of that characteristic expansile impulse which is obtained in a reducible hernia under like circumstances. There may, indeed, be an impulse, but it will be merely of a forward nature, similar to that observed anywhere on the abdominal wall. It is of the utmost importance to distinguish between these two forms of impulse.

5. **Fluctuation.**—This sign is the result of the accumulation of fluid in the hernial sac, and it may be present in many cases. It will be absent if the amount of fluid is very small, or if the tenseness of the sac is too great to allow of it.

6. **Dulness.**—Percussion will, in the majority of instances of strangulation, give evidence of a dull note, owing, again, to the fluid which fills the sac, and to that which is within the contained bowel.

7. **Dumbness.**—Auscultation, which before strangulation may have disclosed the gurgling sounds so characteristic of the presence of intestine, will now only reveal the fact that there is no voice in the contents of the sac. This is due to

the circumstance that there is no movement in the material within the lumen of the bowel.

THE DIAGNOSIS OF A STRANGULATED HERNIA.

The diagnosis of a strangulated hernia falls under two headings. Firstly, there are those instances where there is undoubted strangulation of intestine present, but the symptoms and signs arising therefrom are not wholly those of acute intestinal obstruction due to a strangulated hernia. Secondly, those cases in which other conditions than the nipping of bowel may simulate in their symptoms those of acute strangulation.

I. The diagnosis of a strangulated hernia when the symptoms and signs are incomplete or anomalous.

The cases which have to be diagnosed as strangulation of intestine in which the symptoms and signs are incomplete or anomalous may be conveniently grouped under the following classes :

1. Cases in which the peculiarities in the symptoms or signs are associated with the contents of, or changes within, the hernial sac.
   - (*a*) Nipping of a portion of the calibre of the bowel.
     - (1) Partial enterocele.
     - (2) Strangulation of the vermiform appendix.
     - (3) Strangulation of Meckel's diverticulum.
   - (*b*) Strangulation within the sac.
     - (1) Strangulation by bands of adhesion, holes in the mesentery, etc., within the sac.
     - (2) Kinking of the bowel within the sac.
     - (3) Rotation, or volvulus of intestine within the sac.
2. Cases in which the peculiarities are dependent upon the hernial sac itself.
   - (*a*) Loculated sacs.
   - (*b*) Pouched sacs.
3. Cases in which the peculiarities are due to multiple herniæ.
   - (*a*) Two (or more) herniæ, one irreducible and the other strangulated.

(*b*) Two herniæ, one concealing the other.

(*c*) An inguinal and a femoral hernia on the same side, one strangulated and the other not.

4. Cases in which the peculiarities are due to strangulation within the abdomen, in a patient who is also the subject of a hernia.

This large group of cases is of the utmost importance, for if the several conditions are not recognised they may lead to very serious consequences.

The first division, including the partial enteroceles, the strangulation of the vermiform appendix and Meckel's diverticulum, form a class by themselves. In all intestine is nipped, and in all the condition is a grave one.

Partial Enterocele, or the strangulation of only a portion of the circumference of the bowel wall, is sometimes termed Richter's hernia.* Such herniæ constitute one variety of the so-called 'masked herniæ.' The points in which a strangulation of only a portion of the intestinal wall differs from the symptoms produced by the nipping of a complete loop of gut may be stated as follows: Constipation is but rarely absolute, flatus and some fæcal material often passing the seat of the strangulation to be expelled by the lower bowel. This is obviously due to the passage-way still remaining, though this may become very narrow, owing to the congestion of the mucous membrane which rapidly ensues. Vomiting is not so urgent as a rule, and only in about half the cases would it become stercoraceous if the strangulation goes unrelieved. A tumour at the site of the protrusion is often undetected owing to the small size that the hernia usually assumes. Pain, tenderness and resistance will generally, however, be present over the swelling.

Strangulation of the Vermiform Appendix produces symptoms which are rarely those of a typical strangulated hernia. The action of the bowels may be unaffected, or there may be even diarrhœa. Vomiting is seldom marked, and does not persist,

* Strictly speaking, 'Lavater's hernia' would be a more correct designation, for Lavater's account of the condition was written in 1672, though not published probably till 1755, while Richter's essay on the same subject was not finished till 1799.

and seldom, if ever, becomes stercoraceous. It is probable, however, that many of the cases in which strangulation of the vermiform appendix is said to be present are in reality instances of appendicitis in a hernial sac (see p. 211).

Strangulation of Meckel's Diverticulum is sometimes termed Littre's hernia. Such a hernia is rare, and strangulation of the protruded diverticulum is still less common. When it does occur there will be symptoms very similar to those present in a partial enterocele, especially when the diverticulum is short, or it is strangulated not far from its origin from the ileum. Probably in these cases some kinking of the intestine, due to dragging on the bowel by the nipping of the diverticulum at the mouth of the sac, occurs, with the result that the symptoms pointing to strangulation of small intestine are enhanced. Stercoraceous vomiting and complete constipation may be present in certain cases.

The next division of the anomalous cases is dependent upon strangulation occurring, not by pressure of the tissues without the entrance of the sac, nor by the neck of the sac itself, but within the cavity of the sac. This condition might be termed internal strangulation, but should be clearly distinguished from internal strangulation within the peritoneal cavity of the abdomen itself.

Adhesions within the sac between the contents of the sac and the sac-wall, or between different parts of the contents themselves, apertures in omentum or mesentery through which gut may slip, Meckel's diverticulum attached to the inner surface of the sac-wall—any of these conditions may give rise to such internal strangulation. Again, the loop of bowel within the sac may become kinked, being bent by being tied down by an adhesion at one spot. Lastly, volvulus may occur, the length of bowel constituting the contents of the sac rotating around its own axis.

The fact of utmost importance to remember in such cases as the above is that while there is strangulation of the most severe character, yet in most instances there will be no loss of expansile impulse in the sac. For the prevention of such impulse it is necessary that the bowel be constricted quite high up in the sac, in fact at its mouth, and that the nipping

be so effective that the communication between the sac and the abdomen is entirely shut off. If, however, the constriction occur anywhere below the neck of the sac, or within the sac, it is obvious that an expansile impulse may yet remain. A knowledge of this fact may prevent a very serious error on the part of the surgeon, who, finding an impulse, may consider that strangulation is not present although the other symptoms are marked. The rule to be followed in all cases is, given a patient who exhibits signs of intestinal obstruction and who is the subject of a hernia, to explore the protrusion first of all.

In the second group, the sac of the hernia is the factor which gives rise to the conditions which lead to the abnormal symptoms. Loculated and pouched sacs are by no means rare. The production of such is the outcome of one of several causes which may be in operation. Sometimes adhesions separate off portions of the main sac ; at others, parts external to the sac—as, for instance, the cribriform fascia in a case of femoral hernia—press upon and constrict certain parts so as to produce pouches. Occasionally membranous folds project into the sac in the form of partial or nearly complete diaphragms. It is probable that these occur solely in inguinal hernia, and in those which are of congenital origin. Pouching may, moreover, be brought about in congenital inguinal hernia by the traction of bands of gubernacular fibres upon circumscribed areas of the wall of the processus vaginalis. Again, branches of the spermatic artery supplied to the peritoneum must necessarily take a recurrent course when the testis reaches the scrotum, and thus these may drag down a portion of the wall of the processus vaginalis and then a diverticulum is produced. Local projections of the sac may also arise by unequal dilatation of the sac. Lastly, taxis applied with immoderate force is credited with the production of diverticula from the sac.

It will be easily understood that if a loculated or pouched sac be present, and especially if the entrance into the diverticulum be narrow, there is an ever-ready possibility of a knuckle of bowel slipping into it, and thereby becoming strangulated. In such a case there may be distinct expansile

impulse over the larger portion of the hernia, which contains viscera quite unnipped, and so capable of giving impulse. In some cases a part of the hernial swelling may, on careful examination, be found to be tender and tense, thus giving rise to the suspicion that this is the seat of the strangulation.

The third group consists of cases in which more than one hernia exists in the same patient, and owing to one being strangulated and the other not, uncertainty may arise as to which is the sac in which the bowel is nipped. This is particularly the case when both herniæ are irreducible, but the irreducibility in one is due to strangulation.

In such a dilemma it is important to bear in mind that even in the rupture which is the seat of strangulation the symptoms may not be typical, but here again local tenderness and tenseness may be a clue as to which hernia needs prompt and active treatment. There may be even three irreducible herniæ in one subject, a condition which may still further complicate matters. This would require exploration of each in turn, if by no other means a conclusion as to which is the strangled one can be arrived at.

Another very interesting condition which may be present is the fact of one hernia obscuring another, the hidden one being strangulated. It is not very uncommon for a protrusion to pass through the linea alba a short distance above the umbilicus, and for it to be overshadowed by a true acquired umbilical hernia. If the former become strangulated, this fact may be difficult to determine by local examination. Lastly, if an inguinal and a femoral hernia occur on the same side, and particularly so in an obese patient, the local symptoms produced by the strangulation of one may be masked by the obvious signs pointing to non-strangulation in the other. Such states demand the closest of examinations, which will, however, in most cases reveal the dangerous condition in which one of the herniæ is.

Under the fourth heading are included cases where a patient, the subject of one or more herniæ, is also suffering from intestinal obstruction, the result of strangulation within the abdominal cavity. In these the herniæ will probably

show no signs of any sudden and recent change in character, and none of the local signs of strangulation will be in evidence.

Such cases may occur on account of the very presence of the hernia having caused adhesions, often of omentum, to form at or near the mouth of the sac, under which a loop of intestine may pass.

In other instances strangulation by a band, strangulation of a loop of gut passing through an aperture in the omentum or mesentery, or the nipping of a knuckle of bowel in one of the peritoneal fossæ, may account for the obvious signs of intestinal obstruction, although nothing noticeable has taken place in the hernial sac which the patient possesses.

It is a good rule in all this group of cases to explore the hernial site first of all if there is the slightest suspicion that strangulation exists in connection with the sac, and to forthwith perform laparotomy if no such cause of obstruction be found to exist.

II. The diagnosis of a strangulated hernia from other conditions which simulate it.

These may be summarized as follows:

1. The existing hernia is not in its usual condition.
   - (*a*) Strangulation of omentum.
   - (*b*) The hernia is obstructed.
   - (*c*) The hernia is inflamed.
   - (*d*) Strangulation of unusual contents of a hernial sac.
2. The existing hernia is in its usual condition.
   - (*a*) Inflamed lymphatic glands.
   - (*b*) Acute orchitis or epididymitis.
   - (*c*) Severe colic associated with a reducible hernia.
   - (*d*) Peritonitis or enteritis associated with a reducible hernia.
   - (*e*) Uncontrollable vomiting of pregnancy.

Strangulation of Omentum.—A most interesting class of case is that in which a hernia contains presumably omentum alone, or has omentum by itself protruded into it by some straining effort, followed by a train of symptoms somewhat

resembling those of a true strangulated hernia. It is questionable whether strangulation of omentum alone ever gives rise to signs of intestinal obstruction; but if such are in evidence, and herniotomy reveals the sole contents of the sac to be omentum, there are at least six factors that may have led to them. These are:

1. Cases in which taxis has been employed, but symptoms have more or less continued, and at the operation only omentum has been discovered. These may be explained by the reduction of the nipped intestine by the taxis, but followed by its tardy or incomplete recovery.
2. Cases in which no bowel has been protruded, but in which the herniated omentum has dragged upon the stomach and transverse colon, so as to irritate the former and even kink the latter.
3. Cases of inflamed omental herniæ with or without accompanying intra-abdominal peritonitis.
4. Cases where a very small knuckle of bowel was hidden by the omentum, and was actually returned during the herniotomy without being noticed.
5. Cases where another cause of intestinal obstruction is present within the abdomen.
6. Cases where a patient has an omental hernia, and is the subject of attacks of colic or constipation; it might be possible that one of these should be mistaken for an example of strangulated pure epiplocele producing symptoms of itself.

Ligature of omentum, healthy or congested, but rarely leads to any symptoms similar to those found in intestinal obstruction, provided it is performed with thoroughly aseptic silk, and even in those cases in which it does seem to be followed by these symptoms, they can often be traced to some other cause, such as the anæsthetic, tension in the skin-wound, etc.

The diagnosis from an obstructed or an inflamed hernia has already been given (see p. 35).

The signs and symptoms by which strangulation of unusual

contents of a hernial sac can be distinguished from the strangulation of intestine are dealt with in Chapter XVII.

Inflamed Lymphatic Glands. — In both the inguinal and femoral regions the lymphatic glands are very liable to inflammation from various causes, and there are numerous instances in which such acute adenitis has been accompanied by vomiting, and even constipation, which symptoms have led to the conclusion that a strangulated hernia existed. Fortunately, such a diagnosis in no way harms a patient, though the reverse—that of mistaking a strangulated rupture for simply inflamed glands—would be highly dangerous.

In a few instances inflamed glands have obscured a small strangulated hernia, and because these have been felt, and rightly diagnosed as such, the hernia has been incised. Inflammation of the overlying glands is not infrequent in strangulation, possibly as the outcome of that condition.

Lastly, inflammation of the glands may be associated with simple irreducible hernia, and may lead to the belief that it is a strangulated one.

Acute Orchitis or Acute Epididymitis are two other conditions which occasionally give rise to some suspicion of a strangulated rupture, especially if they occur in a patient who is also the subject of hernia. The extreme tenderness, the weight, and the solidity of the swelling are generally quite conclusive points in the diagnosis.

Inflammation of a partially descended testis—a by no means rare occurrence—is sometimes most difficult to distinguish from strangulation in the hernia which so often accompanies it. Exploration in such cases is generally advisable.

Inflammation of the spermatic cord, apart from the testis altogether, has, in a few instances, been associated with symptoms similar to those of strangulation. Any cause of such inflammation, as, for instance, gonorrhœa, being present will point to the possibility of its existence. In this connection, rotation of the spermatic cord attached to a partially descended or even completely descended testis must be mentioned. Symptoms of strangulation may then occur, as vomiting, pain, tenseness, tenderness, and an increase in

size of the organ. These cases, again, usually call for exploration by way of diagnosis and successful treatment.

Colic.—If a patient have a hernia, and be the subject of a severe attack of biliousness with marked colic, there might be some cause for thinking he was suffering from obstruction of the intestine due to a strangulated condition of the contents of the hernial sac. Careful examination, however, of the swelling will usually settle the diagnosis, though it must be admitted that such circumstances occurring in a person with a rupture are highly suspicious of a repeated gripping of a part of the intestinal wall, or a partial enterocele.

Peritonitis or Enteritis occurring in patients who have hernial protrusions must necessarily not infrequently give rise to a considerable suspicion of strangulation by the marked symptoms of bowel trouble they cause. Local signs in the hernia are of the utmost importance in arriving at a correct diagnosis. A laxity of the sac, absence of tenderness, presence of an expansile impulse on cough or straining all over the sac, and other signs, show non-strangulation of its contents.

Where general peritonitis is present, this may involve the sac as well, and give rise to several of the local signs of strangulation, making a certainty of the exact condition very difficult. Umbilical herniæ are perhaps the most frequent to be associated with marked symptoms from such a cause, and if irreducible, as they so often are, it may become impossible to be sure of the diagnosis.

The almost **uncontrollable vomiting** in some cases of **pregnancy** in women who are the subjects of hernia, especially if it is an irreducible one, may lead to some uncertainty as to the exact condition of the contents of the sac. Here a minute examination of the swelling, and the knowledge that the uterus contains a fœtus, will usually clear up the diagnosis.

THE PATHOLOGICAL EFFECTS OF STRANGULATION.

The effects of strangulation as evidenced in the pathological conditions which follow its onset may be considered under three headings:

1. Those which concern the contents of the sac.
2. Those which affect the sac-wall and its coverings.
3. Those which will be found in the general peritoneal cavity.

It must always be borne in mind that these effects are primarily the outcome of the constriction which the intestine and the other contents of the sac are undergoing, and are not in any way due to such outside influence as that of taxis. The harmful effects of this latter manipulation are dealt with later. The pathological effects, so far as the intestine in the sac is concerned, are the most important of the results produced by strangulation. They may be classified as follows: (*a*) congestion, (*b*) inflammation, (*c*) ulceration, and (*d*) gangrene.

As soon as the intestine is nipped by the constricting band, its vessels become compressed, the veins being more affected than the arteries. Thus there is a marked interference with the return of blood from the bowel walls. Blood can enter fairly freely the arteries of the loop, but it cannot easily return by the veins. The result of this is rapid congestion of the intestinal wall, with much swelling and œdema. The gut at this stage would feel thickened and inelastic.

The turgescence of the vessels leads to the exudation of fluid from their interior into the cavity of the sac, and also into the lumen of the bowel itself. This fluid is at first of a clear serous nature, but as the congestion increases there is a migration or extravasation of red corpuscles, and the fluid becomes more or less tinged with red. Possibly in some cases, and that even without the application of taxis, the vessels of the bowel may actually give way and allow a considerable escape of blood. It is thus that the fluid in the sac may appear to be almost pure blood.

The amount of the fluid which is transuded into the sac depends on the length of the loop of intestine in the hernia, and upon the extent of time that the strangulation has been present. There is a circumstance in connection with this fluid which is of the utmost gravity. It is the fact that in

a very short period of time subsequent to the strangulation there is a strong probability that there has been a passage of bacteria through the congested bowel wall into the cavity of the sac. Normally the intestinal wall will not allow such micro-organisms to transgress its confines, but the gut within the sac of a strangulated hernia is no longer in a normal state, and thus bacteria may readily find their way through.

Among these organisms are the well-known bacilli of the intestine, particularly the *Bacillus coli communis*, which are so often the cause of septic peritonitis. Too much stress cannot be laid on the serious import of the presence of these bacteria, for they ought to be banished, and not returned into the general peritoneal cavity. The diplococcus of pneumonia has also been isolated from the fluid in hernial sacs, and it may be the cause of the pneumonia which is prone to follow herniotomies for strangulation, especially when performed late in the affection.

The colour of the bowel wall in the early stages of congestion is a bluish hue, not unlike that of a varicose vein seen through the integument. The intestine still retains its lustre, and there is no appearance of lymph on its surface or in the fluid within the sac.

As the congestion becomes more and more pronounced, the colour of the gut deepens, so that ere long it assumes a purplish-red tinge, and finally becomes almost black. There is no doubt, however, that, in some cases at least, the change in the colour of the bowel surface is not very great unless undue taxis has been employed.

Before long the congestion of the bowel passes into true inflammation. Peritonitis and enteritis ensue. The surface of the gut becomes covered more or less thickly with lymph, and at the same time the fluid in the sac has flakes of the same material floating in it.

Adhesions may form if the fluid within the sac is not great in amount, and so does not impede their deposition. Such adhesions, however, will be of quite a recent nature, and are therefore easily broken down.

The enteritis, on the other hand, is evidenced by the swollen and indurated mucosa and sub-mucosa. There may

also be a deposit on the inner surface of the mucous membrane comparable to that on the serous surface.

The bowel in the stage of inflammation still maintains its distended condition, and is not collapsed, as it often is when gangrenous.

The inflammation, if allowed to continue, will be followed by ulceration. This is chiefly to be found at the very seat of the constriction, and in the mucous membrane rather than on the surface of the gut. It is well to notice that at the actually nipped part there is a furrow, caused by the fact that the congestion does not occur at this spot. The depth of this furrow is dependent upon the amount of the œdema of the part. Its extent round the circumference of the gut is generally about three-quarters of a circle, while its breadth indicates the width of the constricting band.

If the mucous membrane at the seat of the constriction be examined, it will be found to be undergoing ulceration, and will present certain characteristic appearances. Yellowish-white or distinctly whitish patches arise, indicating that necrosis is beginning. Soon the cellular tissue lining gives way, and an actual ulcer is formed. Next the circular muscular fibres break, to be shortly followed by the longitudinal layer. The peritoneal coat may have already disintegrated, and the termination will be a perforation of the intestine at this spot. It is rare to find true ulceration at other places besides the site of the constriction.

Gangrene of the bowel is the final catastrophe. This is due to several causes:

(*a*) Interference with the circulation in the vessels of the intestinal wall.

1. As the outcome of the hindrance to the return of the venous blood, produced by the constricting band. 2. In consequence of the nipping leading to absolute arrest of the circulation, both arterial as well as venous. 3. As the result of the distension of the lumen of the imprisoned bowel with either gaseous or liquid contents, and this acting as a compressing force upon the bloodvessels of the intestinal wall.

(*b*) Septic infection of the tissues of the bowel by the bacteria which have passed into the wall of the gut.

It is rare for the omentum which may be in the sac of a strangulated hernia to lose its vitality as soon as the intestine. This fact has been explained in different ways, but probably the reason is chiefly to be found in the septic infection, which will obviously act much more readily on the bowel than on the omentum, which has a separate blood-supply. In addition, the omentum adapts itself more easily to the compressing force, which therefore will affect more quickly and severely the delicate tissues of the gut.

Gangrene of the intestine, if the bowel is exposed to view, will be evidenced by the following signs: The serous coat will have lost its lustre, and here and there it will be found to be raised by liquid or gas beneath it. Moreover, it can be easily stripped off with the tip of the finger. The colour of the intestine may be still black, but perhaps more often it assumes a slaty-blue, or an ashy hue. Whitish patches may appear at various spots. A peculiar odour, which, if once experienced, will be readily recognised again, is present, except in quite the early stages. The tissues of the mortified part are very friable, and later they may break up into shreds. Perforation of the intestine, and extravasation of its contents into the cavity of the sac, as a rule occurs at the site of the gangrene.

These signs will in most cases very clearly indicate the presence of gangrenous bowel, but there are frequent instances in which the evidence of mortification is not by any means distinct. These are the 'suspected cases,' and they cause the operating surgeon much careful thought and no little anxiety, for if gangrenous intestine be returned within the abdominal cavity, death of the patient is almost inevitable.

There is, it must be admitted, no certain sign whereby it can be absolutely affirmed that gangrene is really present. Even incision of the wall of the bowel does not give a definite clue, for, although hæmorrhage would in most instances show that mortification had not commenced, yet it does not do so in all. Peristaltic action has been lost long ere gangrene occurred, and its absence is therefore quite useless as an indication of the vitality of the intestine.

The effects of strangulation on the omentum within the sac of a hernia which is nipped have already been briefly noticed. The omentum does not exhibit signs of injury to its tissues nearly so rapidly as does the bowel in the sac. It is a question, indeed, whether a pure epiplocele, if its contents become strangled, ever shows the signs and symptoms of a true strangulated hernia, much less the pathological alterations which occur when bowel is nipped.

If the vessels of the omental tissue are pressed upon severely, so as to produce an interference with the proper return of blood, congestion of the affected part must necessarily ensue. Inflammation, but usually of a simple, non-septic nature, follows. Adhesions will form, and as often as not the omentum, instead of perishing, gains a fresh blood-supply from the sac-wall.

In certain cases true mortification takes place, and in these instances there has probably been a septic infection from some bowel which has lain in the proximity. When omentum is in a sac together with intestine, it is not very infrequent for the former to protect the latter from the full force of the compressing band, and thus to render the strangulation less acute.

The changes which occur in the mesentery of bowel within the sac of a strangulated hernia are chiefly those of congestion, with here and there some patches of ecchymosis. Occasionally the vessels of the part may be plugged with clot.

The changes which occur in the sac-wall as the outcome of the constriction are not so very marked. There may be some inflammation, the result of the inflammatory process spreading from the contents of the sac to the wall itself. This inflammation may lead to some thickening and friability of the serous membrane, which, if improper taxis is employed, may lead to a rupture of the sac. At other times the inflammatory exudation into the substance of the wall of the sac may be so abundant as to render it stiff and unyielding.

The tissues which lie over the sac will remain unaltered until inflammation has spread to them from the interior of the sac, or they have been damaged by the attempts at taxis to which they have been subjected.

Bruising, sometimes with marked ecchymosis, will thus occur, but must not be taken as indicative of the condition of the contents of the sac.

If gangrene has commenced within, the tissues covering the sac generally present a red, swollen, and even emphysematous state. Actual suppuration, with its attendant fluctuation, may supervene.

Occasionally the skin and the subjacent structures may themselves be the seat of gangrene, and this even without the same condition being present within the sac. The overlying slough may separate, and the imprisoned viscera be exposed.

Certain effects may be produced in the general peritoneal cavity as the result of a strangulated hernia. These are, for the most part, of a very important nature, and much of the danger attending the onset of strangulation depends on their existence. As the outcome of the obstruction caused by the nipping of the gut in the hernial sac, the bowel within the abdomen on the proximal side of the constriction becomes distended. This distension is by both liquid and gas, and is partly due to the onward flow being stopped, and partly to the fact that the irritated bowel close above the hernia secretes more copiously than usual.

Gradually the distension of the bowel increases, and thereby some pressure by its contents is exercised upon the vessels of the bowel wall, with the consequence that congestion occurs, and still more fluid is exuded into the lumen of the gut.

The most serious effect of this overdistension of the intestine is that it tends to bring about a paralysis of the muscular tissue of the bowel wall. So marked and complete may this paralytic condition in the end become that it may never disappear, even after the protruded gut has been replaced within the abdominal cavity. It is this fact that must be borne in mind when symptoms of obstruction continue after removal of the constricting force, for it is undoubtedly the commonest reason for such an untoward result. It is most frequently the cause of a fatal end to a herniotomy for strangulation.

In other instances, again, the proximal portion of the bowel may be the site of true inflammation, arising from the spreading of the inflammatory process from the imprisoned gut, or from the distension that the intestine has been subjected to.

Gangrene, either from the prolonged pressure which the distension has produced, or from the inflammatory process which has attacked the bowel wall, also occasionally supervenes.

The distal portion of the bowel is generally found to be empty, contracted, and much convoluted. It is not the rule for any of the lesions which affect the gut within the hernial sac to be present in the distal part of the intestine within the abdomen. This part may, however, become inflamed, and manifest some of the changes which are seen in the proximal portion.

Over and above the lesions that occur in the bowel itself, the omentum within the abdominal cavity may also be affected. Inflammation can extend from the imprisoned omentum to that which is still in its normal habitat.

The serous membrane is also liable to become the seat of inflammation, and this peritonitis is for the most part limited to the area in proximity with the hernial aperture, but it does in some cases become diffuse, so that general peritonitis is present.

The local peritonitis serves to glue the portions of the intestine about the mouth of the hernia together, and to fix them to the parietal peritoneum near by them. These adhesions may act beneficially, for if perforation happen to take place, they will tend to prevent general extravasation of the intestinal contents.

General peritonitis is not usual previous to the reduction of the contents of the hernial sac, though it may occur from perforation of the bowel within the abdomen, or from the passage of intestinal bacteria through the congested walls of the distended proximal portion of the gut. When it is in evidence, there is nearly always a fatal issue to the case.

CHAPTER VI.

THE GENERAL TREATMENT OF STRANGULATED HERNIA.

STRANGULATED hernia implies intestinal obstruction, and is therefore a condition which allows of no delay in its treatment. This treatment resolves itself into **Taxis** and **Herniotomy**.

By taxis is understood the endeavour by external pressure rightly applied to reduce the contents of the hernial sac into the abdomen. By herniotomy is meant the exposure and opening of the hernial sac by incising the tissues over it, and the return of the contents after the passage into the abdomen has been increased in size if necessary.

In discussing the relative value of these two methods of treatment, it must be remembered that taxis may obviate operation, that operation may have to follow ineffectual taxis, or that operation may be performed without any previous taxis.

The specific **advantages** of **operation** may be said to be these:

1. The contents of the sac will be entirely spared the risk of serious injury by the manipulation to which they are subjected by taxis. There is a very grave and real danger of producing ecchymoses in the wall of the bowel, and the failure in the recovery of the bowel after reduction is, in many cases, due to this bruising setting up inflammation. Moreover, actual laceration is not unknown as the result of indiscreet taxis.

2. An accurate investigation of the condition of the con-

tents of the sac can be made after incision. When they are exposed to view, there is also the certainty that they can be dealt with in the way which their actual condition demands.

3. The fluid which is exuded from the bloodvessels of the bowel wall into the cavity of the sac rapidly becomes septic, owing to the passage of micro-organisms through the congested intestinal wall, and among these the most frequent is the *Bacillus coli communis*, so often the producer of septic peritonitis. This fluid must of necessity be returned into the abdominal cavity if taxis is employed with success; on the other hand, if an operation is performed, all the fluid contents of the sac can be thoroughly washed away by an antiseptic solution, and the viscera cleansed before they are returned.

4. Further, a herniotomy enables the surgeon to proceed to the obliteration of the sac and the more or less complete closure of the aperture through which the hernia has escaped, both with a view to the prevention of the return of the protrusion. Such a complete operation will, moreover, do away with the likelihood of a recurrent attack of strangulation, which the patient still remains ever liable to when treated merely by reduction and truss.

On the other hand, there are certain facts which tend to militate **against** a perfectly safe performance of an **operation** for the relief of a strangulated hernia:

1. The careful preparation requisite in order to secure that asepsis which is all important takes some time—in fact, a not inconsiderable amount—during all of which period the contents of the sac remain strangulated, their circulation impaired, and their nutrition endangered.

2. A general anæsthetic is usually required, and this in itself is not without its dangers, for there is no time for any preliminary preparation for it, and the patient has in most cases repeated attacks of profuse vomiting, which are highly hazardous under an anæsthetic. Many of the smaller sized strangulated herniæ can be satisfactorily dealt with by operation with the use of a local anæsthetic alone, but a thorough operation with a view to cure can hardly be performed under these conditions.

3. Sepsis should, of course, be easily avoided, and certainly so; but failure to obtain asepsis may occur, and this complication is so serious a matter that the fear of it deters many from operating before applying taxis. Suppuration in the abdominal wall might not lead to anything more annoying than delay in the process of healing, but infection of the peritoneum may cause fatal septic peritonitis.

4. If too free an incision of the structures forming the stricture be made, a larger aperture may result than was present before and a worse hernia follow.

5. Also after operation a patient is confined to bed for some length of time.

6. Lastly, there has to be taken into account the not unnatural shrinking on the part of the sufferer from any procedure which necessitates an incision.

TREATMENT OF STRANGULATED HERNIA BY TAXIS.

Taxis, as applied to a strangulated hernia, is a very different procedure to that employed in the case of a simple irreducible hernia. In the latter, a very considerable degree of force used in the proper manner and direction may bring about reduction without causing any harm; but in a strangulated hernia the same amount of pressure might be not only ineffectual in returning the contents of the sac, but may do irretrievable damage to the protruded viscera.

This difference arises from the fact that in a strangulated hernia the contents of the sac are in an abnormal condition and easily injured, whilst in the simple irreducible hernia they are merely imprisoned without any interference with their circulation. Taxis, again, is difficult to employ with effect, owing to the layer of fluid which is usually present between the contents of the sac and the sac-wall, and because of the local tenderness.

Before taxis is applied, the patient should assume the horizontal posture on a bed or a couch which is of a convenient height for the surgeon's manipulations. The direction in which the pressure is to be made necessarily varies with the form of hernia that is being dealt with, and most of the remarks that have been already made on this subject

hold good in the case of a strangulated hernia, provided that it is constantly borne in mind that strangulation is present (see p. 32).

The length of time that it is legitimate to continue taxis can hardly be definitely stated, but if the contents of the sac are not reduced during the initial few minutes of its employment, it should not be persisted in.

Taxis is more likely to be effectual in inguinal than in femoral herniæ, in children than in adults, and in large than in small protrusions.

It is essential that the whole of the viscera within the sac should be returned, for if any part is left it will be impossible to say whether or not this may be the strangled portion. If taxis causes the return of only some of the contents, then operation ought to follow.

Taxis is inadmissible in the following conditions:

1. Where a previous attempt at reduction by taxis has been made.
2. Where there are signs that the intestine has become gangrenous.
3. Where the superficial structures are inflamed.
4. Where the general condition of the patient is one of great prostration.
5. Where the protrusion has been in existence for many hours.

The **dangers** arising from taxis are great. They may be:

1. Bruising of the intestine.
2. Laceration of the intestine.
3. Rupture of the intestine.
4. The return of septic fluid with the rest of the contents of the sac.
5. The reduction of gangrenous bowel or of gut incapable of recovery.
6. 'Reduction en masse.'

The **continuance of symptoms** of intestinal obstruction after apparent reduction of the contents of the sac by taxis may occur from any of the following conditions:

1. The effect of the anæsthetic.
2. The reduction of intestine that is paralyzed.
3. The reduction of intestine that is gangrenous.
4. The reduction of intestine which subsequently becomes perforated.
5. The occurrence of peritonitis or enteritis.
6. The presence of a second strangulated hernia.
7. Co-existent internal strangulation.
8. Incomplete reduction.
9. 'Reduction en masse.'
10. Fresh descent of viscera and strangulation within the sac.
11. The persistent vomiting of pregnancy.

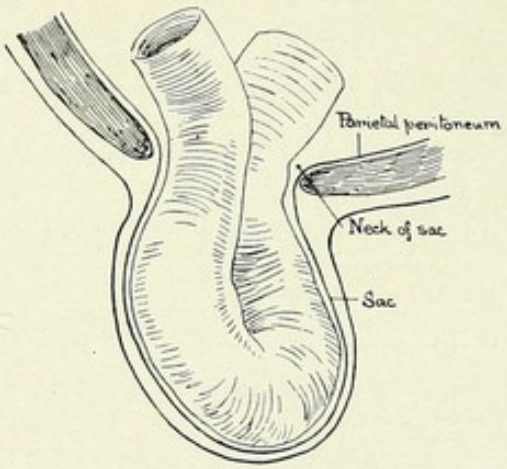

FIG. 14.—DIAGRAM OF A HERNIAL SAC AND ITS CONTENTS.

Provided that the effects of the anæsthetic, the vomiting of pregnancy, or a second strangulated hernia can be excluded, in the remainder of the conditions a very grave prognosis must be given, and as a general rule the proper line of treatment will be the immediate exploration of the site of the hernia. Incomplete reduction, 'reduction en masse,' and recurrent strangulation will in this way be almost certainly satisfactorily dealt with.

If none of these conditions are found, it is probably advisable to perform an exploratory laparotomy, so that the several lesions within the abdomen above mentioned may possibly be remedied.

'**Reduction en masse**' is the term that is used to indicate

various displacements of the strangulated contents of a hernial sac. There are three chief forms of this accident:

1. Where the neck or body of the sac is ruptured, and the contents are forced through the rent into the tissues of the abdominal wall, strangulation remaining at the mouth of the sac.
2. Where the contents of the sac are reduced into a loculus of a bilocular sac.
3. Where the sac itself is dislocated, still containing the strangulated viscera.

All these varieties of 'reduction en masse' are rare, and becoming even less frequent with the increase of operations upon strangulated herniæ.

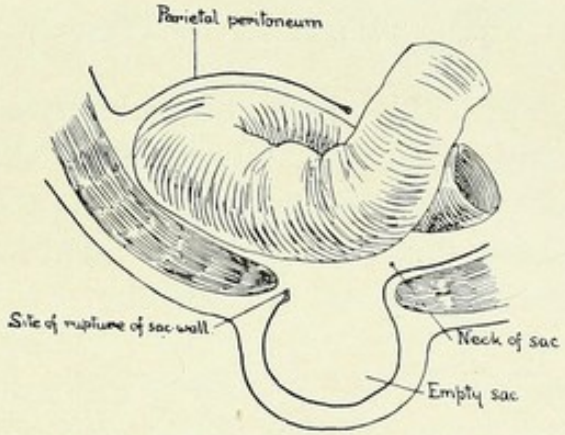

FIG. 15.—FIRST VARIETY OF 'REDUCTION EN MASSE.'

It is generally said that the conditions described as 'reduction en masse' may be diagnosed by the persistence of signs of strangulation, and by the possible history that no gurgling was heard or felt when the apparent reduction took place. The site of the hernial protrusion has diminished in size, but a fulness and sense of resistance may still be felt in the region in which the displacement has occurred. The hernial rings should be carefully examined, and in some cases where the inguinal canal can be explored it may be found occupied by a definite tumour, with at least a forward impulse on cough.

'Reduction en masse' is more frequent in inguinal than in femoral herniæ, and is said to be more often produced in recent than in old protrusions.

Certain aids in the treatment of strangulated herniæ by taxis have from time to time been advised. These include the administration of opium, the immersion of the patient in a hot bath, and the use of an anæsthetic. Morphia masks

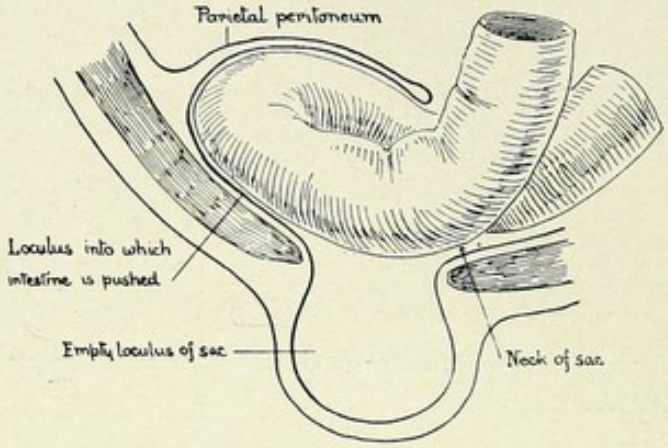

FIG. 16.—SECOND VARIETY OF 'REDUCTION EN MASSE.'

symptoms, and probably does but little else. The bath is unlikely to produce much, if any, relaxation of the tissues about the neck of the sac, causes a considerable amount of unnecessary disturbance of the patient, and is hardly of any service save for the purposes of cleansing. If use is made of

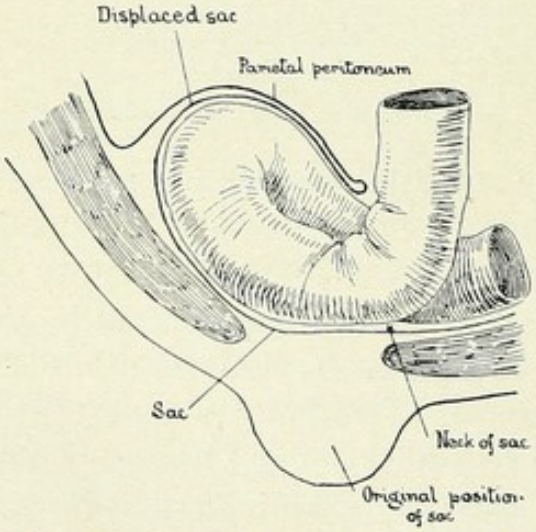

FIG. 17.—THIRD VARIETY OF 'REDUCTION EN MASSE.'

it, taxis should not be employed while the patient is actually in the water, but after he has been taken out and placed between hot blankets.

An anæsthetic, on the other hand, may be of the greatest

assistance, for it brings about complete relaxation of muscular tissue, does away with the undesirable movements on the part of the sufferer, and prevents any pain being experienced. An anæsthetic, however, should never be administered unless the surgeon is prepared to at once proceed to the operation of herniotomy, supposing that taxis is ineffectual in producing a return of the imprisoned viscera into the abdomen.

TREATMENT OF STRANGULATED HERNIA BY HERNIOTOMY.

Herniotomy is an emergency operation, and it is therefore difficult to carry out the preparations in view of obtaining asepsis as thoroughly as could be wished. It is always well in a case of strangulated hernia where there is any likelihood of an operation being decided upon to commence the attempt to cleanse the skin at the earliest possible moment. The patient should have the parts around the hernial protrusion shaved, scrubbed with soap and water, the excess of the soap being removed with boiled water, and the area then treated with ether or turpentine, to remove all superficial greasy matter. Turpentine is usually present in the house, and can therefore be readily procured and immediately used. The excess of the turpentine is to be washed off with boiled water, and the parts sponged over with an antiseptic solution, and covered with an antiseptic dressing if possible. It is customary for practitioners to carry with them in the present day some of the compressed salts for the preparation of such antiseptic solutions, and a towel wrung out of one of these and applied to the region of the hernia will answer better than no preliminary dressing at all. In hospital practice the preparation of the patient can often be accomplished more satisfactorily in most instances, but a deliberate attempt should always be made in private practice towards the same end. The parts should be again cleansed before the actual incision is made. A general anæsthetic is usually desirable; but if from any reason this is contra-indicated, an injection of a 2 to 4 per cent. solution of eucaine into the skin and subcutaneous tissues over the hernial swelling will enable the

surgeon to divide them with but little, if any, discomfort being experienced by the patient. The deeper manipulations cannot, however, be so satisfactorily carried out unless the sufferer is under the influence of a general anæsthetic. If the patient is persistently vomiting, it is sometimes advisable to wash out the stomach, so as to rid its interior of its fæculent contents, and to render it less likely that danger should arise from inspiration of vomit during anæsthesia.

In all cases of strangulation of bowel there is some amount of shock, and in some a very grave degree, therefore every means must be taken to prevent a still greater diminution in the strength of the patient. The chest should be well covered, and the thorax and limbs surrounded, if possible, by hot-water bottles, but not in actual contact with the skin, during the performance of the operation. It is also important to see that the bed into which the patient is to be placed after the operation has been thoroughly well warmed while the operation is in progress.

The **instruments** required for the operation of herniotomy are, in the majority of instances, but few. They include a scalpel, two pairs of dissecting forceps, six pairs of pressure forceps, possibly a hernia bistoury, a broad director with a deep groove, retractors, two hernia needles, ordinary needles, aseptic twist silk, silkworm gut, aseptic swabs or sponges, and dressings. In addition to the above, the surgeon should be provided with such apparatus as he may deem necessary for resection and anastomosis of intestine.

The actual **line** of the **incision** varies with the form of hernia that is being dealt with. The incision through the superficial structures should be free, so that the subsequent details of the operation may not be hampered for want of room. The various layers of tissue that overlie the hernial sac are difficult to distinguish from one another, and it is not of any great moment that they should be so differentiated.

It is important, however, to be able to determine when the sac itself is reached. As a rule, the colour of the sac should aid in its recognition. Owing to the fluid within it, the serous membrane presents a bluish or slaty-blue appearance. It is stated that there is an arborescent arrangement of the

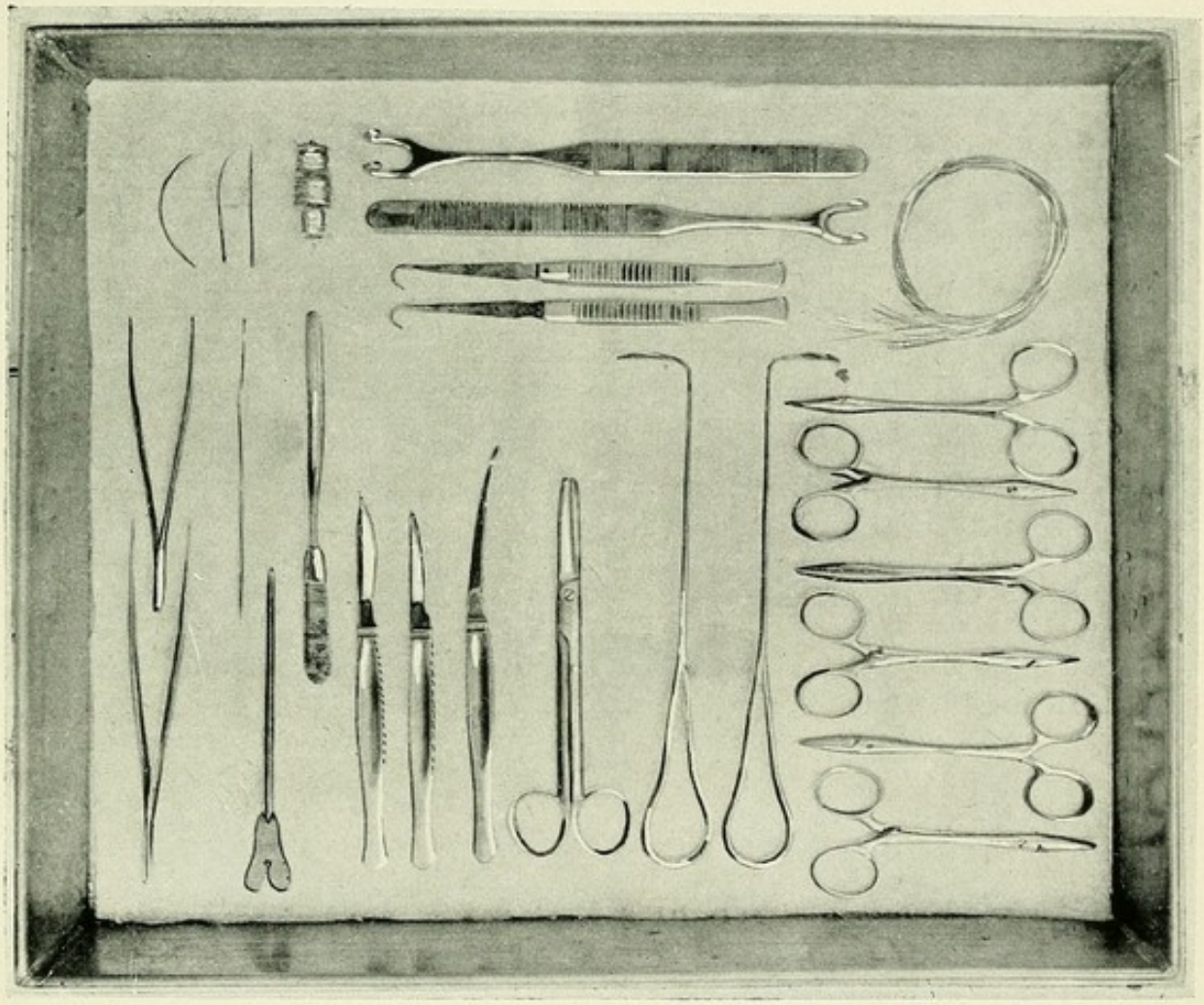

FIG. 18.—THE USUAL INSTRUMENTS REQUIRED FOR HERNIOTOMY.

To face p. 70.

bloodvessels of the sac-wall; but it must be confessed that this is not by any means always to be observed. Moreover, the sac may be sufficiently thin to enable its contents to be visible through it. The sac is not shiny on its outer aspect, seeing that it is only the inner surface of the peritoneum that is smooth and glistening. If, therefore, such an appearance is encountered, it will indicate that the interior of the sac has been reached, and possibly even the intestine exposed. In some cases, where the sac is not very tense, it may be possible to pick up its wall between the finger and thumb, and to feel the contents slip away from their grasp.

If any doubt should still exist, a small portion of the layer of tissue immediately presenting can be picked up with a pair of forceps, and very carefully incised with the scalpel held on the flat. If the sac is thus opened into, a small quantity of fluid will at once escape.

The sac-wall may be extremely thin, or it may be a good deal thickened, either by previous inflammation or by the condensation of the tissues over it and their incorporation with it.

The sac having been exposed, its interior should in every case be fully explored. There is practically no danger in so doing, but there may be a fatal result from reduction of the contents of the sac without their having been inspected. Intestine that will not recover itself, intestine that is on the verge of gangrene, and septic fluid surrounding the contents of the sac, are all liable to be displaced into the abdominal cavity, with consequences that might have been easily avoided. By opening the sac, the exact condition of its contents may be readily made out, and all the fluid, which has probably become infected with intestinal bacteria, can be completely washed away.

All things considered, therefore, there is nothing to be lost by opening the sac, and much to be gained by so doing.

The division of the sac-wall is carried out in the following way: Before the small diagnostic opening is made in the manner mentioned above, it is well to be ready to catch all the fluid—possibly septic—which will flow from its interior, so as to prevent the contamination of the incised tissues. It

may be that in certain cases the passage of this liquid over these structures has been the cause of suppuration taking place. When the small opening has been made, it is to be slightly enlarged, and a director passed through it, upon which the sac-wall can be safely divided with scissors as far as its neck, caution being exercised in case the contents of the sac are adherent to the inner surface of the serous membrane. The whole of the fluid should be washed away by the irrigation of the interior of the sac with a weak antiseptic solution, such as 1 in 4,000 biniodide of mercury.

The division of the constricting bands which have produced the strangulation is the next step in the operation. In many instances, as is the case with inguinal and umbilical herniæ, this tight tissue can be cut through from without inwards. There is no doubt that this is the safest method to employ, for what is being divided can be actually seen, and the imprisoned viscera can be readily protected by the introduction of the director between them and the sac-wall.

In the cases in which the constriction is formed by the tissues outside the neck of the sac, if care is taken these may be divided by the above method without the incision being carried through the peritoneum forming the sac. In certain instances of inguinal herniæ, and in many femoral protrusions, it may be necessary to divide the stricture from within outwards. This can be carried out by the passage of the director within the sac, so that it comes to lie behind the site of the constricting band, followed by a Cooper's hernia bistoury cautiously made to pass along the groove in the director until its cutting edge is opposite the stricture, and then by a gentle sawing movement of the bistoury the resisting structures are divided to the necessary extent. The operator's finger can sometimes be employed in a manner similar to the director, and by means of it the passage of the knife and its movements can be felt and directed.

During the division of the stricture from within, there is always some danger of damage being done to the viscera lying within the neck of the sac. The intestine may curl up

round the edge of the director, so as to push itself in the way of the cutting border of the knife.

In other instances the actual division of the constricting bands need not be carried out, but they may be stretched by a director or a pair of forceps passed beneath them, care being taken during this manipulation to avoid any injury to the intestine or omentum.

If such dilatation of the tissues can be accomplished, they will afterwards recontract, a result which is improbable after their section. As soon as the structures have been made to relax their grasp upon the contents of the sac, these latter should be in every case drawn down, so that the site where they have been most pressed upon can be thoroughly examined. As has already been pointed out, it is at the seat of constriction that the gut suffers the greatest damage. This may be considered one of the most important steps in the whole of the operation of herniotomy.

If any omentum is found within the sac, it should be ligatured in the manner indicated on page 131, and the part beyond the ligature cut away. The stump which is thus formed is usually reduced after the return of the intestine into the abdomen.

It now remains to deal with the intestine itself. There are three classes of cases in which strangulated herniæ may be placed with reference to the condition of the exposed but still strangled bowel. The first is where the intestine, although deeply congested, has not had its vitality so far lowered as to be incapable of recovery. Another, and happily rarer series, is that in which the intestine is obviously gangrenous or so damaged at the site of constriction that it cannot possibly recover. But there is a third division, which may be even the largest, in which great uncertainty exists in the surgeon's mind as to whether or not the bowel will resume its functions if returned within the abdomen. It is probable that the number of these doubtful cases in the practice of any individual operator becomes fewer as his experience increases, and he is better able to judge of the real amount of damage that the gut has sustained.

It is dangerous to return intestine if its colour is so dark

as to have assumed an almost black hue, and it is safer to leave such suspected bowel within the sac, after dividing the stricture, than to return it into the abdominal cavity.

If suspected intestine is replaced, no attempt should be made to push it far from the site of the hernial aperture. If for any reason the bowel gives way after its return, its contents will thus have a better chance of exit through the wound than would be the case if the gut had been made to lie away from it.

The reduction of a protruded loop may be a matter of some difficulty, even when the ring through which it has slipped has been dilated. This is partly owing to the thickening of the walls of the bowel, and partly to its contents. Any crowding of the bowel over the aperture should be avoided, and if its contents can be first reduced, the return of the intestine will be facilitated. It is hardly necessary to add that the utmost gentleness must be employed in the manipulation requisite for the reduction, seeing that the bowel is far from being in a normal condition.

Some have advised the pricking or even incising of the bowel, so as to diminish its bulk by the exit of its liquid and gaseous contents, but unless this is needed owing to the complete paralysis of the intestine above the site of the obstruction, it is well not to resort to it, but to still further enlarge the size of the opening through which the gut has to be returned.

It is of the greatest importance that it is made certain that the whole of the contents of the sac have been completely returned within the abdominal cavity, for in some cases it is easy, if care is not exercised, merely to reduce the bowel into the upper parts of the hernial aperture and not thoroughly within the abdominal wall. Such a misfortune may of course lead to the continuance of the symptoms of obstruction, with fatal results. The surgeon's finger should be made to pass freely into the abdominal cavity, not only to determine whether the contents are returned so as to lie free within the abdomen, but also to discover whether they are uncompressed by any adhesion, which is not uncommonly found in the region of the mouth of a hernial sac.

When bowel, which it is believed will recover, has been reduced, it then remains to deal with the hernial sac, and the aperture through which the descent has taken place, so as to endeavour to rid the sufferer of his trouble. The general condition of the patient may negative this being carried out thoroughly, but an attempt should always be made, provided that it is not wholly contra-indicated.

When the dressings have been applied, and the patient has been placed in bed, the **after-treatment** commences, and this is of much importance.

It is well to combat any shock that has been added to by the operation itself. Hot bottles should be placed close to the limbs, but not in actual contact with them. Some vomiting will probably occur, chiefly as the outcome of the effects of the anæsthetic, though it may be the result of non-relief of the obstruction. As a rule, the slight vomiting that follows the operation will, if due to the anæsthetic, pass off of itself, and seldom, if ever, requires any treatment.

With regard to the administration of food after herniotomy, each case has to be taken on its own merits.

If the patient was in good health prior to the strangulation, and has not markedly suffered as the outcome of it, he may be safely left to food administered by the mouth in small quantities during the first twenty-four hours; but, on the other hand, if the sufferer has not been robust before the operation, or has greatly felt the effects of the strangulation, then it is wiser to not only more liberally feed him by the mouth, but also give him nourishment by the rectum. Sometimes it is unfortunately impossible to carry out this latter mode of feeding on account of the very frequent discharge of intestinal material that takes place after the bowel has been freed from its constriction.

It is a noteworthy fact that the rectum will absorb nutriment even although the intestine above it is completely paralyzed, and rendered incapable of allowing fluids to pass into the vessels of its coats.

Strychnine given hypodermically in doses of a few minims at a time has a very beneficial effect, not only upon the

action of the heart, but also upon the peristaltic action of the intestine.

Generally the bowels may be left to act spontaneously, but in some cases where no movement has occurred, although flatus has been freely passed, it is well to administer an enema on the third or fourth day. Purgatives by the mouth had better be avoided for at least a week.

When the intestine within the sac is in such a condition that the operator is somewhat doubtful as to whether it will recover itself or not, it is considered that it is best to give it the greatest chance by returning it just within the hernial aperture, after the division of the stricture that has nipped it. Should it give way in this position, there will be less liability of the general cavity of the peritoneum being fouled, and as a rule an intestinal fistula results. In the case of a piece of intestine having been returned which has been very considerably damaged, and its recovery is decidedly uncertain, it may be well to leave the external wound unsutured—at any rate, in its depths—and in some instances to place a drainage-tube right up to the position of the hernial aperture.

It is to be hoped that this class of case, as well as that in which the intestine is found actually gangrenous, will become less and less frequent.

When death of the bowel has undoubtedly taken place, there are three lines on which treatment may be conducted.

The first is to merely lay freely open the gangrenous portion *in situ*, without in any way disturbing the gut at the seat of strangulation, the stricture itself being left untouched.

The second is to divide the stricture, to draw down the loop of bowel, to cut away the whole of the gangrenous portion, and to fix the cut ends in the wound, thus making a deliberately planned artificial anus.

The third is to remove the gangrenous part, and to perform an immediate anastomosis, with return of the bowel into the abdomen.

The first method has the great advantage of rapidity, which may be all-important where the general condition of the patient is desperate. The last is without doubt the ideal plan; but, unfortunately, when gangrene is in evidence, the

patient can hardly be in a condition to stand a prolonged operative procedure.

In a certain few cases the area of gangrene may be so limited that it would be possible, by means of some Lembert's sutures, to so pleat the gut as to sew the dead portion within the lumen of the bowel.

By simply laying the gangrenous loop of bowel freely open without any division of the stricture, there is some danger of not discovering the full extent of the dead tissue, and of not securing a free evacuation of the pent-up intestinal contents. As a rule, however, it would seem that the bowel will of itself form sufficient adhesions to prevent extravasation of fæcal material, and the stricture will allow of the passage of the contents through the artificial anus.

Should it be thought better, and the patient's state does not negative some lengthening of the operation, the stricture should be carefully divided and the gut gently drawn down, the dead portion freely cut away, and the two open ends fixed by suture in the wound. If the patient survives, the artificial anus can be dealt with at a future period.

Supposing that the condition of the patient previous and subsequent to the strangulation is such as would warrant a rather prolonged manipulative proceeding, then primary excision and anastomosis is the most satisfactory operation. By its means the continuity of the bowel is restored at once, the sufferer is spared the misfortune of an abnormal exit of fæcal matter, and need not be subjected to a second and not too safe operation for the closing of an intestinal fistula. On the other hand, it must be remembered that the union will not of itself overcome the partial or complete paralysis that may be present in the proximal portion of the intestine, nor will it be a very easy matter to prevent some fouling of the peritoneal cavity, particularly if the contents of the dilated bowel are evacuated before the anastomosis is performed.

The actual method by which the union is to be brought about need hardly be discussed here, but the reader may be referred to a treatise on operative surgery for the details.

CHAPTER VII.

INGUINAL HERNIA: ITS ANATOMY, CAUSATION, SIGNS, SYMPTOMS, AND DIAGNOSIS.

DEFINITION.

By **Inguinal Hernia** is meant the protrusion of a hernial sac through the anterior abdominal wall in either inguinal region —that is to say, through that portion of the wall which lies at the lower part of the abdomen on either side.

Here there is a weak area, for in it is placed the oblique passage known as the inguinal canal. This is a flat-sided passage, through which in the male the testis descends before birth, and in which lies the spermatic cord, or the termination of the round ligament of the uterus after birth. Although this passage in the adult is merely a potential one, yet its very existence as such is a predisposing cause of hernia in this locality.

ANATOMY.

The **Anatomy** of the inguinal region must therefore be thoroughly understood in order that inguinal hernia may be rightly dealt with. As a hernia means the protrusion of a definite process of peritoneum, it is well to observe the abdominal aspect of this region.

It will be seen that there are three distinct fossæ formed by certain separate and prominent cords. These fossæ may be described as being one internal, one middle, and one external.

The internal fossa lies between the median cord, known as the urachus, and the obliterated hypogastric artery; the middle fossa between this latter cord and the deep epigastric

artery; while the external fossa lies outside the deep epigastric artery.

From each of these depressions a process of peritoneum may be developed, but most frequently from the external, for this is naturally the deepest of the three, owing to the spermatic cord or round ligament of the uterus passing down into the inguinal canal with a funnel-shaped process of the fascia transversalis.

The course of the deep epigastric artery may be depicted on the abdominal wall by drawing a line from a point midway between the anterior superior spine of the ilium and the

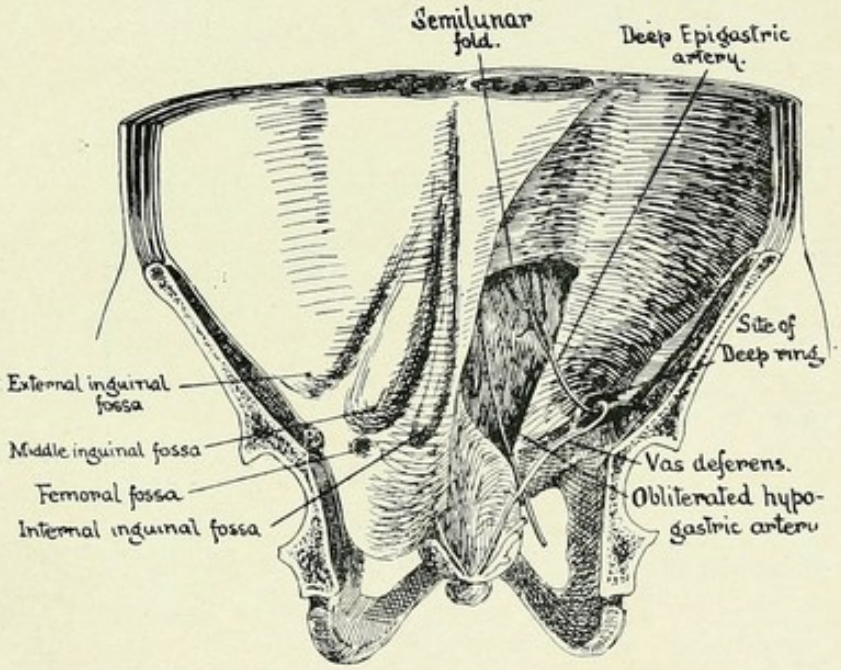

FIG. 19.—THE PERITONEAL FOSSÆ.

symphysis pubis to a point on the outer edge of the rectus abdominis muscle about half-way between the level of the umbilicus and the symphysis pubis. This line forms the outer boundary of Hesselbach's triangle, the other sides being the outer border of the rectus internally, and Poupart's ligament below.

Directly external to the deep epigastric artery is a pseudo-opening in the fascia transversalis, generally known as the internal abdominal ring. It is designated 'internal,' not because it lies nearer the middle line than another aperture known as the external abdominal ring, but because it is

found on the inner or peritoneal aspect of the anterior abdominal wall. It is therefore deeply placed in the tissues constituting this wall, and would be more correctly termed the 'deep' abdominal ring.

The exact position of the **deep** (or internal) **abdominal ring** in the normal adult may be indicated by describing a circle the size of a shilling, the centre of which should be at a point half-way between the anterior superior iliac spine and the spine of the os pubis—that is, the mid-point of Poupart's

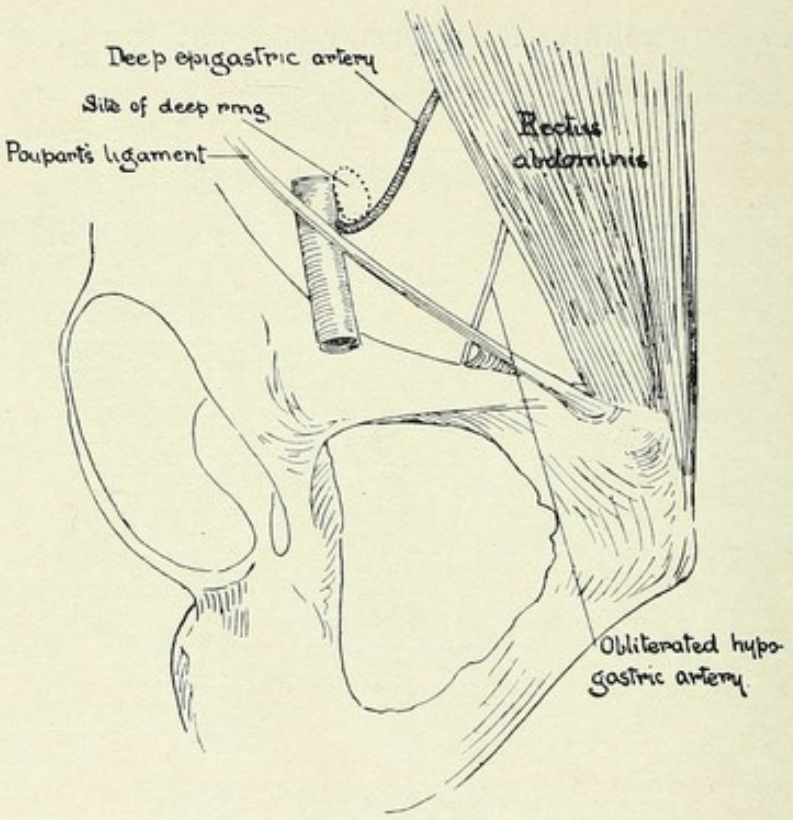

FIG. 20.—HESSELBACH'S TRIANGLE.

ligament—and a finger's breadth above the level of the ligament.

On the outer side of the ring is to be found the fascia transversalis passing down as the deep crural arch.

The deep abdominal ring is the beginning of, or entrance into, the inguinal canal.

The **inguinal canal** is a flat-sided passage running obliquely inwards and downwards for a distance of about 1½ inches in the adult male, but is rather longer and narrower in the female. At birth there is only a very short canal, owing to

the fact that the deep abdominal ring lies almost directly behind the superficial one; but as the pelvis becomes developed, so the distance between the two rings increases, and the canal lengthens.

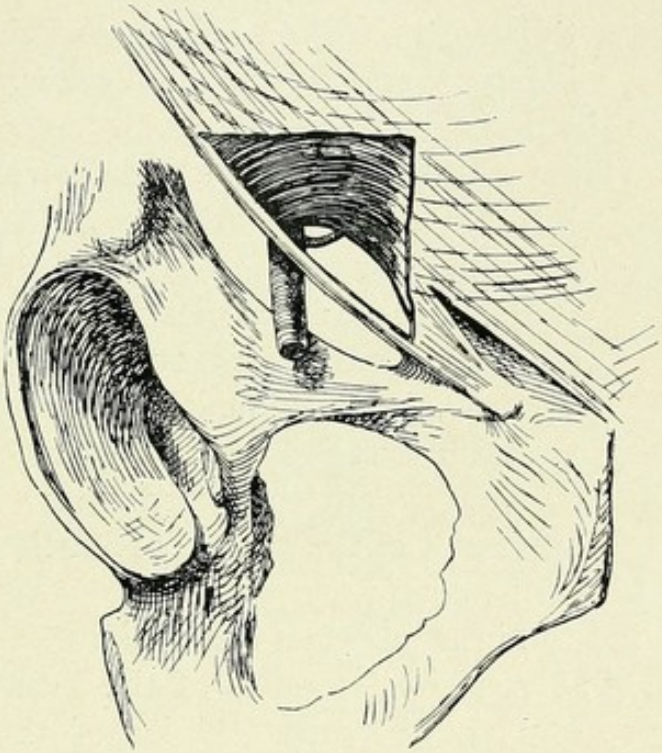

FIG. 21.—INGUINAL CANAL.

The boundaries of the canal in the normal adult are as follows:

Anteriorly, that is, superficially—

(*a*) Over the whole length of the canal.

1. Skin.
2. Two layers of superficial fascia—firstly, that containing the subcutaneous adipose tissue, and superficial vessels and nerves; secondly, that which is devoid of fat, and is more fibrous in texture.
3. The aponeurosis of the external oblique muscle. The fibres of this layer run in a direction parallel with the canal—that is, inwards and downwards. There are, however, numerous other fibres lying in a more superficial plane

which curve upwards and inwards, thus crossing the deeper fibres almost at right angles. These are spoken of as the intercolumnar fibres, and serve to strengthen the anterior wall of the canal, and possibly help to keep the edges of the superficial ring from being separated from each other.

(*b*) Over the outer fourth of the canal.

Here will be found some muscular fibres of the internal oblique muscle, forming an important anterior relation of the deep abdominal ring. These fibres arise from the outer half of Poupart's ligament, and arch upwards and inwards, being joined by other fibres from the transversalis abdominis muscle. Together these may act in the manner of a partial sphincter of the upper part of the canal.

Posteriorly, that is, deeply—

(*a*) Behind the inner third of the canal.

1. The conjoined tendon of the internal oblique and transversalis muscles of the abdomen, passing down to be attached to the crest of the os pubis, and to a variable extent along the ilio-pectineal line, deep to Gimbernat's ligament.
2. In front of the innermost portion of the conjoined tendon, and directly within the superficial abdominal ring, is a band of tendinous fibres, very well marked in some instances, but feebly in others. The exact source of these fibres is difficult to determine, but their probable origin is from the external oblique muscle of the opposite side. They have been named the triangular fascia, from their having a somewhat triangular form. The term 'ligament' should not be applied to them, for fear of confusion arising between them and the triangular ligament of the urethra.

(*b*) Behind the whole length of the canal.

1. The transversalis fascia. The portion of this fascia which lines the lower part of the anterior abdominal wall is decidedly thicker and stronger than it is elsewhere, and is particularly well developed where it comes in contact with Poupart's ligament.
2. Subperitoneal tissue, more correctly termed extra-peritoneal tissue. This layer lies directly posterior to the transversalis fascia, and varies in thickness according to the amount of fat which is deposited in it. In the extra-peritoneal tissue lie:
   - (*a*) The deep epigastric artery, a branch of the external iliac artery just before that vessel passes behind Poupart's ligament and becomes the femoral. The deep epigastric is placed directly internal to the deep abdominal ring.
   - (*b*) The obliterated hypogastric artery runs almost parallel with, but internal to, the deep epigastric artery.

The roof of the canal is formed by the arching fibres of the internal oblique and transversalis muscles. The floor of the canal is formed by the transversalis fascia passing downwards to become attached to Poupart's ligament, and consists of a distinct groove.

The **superficial** (or external) **abdominal ring** is found at the inner or lower end of the canal, and is thus its termination. It is in no sense a ring, but rather a triangular opening. It is formed by the divergence of the fasciculi which constitute the aponeurosis of the external oblique muscle of the abdominal wall. It is bounded by:

1. The internal pillar, which is a flat band of fibres derived from the external oblique, passes downwards and inwards to the symphysis pubis, and blends with the suspensory ligament of the penis in the male.
2. The external pillar, which also has its origin from the external oblique, is much stronger and more

rounded in form than the internal. It descends to be attached to the pubic spine, and to blend with Poupart's ligament, and through it with the fascia lata of the thigh. The movements of the thigh will thus influence the external pillar, for when the thigh is abducted and extended the opening between the pillars will be smaller and the pillars themselves on the stretch. But in flexion and adduction the pillars will be relaxed and the opening somewhat larger.

3. The base of the aperture is formed by the crest of the os pubis. The normal superficial ring in the adult will but barely admit the tip of the little finger.

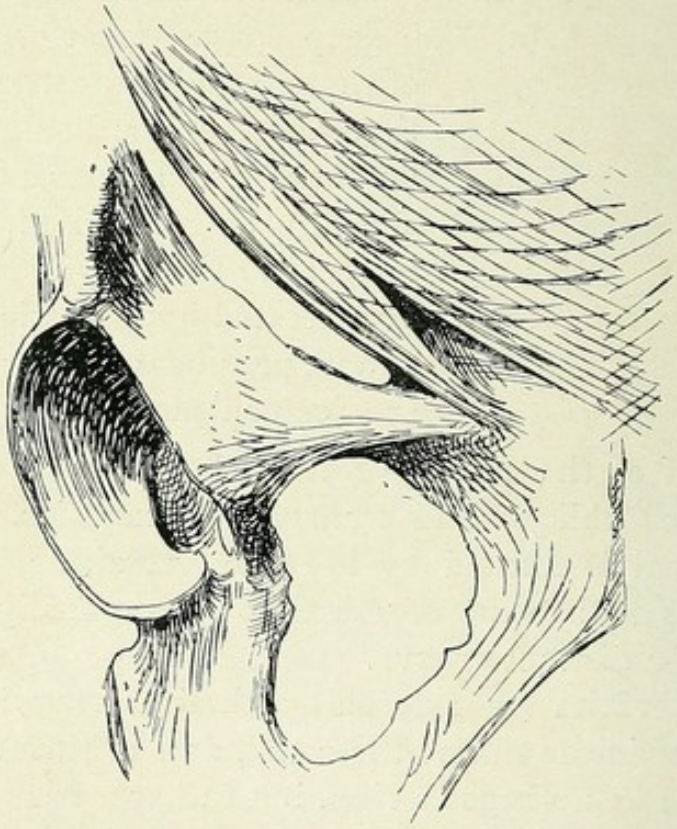

FIG. 22.—THE SUPERFICIAL ABDOMINAL RING.

Prolonged from the margins of the ring is a membranous fascia, probably derived from the aponeurosis of the external oblique, but said by some to be in reality part of the deep layer of the superficial fascia. This fascia is called the intercolumnar fascia, although it may be termed the external spermatic fascia, but should not be confused with the intercolumnar fibres mentioned before.

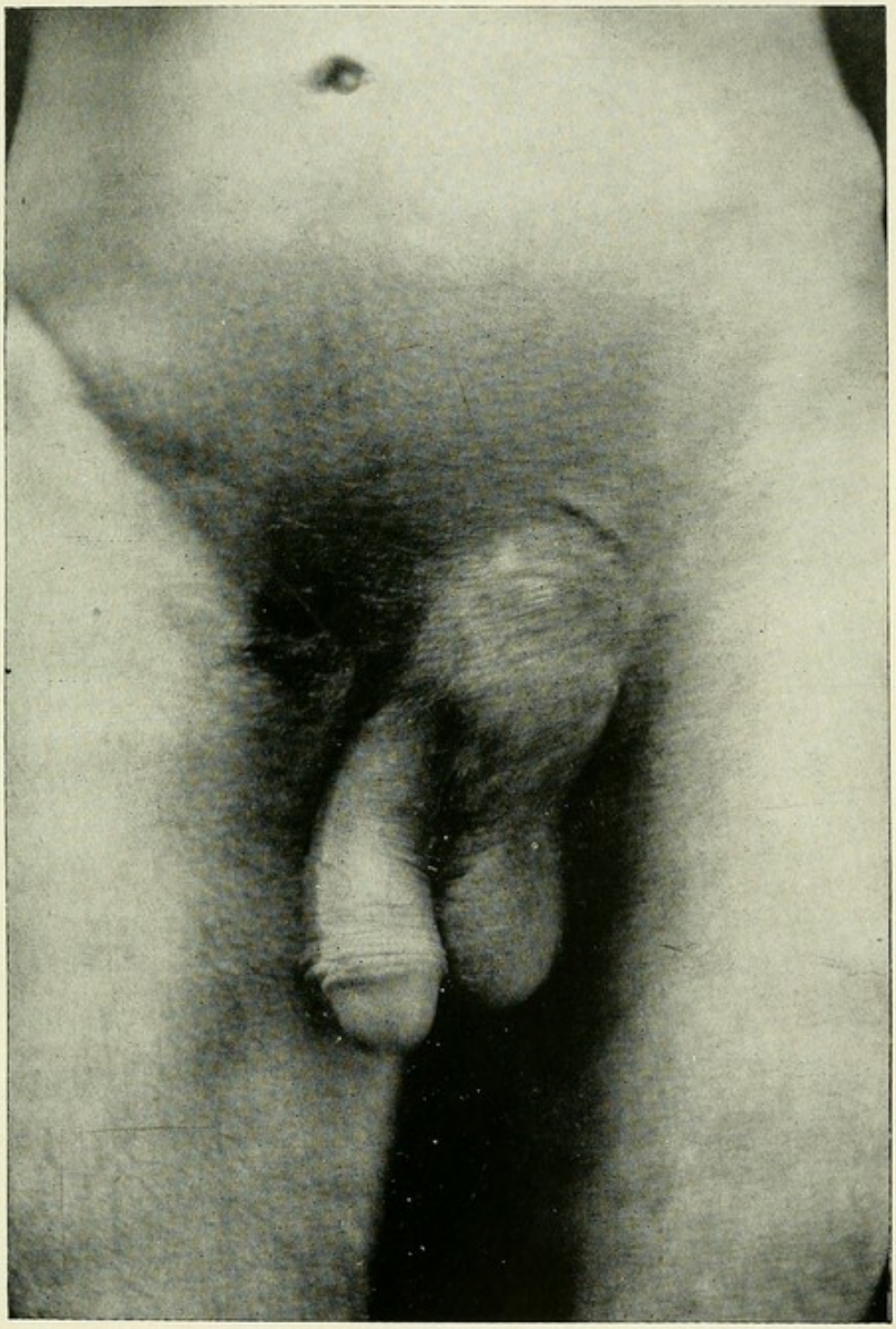

FIG. 23.—LEFT INDIRECT INGUINAL HERNIA, EARLY STAGE.

To face p. 84.

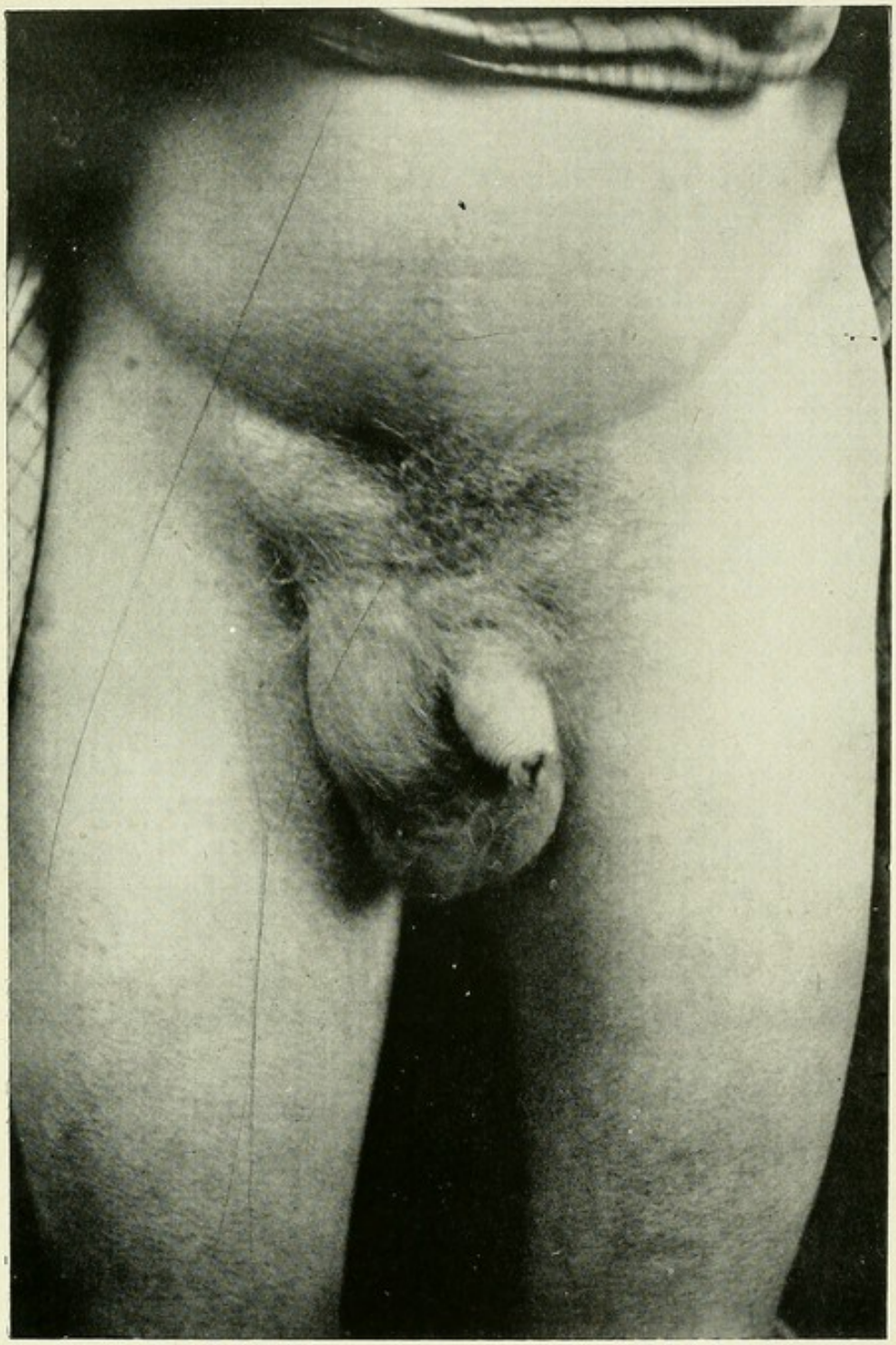

FIG. 24.—RIGHT INGUINO-SCROTAL HERNIA.

To face p. 84.—I.

The contents of the inguinal canal in the male are the spermatic cord and the ilio-inguinal nerve; in the female is the round ligament of the uterus as well as the ilio-inguinal nerve.

It may be well to repeat the boundaries of the three-sided space called Hesselbach's triangle: externally, the deep epigastric artery; internally, the outer edge of the rectus abdominis muscle; and below, Poupart's ligament. The floor is crossed by the obliterated hypogastric artery in an upward and inward direction, thus dividing the triangle into two parts: an outer, which is four-sided, and an inner, which is again triangular.

THE NOMENCLATURE OF INGUINAL HERNIA.

There are a considerable number of terms in constant use with reference to inguinal hernia. It is of much importance to clearly grasp the meaning of each.

1. **Indirect Inguinal Hernia**, otherwise known as oblique, or external. This common form passes into the inguinal canal through the deep (or internal) abdominal ring. It is indirect, because it does not protrude straight through the abdominal wall. It is oblique, because its course along the canal is in the line of that passage downwards and inwards. It is external, because it passes into the canal outside the deep epigastric artery.

2. **Direct Inguinal Hernia**, otherwise known as internal. This variety enters the inguinal canal through Hesselbach's triangle, the boundaries of which are given above. It is direct, because its passage through the abdominal wall is practically quite straight. It is internal, because it protrudes on the inner side of the deep epigastric artery. Strictly speaking, this form of hernia is one of the linea semilunaris at its lowest part, and has therefore more rightly a place among ventral herniæ. It has been termed on this account ventro-inguinal. (See p. 146.)

Either of these two forms of inguinal hernia—indirect and direct—may be, moreover, incomplete or complete.

By the term **incomplete** is indicated that the hernial protrusion, although it has entered the canal, yet has not left it

by the superficial abdominal ring. Such a hernia is also sometimes called a bubonocele. It will be readily seen that all inguinal herniæ must of necessity be incomplete in their early stages, except that known as congenital. An indirect inguinal hernia may not infrequently remain incomplete, and especially so in female subjects, but it is quite unusual for a direct inguinal protrusion not to transgress the exit of the canal.

By the term **complete** is meant that the hernia has passed out of the canal through the superficial ring. After leaving the canal it will enter the scrotum in the male, and the labium in the female.

In male subjects, when the hernia extends only into the upper part of the scrotum, it is sometimes termed inguino-scrotal, but if it has fully entered the scrotum, it is most usually designated scrotal.

The **coverings** of a complete indirect or oblique inguinal hernia are from without inwards as follows:

1. Skin.
2. Superficial fascia, in the scrotum known as dartos tissue.
3. Intercolumnar fascia, or external spermatic fascia.
   These coverings are derived as the hernia passes through the outlet of the inguinal canal.
4. Some fibres of the cremaster muscle with the intervening cremastic fascia.
   This covering is acquired in the canal itself.
5. Infundibuliform fascia, or internal spermatic fascia.
   This fascia is in reality a prolongation of the transversalis fascia.
6. Extra-peritoneal tissue.
   The peritoneum deep to this is the sac-wall itself.
   These layers are obtained while the protrusion is entering the canal.

The **coverings** of a complete direct inguinal hernia from without inwards are as follows:

1. Skin.
2. Superficial fascia.

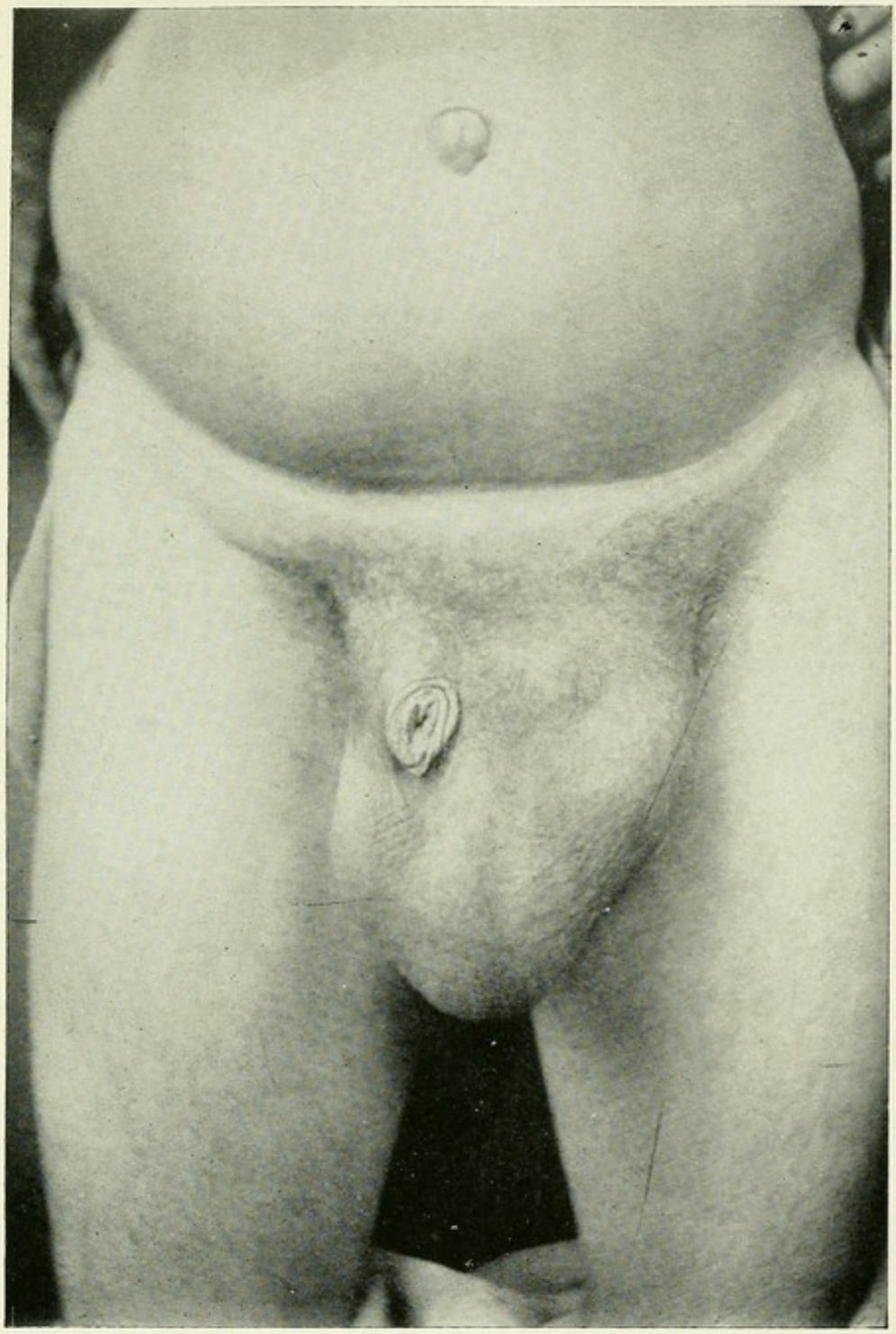

FIG. 25.—LEFT SCROTAL HERNIA.

To face p. 86.

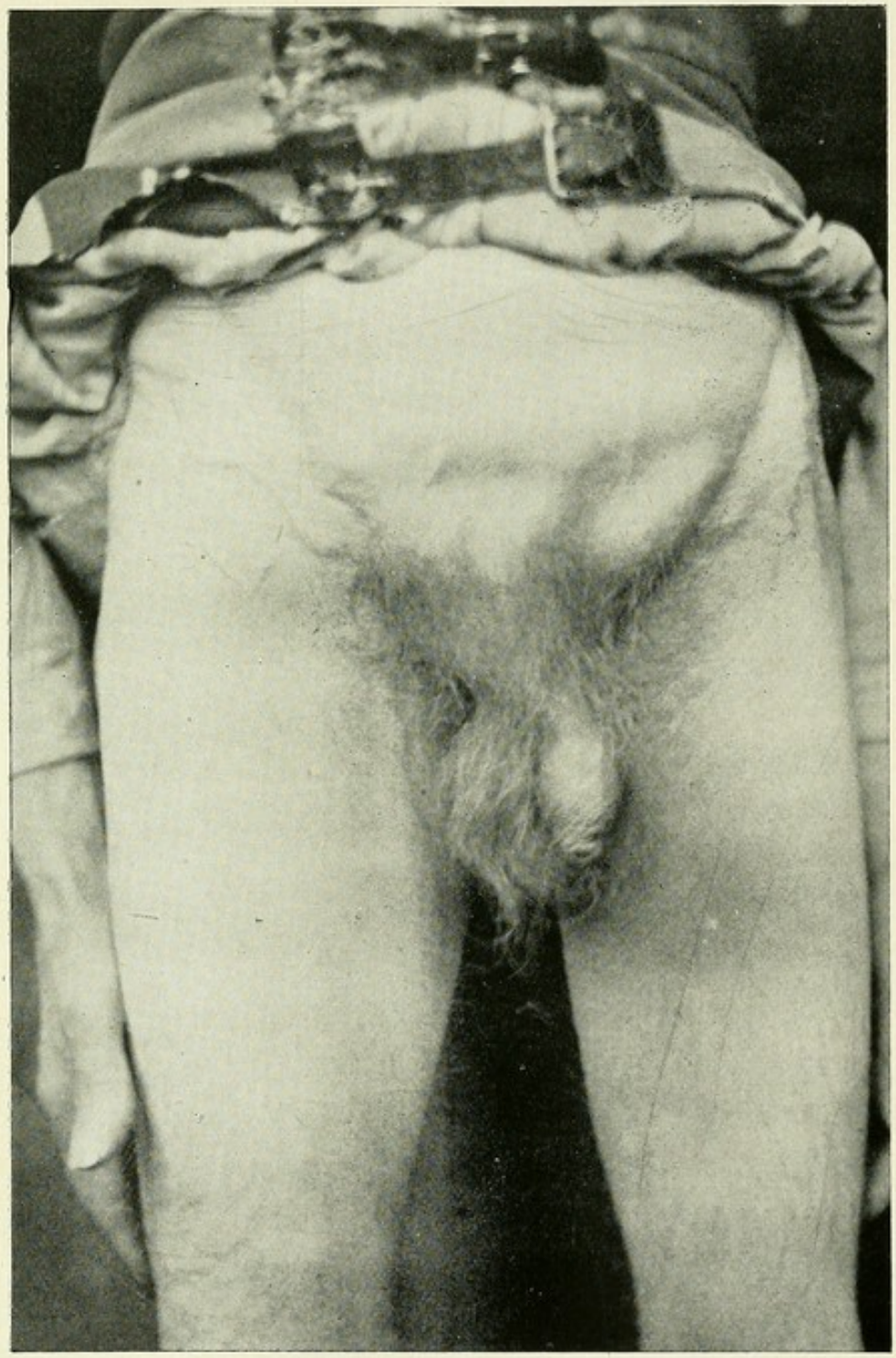

FIG. 26.—DIRECT INGUINAL HERNIA ON RIGHT, EARLY INDIRECT INGUINAL HERNIA (BUBONOCELE) ON LEFT.

To face p. 86.—I.

3. Intercolumnar fascia.
4. Conjoined tendon of the internal oblique and transversalis muscle, although probably in some cases the fibres of this structure are split apart by the protrusion.
5. Transversalis fascia.
6. Extra-peritoneal tissue.

When actually cutting down on to the sac of an inguinal hernia, these various layers of tissue, so clear on paper, are very difficult, in fact almost impossible, to differentiate; nor is it indeed necessary to do so.

While the sac of an oblique inguinal hernia is traversing the inguinal canal, it lies in front of the spermatic cord, and is often closely adherent to it. When the sac reaches the scrotum, although it still bears an anterior relation to the cord, it has a tendency to separate the constituents of that structure, so that they become spread out on the posterior surface of the sac, necessitating very careful dissection to free them from the sac-wall.

The sac of a direct inguinal hernia often has the cord lying on the outer side of it.

The testis may bear the following relations to the sac of a scrotal hernia:

1. Below and behind the fundus of the sac, and usually quite distinct from it.
2. Internal, or
3. External to the sac.
4. Anterior to the lower part of the protrusion. This position is but rarely seen.

THE CAUSES OF INGUINAL HERNIA.

Seeing that inguinal herniæ are by far the most frequent form of protrusion met with, it is probable that over and above the causes of hernia in general there are some factors at work which tend towards the production of inguinal hernia in particular.

The anatomical conditions dependent upon the transit of

the testis in the male plays an important part in the causation of this variety of hernia. Briefly stated, it may be said that the testis in its descent is preceded, as well as accompanied, by a finger-like process of peritoneum, termed the processus vaginalis. This acts the part of a fully formed sac into which at any time viscera may protrude, and may at their first descent become strangulated. If this process remain patent for an abnormal length of time, the bowel or other viscus may be forced into it, and the repetition of this protrusion will produce dilatation of the mouth of the sac, and thus allow a still greater amount of abdominal contents to escape. This constitutes a true congenital inguinal hernia. It must be clearly borne in mind that when the word 'congenital' is used in this way, it merely relates to the congenital condition of the parts which predispose to inguinal hernia, and not to the fact of the hernia being present at birth. An adult may be the subject of a congenital inguinal hernia, the contents of which may have prolapsed at any period of life. It must not be thought, however, that a patent processus vaginalis necessarily means that viscera will descend into it.

Phimosis has been considered as an exciting cause of congenital inguinal hernia in boys, but it is unlikely that it will so act, unless there is actual obstruction to the outflow of urine, a condition which is rare. Moreover, Jewish boys would seem to be peculiarly prone to inguinal hernia. Even if phimosis should in some instances be a factor in the production of hernia, it does not therefore follow that such a protrusion will be cured by the mere removal of the foreskin.

Again, it is obvious that these congenital herniæ may appear suddenly, and they are probably the only kind of herniæ which can be formed in so short a space of time.

Moreover, the anatomical peculiarities consequent upon partial descent of the testis, most commonly on the right side, are such as strongly predispose to the appearance of a hernia. In the female a patent canal of Nuck acts in much the same way as a patent processus vaginalis, and both of these conditions are liable to give rise to a variety of inguinal hernia known as interstitial.

THE CO-EXISTENCE OF INGUINAL WITH OTHER FORMS OF HERNIA.

Inguinal herniæ may be single or double, and they exist alone or in association with other forms of protrusions.

It is not uncommon to observe an inguinal hernia on one side of the body, combined with a femoral hernia on the opposite side. In other less frequent instances an inguinal and a femoral protrusion may occur on the same side, and may create some difficulty in diagnosis.

Occasionally an inguinal protrusion appears to give place to a femoral protrusion on the same side.

A subject who has developed one hernial protrusion may be said to be more prone to the formation of subsidiary herniæ, which may be other than of the original variety.

THE SIGNS AND SYMPTOMS OF AN INGUINAL HERNIA WHEN REDUCIBLE.

These will be those of a reducible hernia in general (see p. 19), with the fact that the swelling is in the inguinal region, and that reduction is effected in a direction which is outwards, upwards, and backwards. The protrusion will be noticed, as a rule, first as a bulge at the site of the deep abdominal ring. Often this is better seen than felt, and should be looked for with the patient recumbent in a good light, and again with the patient upright and observed from the side.

THE DIAGNOSIS OF INGUINAL HERNIA.

The diagnosis of inguinal hernia naturally falls under two headings :

1. The diagnosis of inguinal hernia from other conditions.
2. The diagnosis of one form of inguinal hernia from that of another variety.

1. The diagnosis of inguinal hernia from other conditions.

This division of the subject may be thus further subdivided:

(*a*) The differential diagnosis of complete inguinal hernia.

1. Reducible.
2. Irreducible.

(*b*) The differential diagnosis of incomplete inguinal hernia.

1. Reducible.
2. Irreducible.

1. The Differential Diagnosis of Complete Reducible Inguinal Hernia.

This diagnosis has to be made both in the male and in the female.

In the Male.—The fact that a swelling in the scrotum will disappear when pressure is brought to bear upon it (owing to the parts which in great measure compose it being displaced) is not necessarily an indication of a hernia. There are three conditions which cause enlargements of the scrotum and which tend to become less or to altogether pass away when pressed or otherwise acted upon, viz.: (*a*) Reducible scrotal hernia; (*b*) varicocele; (*c*) congenital hydrocele.

The diagnosis of these three lesions is generally comparatively easy. It may be given in a tabular form (see p. 91).

There should not be the least difficulty in diagnosing between a complete inguinal hernia and a femoral hernia in either sex; it is the incomplete variety of inguinal hernia which may occasion difficulty. The complete inguinal hernia may be thus diagnosed from the femoral hernia:

Complete Inguinal.	Femoral.
i. Protrudes through superficial abdominal ring *internal* to the spine of the os pubis.	Lies wholly *external* to the spine of the os pubis.
ii. The inguinal canal is occupied when the hernia is protruded.	The inguinal canal remains empty.
iii. Reduction is effected in a direction upwards, outwards, and backwards.	Reduction is effected in a direction backwards and upwards.

FIG. 27.—A LEFT VARICOCELE.

To face p. 90.

DIAGNOSIS OF REDUCIBLE SCROTAL SWELLINGS.

	HERNIA.	VARICOCELE.	CONGENITAL HYDROCELE.
1. *Age:*	Occurs at all ages.	Between 15 and 40.	Infancy.
2. *Appearance:*	Pyriform.	Irregular, nodular.	Pyriform.
3. *Feel:*	Soft, semi-elastic.	Soft, like 'a mass of earth-worms.'	Harder, and definitely elastic.
4. *Impulse on cough:*	Definite and expansile.	Indefinite, more as a fluid thrill.	Usually absent; but if present, only slight.
5. *Translucency:*	In the adult, non-translucent; in the infant, may be translucent.	Non-translucent.	Translucent.
6. *Fluctuation:*	None.	None.	Can be obtained.
7. *Percussion:*	If intestine is present, there may be resonance; but the note is dull if omentum alone.	Dull.	Dull.
8. *Auscultation:*	Gurgling if intestine is present.	Dumb.	Dumb.
9. *Points to be noticed on reduction by taxis:*	The feeling of a solid body slipping away from the fingers; if intestine a characteristic gurgle.	Is not reducible by taxis in the ordinary sense of the term.	Usually takes a considerable time for the fluid to be reduced, and it passes back without any characteristic symptom.
10. *Change on the patient assuming the horizontal position:*	May disappear completely.	Always disappears, especially if the scrotum be somewhat raised.	Does not disappear.
11. *Change on the patient reassuming the upright position with the surgeon's finger pressed over the superficial abdominal ring.*	Will not reappear.	Will reappear; filling from below, owing to the fact that blood is brought by the spermatic artery.	Will reappear, but slowly in most cases, if reduction had been effected.

In the Female.—The diagnosis of complete reducible inguinal hernia in the female is a much more simple matter than it is even in the male. Labial herniæ are not so common a form of protrusion in women as scrotal are in men, and, moreover, the majority of the herniæ which reach the labium are reducible, while the other swellings met with in this region are irreducible. There is one swelling which may have a semblance of reducibility, and that is varicosity of the labial veins. This may be very marked in some of the later months of pregnancy, but their appearance, feel, and the fact that there are most usually other varicose veins in the lower extremities, will sufficiently indicate the condition.

2. The Differential Diagnosis of Complete Irreducible Inguinal Hernia.

In the Male.—An irreducible swelling in the scrotum may be:

1. An irreducible scrotal hernia.
2. A hydrocele:
   (*a*) vaginal;
   (*b*) encysted of the spermatic cord or testis.
3. An inflamed testis:
   (*a*) acute;
   (*b*) chronic.
4. A testicular new growth.
5. A hæmatocele.

Such swellings are sometimes extremely difficult of differential diagnosis, although typical examples of each cannot well be mistaken for one another.

The diagnosis may be conveniently given in a tabular form (see p. 93).

In some few cases a hydrocele of a hernial sac is present (see p. 9), and will have to be distinguished from an ordinary hydrocele of the tunica vaginalis. The previous history of a reducible swelling, the fulness in the inguinal canal, and the cord-like mass running up to the region of the deep abdominal ring, will indicate the condition as that of

DIAGNOSIS OF IRREDUCIBLE SCROTAL SWELLINGS.

	HERNIA.	HYDROCELE.	INFLAMMATION OR NEW GROWTH OF TESTIS.	HÆMATOCELE.
1. *History:*	Of a previously reducible swelling gradually formed.	Always irreducible and of gradual formation.	Always irreducible and of gradual formation.	Of injury, with rapid formation, or of new growth with gradual formation.
2. *Appearance:*	Pyriform.	Globular; may be pyriform.	Rounded, or oval.	Globular. There may be ecchymosis of skin.
3. *Feel:*	Soft, semi-elastic, as of a solid substance; impressionable.	Tense, elastic, uniform, unimpressionable.	Firm; may be irregular.	Tense, elastic.
4. *Impulse on cough:*	Definite and expansile.	No expansile impulse; may be a forward one.	No impulse.	No impulse.
5. *Translucency:*	Not translucent.	Generally translucent.	Not translucent.	Not translucent.
6. *Fluctuation:*	None.	Can be obtained.	None, unless hydrocele or hæmatocele coexist.	Usually can be obtained.
7. *Percussion:*	May be partly resonant if intestine is present.	Dull.	Dull.	Dull.
8. *Auscultation:*	Gurgling if intestine is present.	Dumb.	Dumb.	Dumb.
9. *Condition of spermatic cord:*	Obscured by hernia in front of it.	Easily felt above the swelling.	Vas may be enlarged, and tender.	Easily felt above the swelling.
10. *Comparative weights of swellings:*	Medium weight.	Heavy for its size.	Usually heavy.	Heavy.
11. *Position and palpation of testis:*	Behind and below; usually easily felt.	Not felt if sac is very tense; otherwise made out by its opacity.	Epididymis or body of testis can be made out.	Not usually felt, but lies below and behind.

a collection of fluid in the sac of a scrotal hernia. In some cases, by transmitted light, opacity may be seen marking the solid as well as the fluid contents of the sac.

In other cases, again, a hernia may co-exist with a vaginal hydrocele in the same scrotum. The two swellings are frequently partially separated from each other by some degree of constriction between them, and each will present the characters typical of itself.

In the Female.—The differential diagnosis of complete irreducible inguinal hernia in the female, a condition which in itself is rare, will be from all other irreducible swellings of the labium majus, which include:

1. Cyst:
   (*a*) Glandular.
   (*b*) Hydrocele of the canal of Nuck.
2. Abscess.
3. Fibro-cellular tumour.
4. Hydrocele of a hernial sac.

The diagnosis may be given in a tabular form (see p. 95).

1. The Differential Diagnosis of Incomplete Reducible Inguinal Hernia.

In the Male.—There is but little difficulty in the diagnosis of such cases, for there is practically but one other reducible swelling limited to the inguinal canal, and that is a rare one. It is a form of congenital hydrocele known as the funicular variety. In this the processus vaginalis has been locally obliterated at the region of the superficial ring, but is patent above and still in communication with the cavity of the abdominal peritoneum.

In this funicular portion fluid may collect and form a swelling, which may be reducible, but it is devoid of any sign or symptom of hernia in addition.

In the Female a somewhat similar condition may occasionally arise.

In both sexes a large reducible femoral hernia may come to occupy a position above and in front of Poupart's ligament,

DIAGNOSIS OF IRREDUCIBLE LABIAL SWELLINGS.

	Irreducible Hernia.	Cyst.	Abscess.	Fibro-cellular Tumour.	Hydrocele of Hernial Sac.
1. *Frequency:*	Rare.	Common.	Comparatively common.	Rare.	Rare.
2. *Feel:*	Soft, semi-elastic.	Tense.	Tense.	Soft, but not elastic.	Tense.
3. *Impulse on cough:*	Definite and expansile.	None.	None.	None.	None, usually.
4. *Translucency:*	Not translucent.	Generally translucent.	Not translucent.	Not translucent.	May be translucent.
5. *Fluctuation:*	None.	Present.	Present.	None.	Present.
6. *Percussion:*	Partly resonant if intestine be present.	Dull.	Dull.	Dull.	Dull.
7. *Auscultation:*	Gurgling if intestine be present.	Dumb.	Dumb.	Dumb.	Dumb.
8. *Condition of the Inguinal Canal:*	Occupied by a cord running up from the labial swelling.	Empty.	Empty.	Empty.	Occupied by a cord running up from the labial swelling.

and thus require to be distinguished from an inguinal bubonocele. In males this diagnosis is comparatively easy but in women it may present much greater difficulty, especially if the subject be fat. An inguinal hernia is seldom mistaken for a femoral, but the reverse error, a femoral for an inguinal, is not infrequent. Both swellings, the incomplete inguinal and the femoral hernia, lie external to the spine of the os pubis, and therefore their relationship to this bony prominence is of no diagnostic value, although often mentioned as such (see p. 160).

The diagnosis in tabular form will be:

	Incomplete Reducible Inguinal Hernia.	Reducible Femoral Hernia.
1. *Position with relation to Poupart's ligament:*	Wholly above the ligament, which usually can be made out clearly below the protrusion.	Lies in front of and thus obscures the inner end of the ligament.
2. *Condition of the inguinal canal:*	Occupied by the swelling. In the male, if the scrotum is invaginated, and the finger made to enter the canal, the hernia will be felt to impinge on it when the patient coughs.	The canal, if explored by the finger, will be found to be empty; and no protrusion can be felt to impinge on the finger when the patient coughs.
3. *Points noticed on reduction:*	Reduction is effected in an outward, upward, and backward direction.	Reduction is effected in a downward, backward, and upward direction.

2. The Differential Diagnosis of Incomplete Irreducible Inguinal Hernia.

In both sexes such a hernia is rare, reducibility being the rule in incomplete inguinal herniæ, therefore the question of diagnosis does not often present itself. There are, however, a large number of conditions with which this condition might be confounded.

In the Male.—An incomplete irreducible inguinal hernia has to be distinguished from (1) a partially descended testis;

(2) a hydrocele of the tunica vaginalis of a partially descended testis; (3) encysted hydrocele of the cord in the inguinal canal; (4) hæmatoma of the cord; (5) lipoma of the cord; (6) malignant growth of the cord.

In the Female.—It has to be distinguished from (1) hydrocele of the canal of Nuck; (2) lipoma of the round ligament; (3) other tumours of the round ligament.

In both Sexes.—It may have to be diagnosed from (1) enlarged inguinal lymphatic glands (horizontal set); (2) abscess superficial to the muscles; (3) iliac abscess; (4) exostosis of the os pubis; (5) inguinal aneurysm.

In the **male** a partially descended testis is readily recognised by the absence of the organ from the corresponding side of the scrotum, and generally by the distinctive testicular sensation when pressure is applied to the swelling. When, however, the testis is surrounded by a collection of fluid in its tunica vaginalis, it may be very difficult to make out the testis itself.

Encysted hydrocele of the cord is a tense, fluctuating swelling, which can be shown to be attached to the cord if that structure be dragged upon, for although the hydrocele can be easily moved laterally from the line of the cord, yet there is little, if any, movement to be obtained in the axis of the cord itself.

Hæmatoma of the cord may occur after an injury, and the patient may believe he has 'ruptured' himself. Ecchymosis is often present in such a case.

Lipoma of the cord and malignant disease of the same both have the characteristics of a solid swelling in the region of the cord; the former is softish, the latter indurated.

In the **female** hydrocele of the canal of Nuck is not very common, but it presents itself as a fluctuating swelling with a distinct outline, and which cannot be displaced from the line of the inguinal canal. It may give an impulse, but of a forward rather than of an expansile character. Translucency can at times be obtained, and occasionally there is a history of the swelling altering somewhat in size at different periods.

Lipoma of the round ligament is uncommon, and not

usually diagnosed before being exposed by the scalpel, while other tumours of the same structure are very rare.

But by far the most frequent swelling in the inguinal region mistaken for an inguinal hernia is an enlargement of the lymphatic glands of the part, and this in both male and female subjects, although much more often in the former sex. Inflammation of these glands leads to a somewhat indefinite swelling owing to the perilymphadenitis which accompanies the lymphadenitis itself. The mass, however, appears to be more fixed and more superficial than hernia. It is dull on percussion, and usually shows evidence of inflammation. In addition there will be found in the area from which the lymph has been derived a source of the infection of the lymphatic glands. It must, however, be remembered that inflammatory swellings in the inguinal region may overlie a hernial protrusion, and may themselves be the outcome of an improperly formed or badly adjusted truss. Inguinal lymphatic buboes can also be mistaken for femoral herniæ.

It is, of course, an unpardonable error to mistake an inflamed hernia or inflammation of the tissues over a hernial sac for an abscess, and to make an incision into the same.

An abscess in this region superficial to the muscles is generally the result of lymphatic gland trouble. An iliac abscess, on the other hand, may come forward above Poupart's ligament, and being in a sense reducible, as well as having an expansile impulse on coughing or crying, it may be mistaken for a hernia. But there may be fluctuation, and signs of inflammation over it, and a cause for its existence may be obvious.

An inguinal aneurysm is hardly ever a source of confusion, but it should be kept in mind when a swelling in this region is being examined.

CHAPTER VIII.

INGUINAL HERNIA: ITS TREATMENT BY TRUSSES.

THE greater part of what has been said in reference to the general treatment of hernia in its different clinical conditions (Chapter III.) is fully applicable to the discussion of the treatment of inguinal hernia, its local anatomical peculiarities being duly observed.

REDUCIBLE INGUINAL HERNIA.

The **treatment by trusses** of this clinical form of inguinal hernia falls under three headings:

(*a*) The treatment in childhood.
(*b*) The treatment in adult males.
(*c*) The treatment in adult females.

The Treatment of Reducible Inguinal Hernia in Childhood.

The question of sex does not have any very marked bearing on the treatment of inguinal hernia in infancy, or up to the period of puberty. As has already been noticed, by far the larger number of protrusions in female children are of the inguinal variety; but the male infant, on account of developmental reasons, is peculiarly liable to be afflicted with this form of hernia.

The treatment of hernia in early childhood is of the utmost importance, and especially so with regard to inguinal hernia. In both sexes there is a natural tendency for the congenital process of peritoneum, into which the viscera are prone to descend, to become obliterated. This obliteration, however, cannot take place unless the walls of the tube are

kept in contact with each other. Descent of viscera every time it occurs separates the surfaces from one another, and the distension of the tube thus produced militates against its permanent closure.

Thus it would seem that the rational treatment of such herniæ in infants is either (1) to prevent the protrusion of viscera, and at the same time to keep the walls of the tube of serous membrane in apposition; or (2) to remove the neck of the process altogether.

The first method may be carried out by the application of a suitable truss, the second by operation (p. 121).

The Treatment of Reducible Inguinal Hernia in Children by Trusses.—Inguinal herniæ in children are readily treated by trusses, in spite of the very general opinion to the contrary. Furthermore, it is very rare—almost an unknown circum-

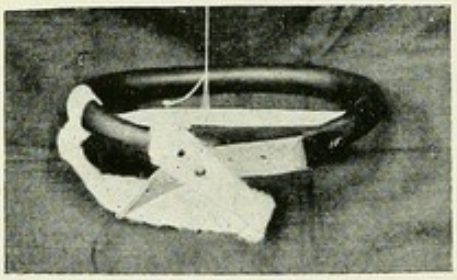

FIG. 28.—AN ORDINARY RUBBER-COVERED INGUINAL TRUSS FOR AN INFANT.

stance in infants—that the protruded viscera cannot be reduced and prevented from subsequently descending into the sac by the proper adjustment of a right form of truss. Such a truss must have a steel spring if it is to be effective, and in infants it must be covered with pure indiarubber for the sake of cleanliness and its preservation. Any other form of truss will invariably be found to be uncertain in its retentive power, and will have little or no effect in bringing about the co-aptation of the walls of the tube. One variety of appliance which has had many advocates is the skein of Berlin wool. This must be strongly objected to under any conditions, in spite of the recommendations which are urged in its favour—its simplicity, its cheapness, and its comfort. Even when accurately adjusted by those who order it, the wool skein cannot be relied on to prevent the protrusion of

bowel in any but the simplest of cases; and, further, it exercises no effective pressure over the inguinal canal, and therefore will not tend to bring about a cure.

The points which have been urged against the steel spring truss are: (1) That it causes much irritation, and is thus liable to produce eczema, excoriation, swelling of the scrotum, or even orchitis; (2) that it is very easily displaced; (3) that it soon becomes too small by reason of the growth of the child; and (4) that it rapidly wears out.

It may be conceded at once that an ill-fashioned steel spring truss, covered with impure indiarubber (red composition), one which is too small or too large, or one improperly

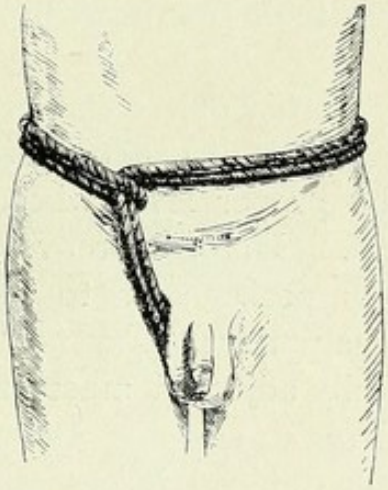

FIG. 29.—APPLICATION OF A SKEIN OF WOOL TRUSS.

adjusted, will inevitably cause trouble, but one cannot admit that a thoroughly well made and accurately adjusted steel spring truss will often do so. On the contrary, even the youngest and most poorly nourished of infants can wear such a truss with comparative ease.

The method of **measurement** for an inguinal truss in an infant is the same as in an adult (p. 107). The adjustment of the truss at so tender an age is of the utmost importance. In infancy, as has been mentioned, the inguinal canal is practically non-existent, since the deep abdominal ring lies almost directly behind the superficial; but both, it must be remembered, are placed wholly above the level of the pubic bone and therefore of the symphysis pubis. In children

the upper part of the symphysis pubis is considerably higher than it is generally supposed or than it appears to be. There is, however, a very distinct guide to the level required, for every child, and particularly a well-nourished one, presents a curved line running across the lower part of the abdominal wall—the fold of Venus—which accurately indicates the upper limit of the pubic bones. (See Fig. 29.)

The important fact to be borne in mind is that the whole of the pad of the truss must lie above this line, for if it be placed below it, the soft parts upon which it will then impinge must of necessity be compressed between the pad and the unyielding bone beneath, and, moreover, the pad would in no way tend to retain the intestine, seeing that it is placed altogether below the site of the rings through which the protrusion passes.

Very soon such pressure would cause irritation and excoriation, but this untoward result can be entirely avoided if the truss be worn at the proper level, where it will press only upon the soft parts. Here, moreover, it has but little tendency to shift its position or to be displaced by the intentional acts of the patient.

A truss thus carefully adjusted must be worn by the child continually day and night, sleeping and waking, crying and peaceful. Temporary removal is necessary for the purpose of cleanliness, and when this is needed, it should be undertaken with the patient recumbent, and when left unguarded by the truss the hernial aperture should be protected by the nurse's finger or thumb. It is remarkable how rapidly, often within a few weeks after the application of a proper form of truss for a congenital inguinal hernia, descent of the viscera ceases, but such would soon recur if the truss for any reason were discontinued. Permanent closure of the processus vaginalis will be obtained in the majority of the cases only after a continuous action of the pressure of a steel spring truss over a period of some years.

A cure can therefore be safely predicted, but the truss should not be discarded until the child has reached the age of at least three years. Treatment by trusses should be begun at the very earliest possible moment, as for each year

of life which is passed without such treatment there is a corresponding diminution of the probability of a permanent cure. It is highly fallacious to aver that a hernia in an infant will become spontaneously cured without active truss treatment. Such a result is so extremely rare that it must be disregarded in practice.

Congenital inguinal herniæ in female infants are even more likely to be cured by treatment than those in male subjects.

In certain instances, boys may develop, as the outcome of neglect, very large scrotal herniæ, which may not be efficiently controlled by an ordinary truss. In such cases a rubber-covered rat-tail, or forked-tongue, scrotal truss will be required, which are described fully on p. 111. By means

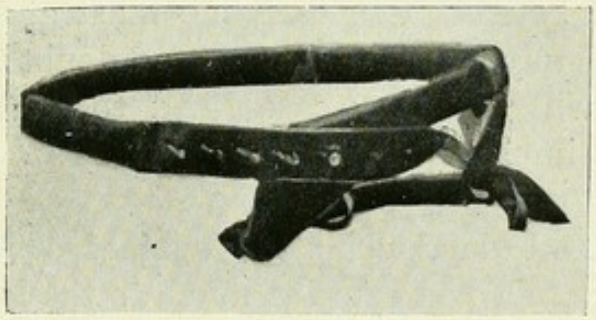

FIG. 30.—A RUBBER-COVERED RAT-TAIL TRUSS.

FIG. 31.—A RIGHT-TAIL AND LEFT ORDINARY PAD.

of efficient truss pressure, the viscera will be retained, and the hernial apertures will diminish in size in addition to the actual obliteration of the patent process of peritoneum.

All truss treatment in infants, and indeed any form of treatment, is almost certainly doomed to failure, unless special attention is paid to the diet of the little patient. All food which tends to the production of flatus is particularly detrimental. Distension of the intestines with gas, the consequent colic, and the associated crying on the part of the child, all combine to produce or increase the protrusion of the viscera. Circumcision should always be performed if there is phimosis present, not with a view to the cure of the hernia, but to remove any possible source of its aggravation.

In older children attention should be paid to the encouragement of muscular development.

Finally, the cases in which operation should be preferred to or follow after truss treatment, and the variety of operation to be undertaken, are discussed later (p. 121).

The Treatment of Reducible Inguinal Hernia in Adult Males.

As in childhood, so in adult life in male subjects, the treatment of reducible inguinal hernia may be divided into two methods—mechanical and operative—but there is one very important difference between the two periods of life. In infancy there is a great probability of cure by truss pressure, while in adults one cannot hope for such a result, therefore the treatment by truss after early life must at the best be considered as merely palliative, though no doubt the use of an instrument will in many cases lead to a very appreciable amount of improvement in the patient's condition.

Probably in the present day, when the subject of the operative treatment of hernia has come so much to the fore, the public as well as the profession are considerably more alive to the fact that such treatment must be fairly weighed against the purely mechanical method. 'Can I have my "rupture" cured by operation?' says the sufferer. 'Is this a suitable case for operation?' says the surgeon. And it is for the medical practitioner to answer the questions, and he should give no uncertain reply. As to the cases of inguinal hernia in which operation should be advised, they are fully dealt with later when operative procedures are under review (p. 121).

Treatment by Trusses.—A reducible inguinal hernia in the majority of cases can be efficiently controlled by a suitable truss rightly adjusted.

An ordinary or simple inguinal truss consists of the usual component parts of such an instrument, namely, a pad, a spring, and an understrap.

The pad should be of a somewhat oval shape, with two

studs on its anterior surface, and a slightly convex smooth face on its posterior aspect. The size of an inguinal pad for an adult is about 4 inches long, 2 inches broad, and $1\frac{1}{4}$ inches thick. Its lower border, which is curved, should project about half an inch below the level of the inferior edge of the spring. It is very important that it should not descend further than this, for if it does there will be a great tendency for the pad to become displaced upwards by the movements of the thigh.

The spring in a single truss should be more than a semicircle—that is to say, it should reach to just behind the

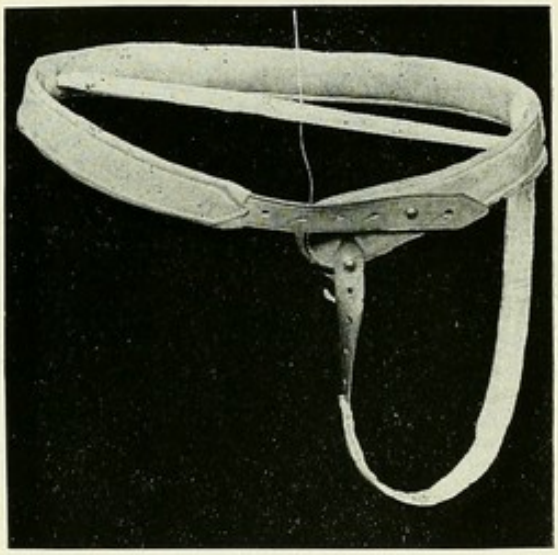

FIG. 32.—AN ORDINARY LEFT INGUINAL TRUSS.

anterior superior spine of the opposite side. From this point the coverings of the spring are prolonged as a cross-strap, which is fastened to the upper stud on the face of the pad. It is very important that the termination of the spring should in the process of manufacture be hammered out so that it becomes thin and flat, and therefore much more flexible, and likely to cling steadily around the hip opposite the hernial protrusion without causing unnecessary pressure.

In order that the spring should rest flat on the body, the lower edge of it must be longer than the upper—that is, it must be the arc of a larger circle—owing to the larger circumference of the lower circle of the pelvis around which

the truss is applied. If this were not so, it would naturally follow that the truss would only rest on its lower border, and would consequently be very uncomfortable. The spring and pad should be immovably fixed together by rivets. The pad, moreover, should continue the line of the spring, except for a slight curve backwards when it is off the body. If, as is the case in some trusses, the curve is so great as to make the pad touch the posterior part of the spring, the pressure will be excessive, and the patient unable to comfortably bear it, and, moreover, such pressure will be actually injurious.

The size of an inguinal truss for the purposes of manufac-

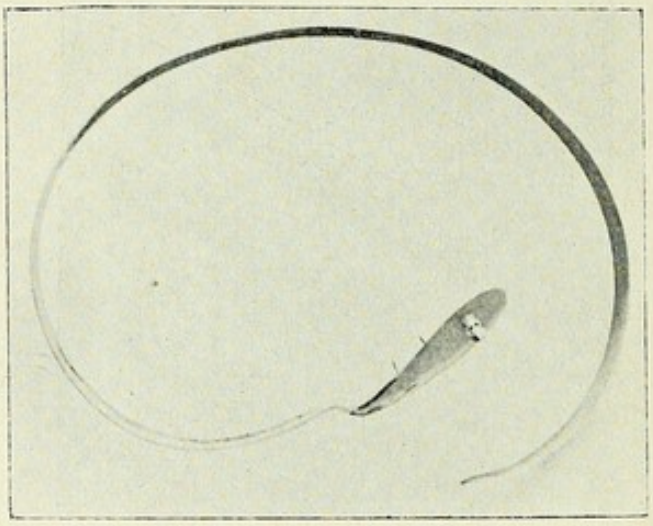

FIG. 33.—PROPER CURVE OF SPRING.

ture is determined by the internal measurement of the spring, but this is obviously not to be taken as the size for adjustment, which will naturally be several inches longer in a single truss than the length of the spring. The under-, thigh-, or perineal-strap is an essential part of an inguinal truss, though often omitted. It is useful in keeping the spring from riding up over the hip-bone, in preventing the upward displacement of the pad, and in giving this latter a tilt, so that it faces somewhat less vertically. Its proper adjustment is of much importance, for if it be applied wrongly it is worse than useless. It should be fixed just behind the shoulder of the truss, viz., that part of the truss which when properly adjusted lies directly behind the

anterior superior spine of the ilium of the same side as the hernia, and, further, it should be fastened in such a manner that it cannot of itself shift its position. It is then carried down and along the gluteal fold, across the perineum, and up to fasten in front to the lower stud on the pad. It is not to be applied tightly, but is to be well drawn upon while it is being fixed in position. Often the under-strap is placed by the patient or instrument maker at or near the middle line behind, where it cannot in any sense fulfil its functions. Many patients cease to wear the under-strap, considering it of no value, but this is usually owing to their want of knowledge of its great usefulness.

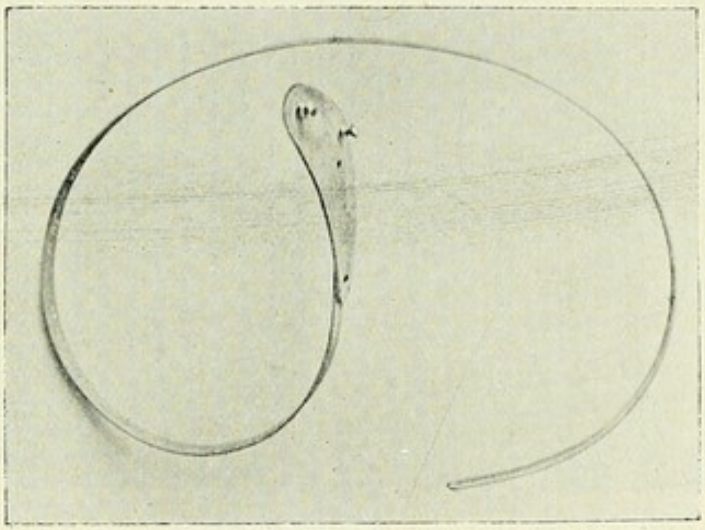

FIG. 34.—IMPROPER CURVE OF SPRING.

A double inguinal truss differs but little in its general characters from a single one. There are two pads of like form, but the spring is prolonged from one pad to the other, thus nearly encircling the body. There is a cross-strap passing from the upper stud on the face of one pad to the corresponding stud on the other, and there is a second under-strap to be adjusted in precisely the same way as its fellow.

A double truss seems to have less tendency to be moved away from its proper position than even a single one.

To Measure for an Inguinal Truss.—A flexible tape measure is carried round the patient's pelvis, so that it crosses the base of the sacrum behind, lies halfway between the crest of the ilium and the summit of the great trochanter at the

sides, and well above the symphysis pubis in front. The number of inches recorded is the requisite size of the truss.

While the measurement is being taken, the patient should be lying in the dorsal posture, with the lower limbs extended and parallel with each other. The surgeon stands on the patient's right. He grasps the measure with his right hand in such a manner that the numerals will lie next the patient's skin when the tape is applied to his body. The surgeon directs the patient to raise the pelvis from the couch, and forthwith slips the tape from the left side under the patient, so that it crosses the base of the sacrum behind. He then

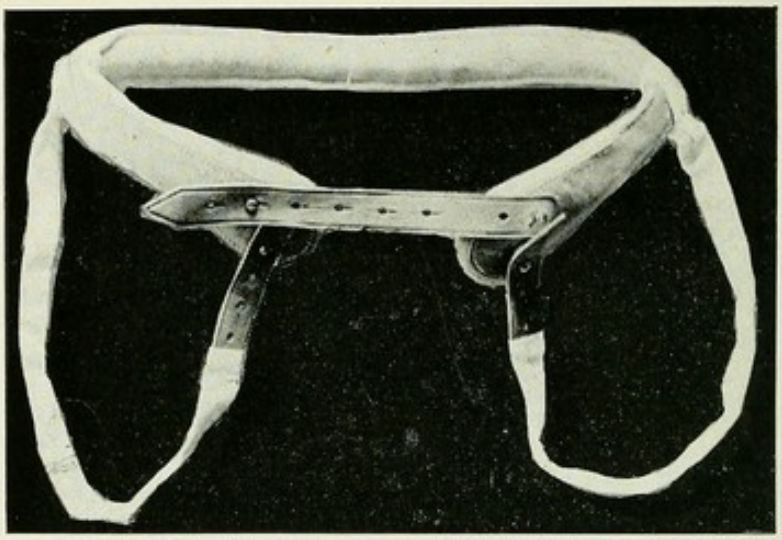

FIG. 35.—A DOUBLE ORDINARY INGUINAL TRUSS.

seizes the free end now appearing at the right side of the pelvis with his left hand, and draws it round so that it lies just below the anterior superior spinous process of the ilium.

The surgeon's left thumb is now to be placed on the point of the commencement of the numerals, and brought over the site of the deep abdominal ring. His right thumb and forefinger grasping the other portion of the tape brings it round from the left side of the pelvis and across the front above the symphysis, until his two thumbs are in contact over the region of the deep ring of the right side. While doing this the surgeon pulls the measure fairly tightly, so that it is accurately adjusted the whole way round the pelvis.

As soon as the surgeon's two thumbs have met one another, he relaxes his hold on the tape by his left thumb

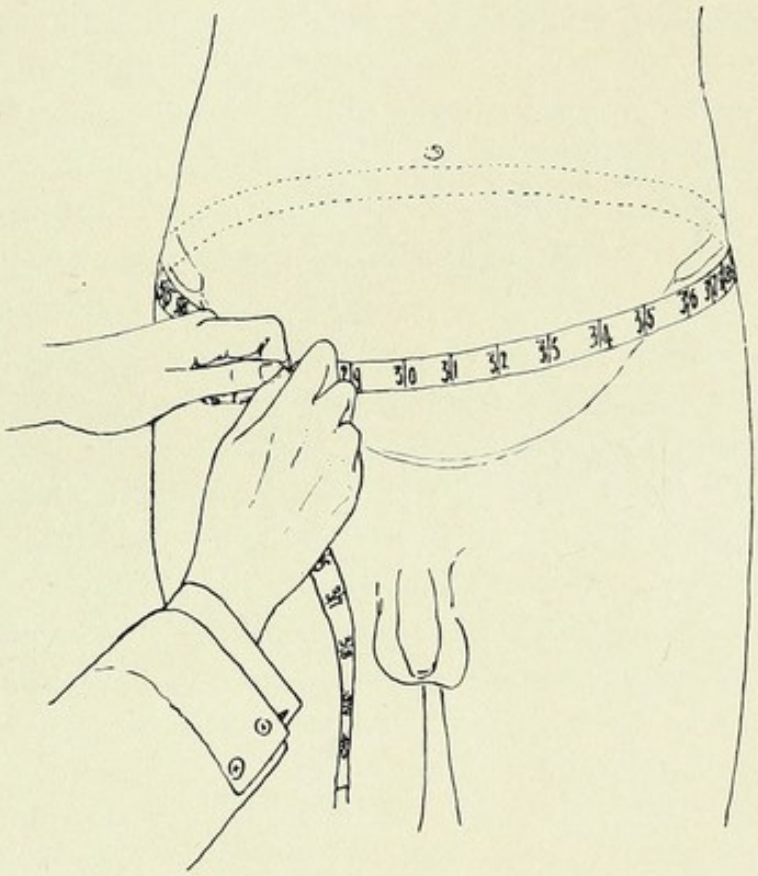

FIG. 36.—HOW TO MEASURE FOR AN INGUINAL OR A FEMORAL TRUSS.

To face p. 108.

and forefinger, but maintains that by his right. He then withdraws the measure from around the patient's pelvis, and noting the spot on the tape where his right thumb is, he reads the number of inches recorded. This is the accurate size for the truss. Supposing that the numeral indicated was 32, the truss to be ordered, if a single one, would be one of 32 inches. If, however, the measure were 32½ inches, then it is well, seeing that generally trusses are not graduated by half-inches, to order the next inch size, viz., a 33-inch rather than a 32-inch truss.

When the truss is applied to the patient he often complains that it feels rather tight, but in a single truss it is to be remembered that all the part known as the cross-strap will ere long stretch considerably, and the truss thus become less closely fitting.

When, however, a double truss is being measured for, it is usually a good rule to add one inch to the actual measurement; for a double truss, from its almost completely circular spring, will not stretch at all. It is perhaps best when ordering a rat-tail truss to procure one which is one inch smaller than the precise measurement, since it seems to be capable of even greater stretching than is an ordinary truss. It is never safe to trust the eye in determining the size of the truss required in any given case, and it must be confessed that in some instances the actual measurement obtained is not that which is the exact one for the truss that will accurately fit the patient. This somewhat contradictory statement can be explained by the fact that the shape of the pelvis differs considerably in various individuals, and this renders the measurement inaccurate so far as the particular case is concerned.

It is much more likely that the measurement taken for a truss is too large than too small. This is most commonly due to the fact that the tape has been placed too low down behind, in some cases even over the buttocks instead of across the base of the sacrum.

It should be remembered that if the measure is rightly applied, it has to pass obliquely round the pelvis, in the plane of its brim, and not horizontally, as so often it is

allowed to do, which tends to produce a measurement far too large.

In ordering a truss it is necessary to give the truss-maker the variety, the size, whether single or double, and if single the side for which it is required.

The Adjustment of an Ordinary Inguinal Truss.—Even if a truss be of the right shape and size, it may be entirely useless if improperly applied. Mal-adjustment is very common. A golden rule to follow is that the truss should be worn high up behind, high up in front, and well drawn down at the sides (see Figs. 38 and 49).

In order to adjust an inguinal truss, the patient should maintain the horizontal position, and the surgeon should stand on the patient's right, and facing him.

The surgeon's first object is to completely reduce the contents of the sac. He then takes the truss in the right hand, with the posterior part of the spring held towards the lumbar spine, and asking the patient to raise the pelvis, he slips the truss under it from the left side, and thus encircles the pelvis with it.

The pad must lie over the region of the deep abdominal ring and the inguinal canal, where it will exercise pressure only upon soft structures. It should not under any circumstance, in an ordinary oblique inguinal hernia, reach further than the outer border of the rectus muscle, thereby only just encroaching upon the region of the superficial ring, and certainly not resting entirely over it.

The whole of the pad must lie above the level of the crest of the os pubis—a level which can be easily determined by finding the upper limit of the symphysis pubis with the finger, the crest being on the same level. If the pad be placed even to a small degree below this level, it will compress the softer tissues against the unyielding os pubis, and thus cause intolerable discomfort. Further, if the truss be of too large a size, the pad will lie too far towards the middle line, and so leave the deep ring and the upper part of the canal virtually unsupported, and thus allow descent of the contents of the abdomen into the neck of the sac. It is a very common mistake for patients to place the pad of an inguinal truss

FIG. 37.—A SINGLE ORDINARY INGUINAL TRUSS ADJUSTED.

To face p. 110.

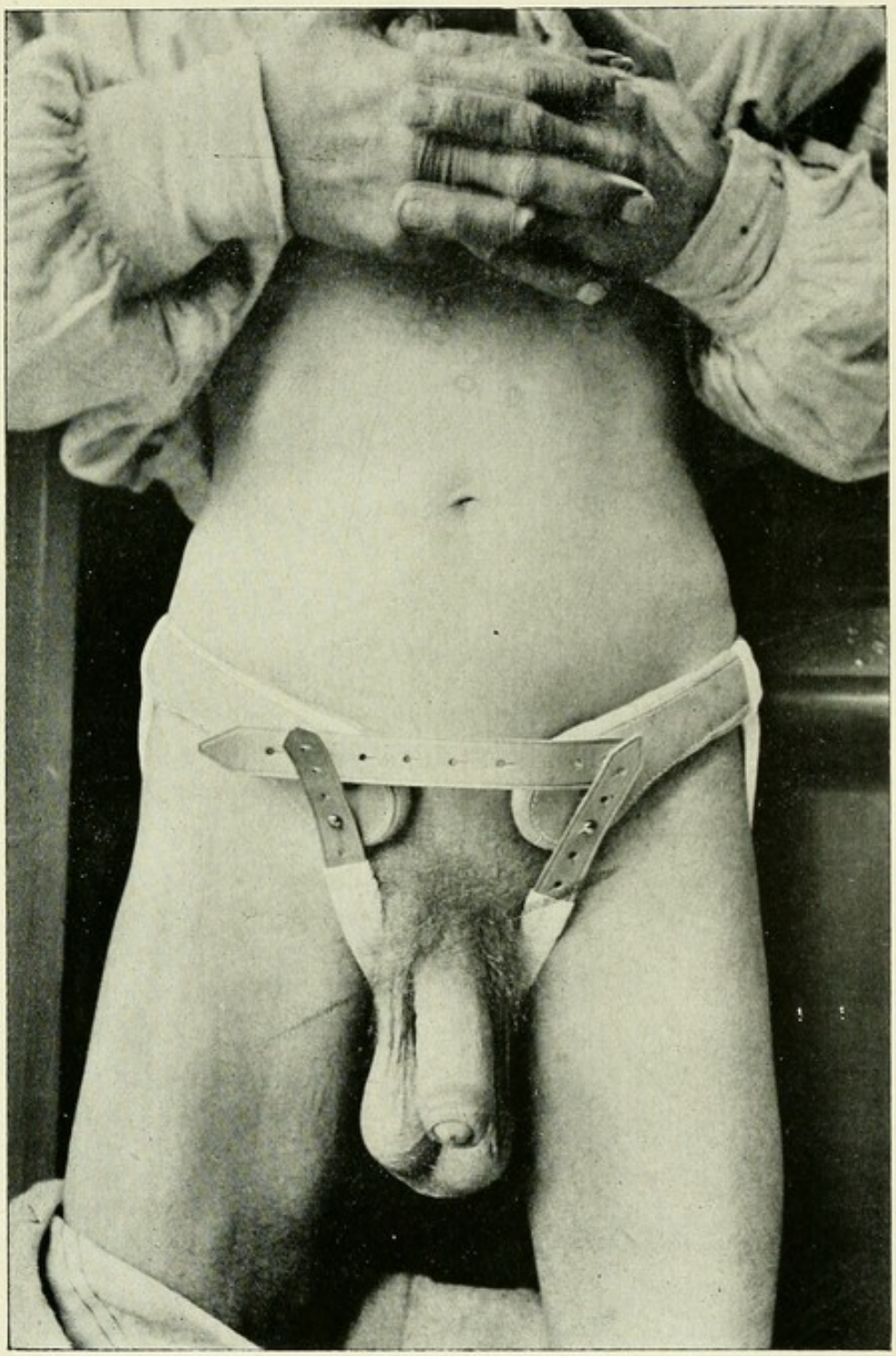

FIG. 38.—A DOUBLE ORDINARY INGUINAL TRUSS PROPERLY ADJUSTED.

To face p. 110.—I.

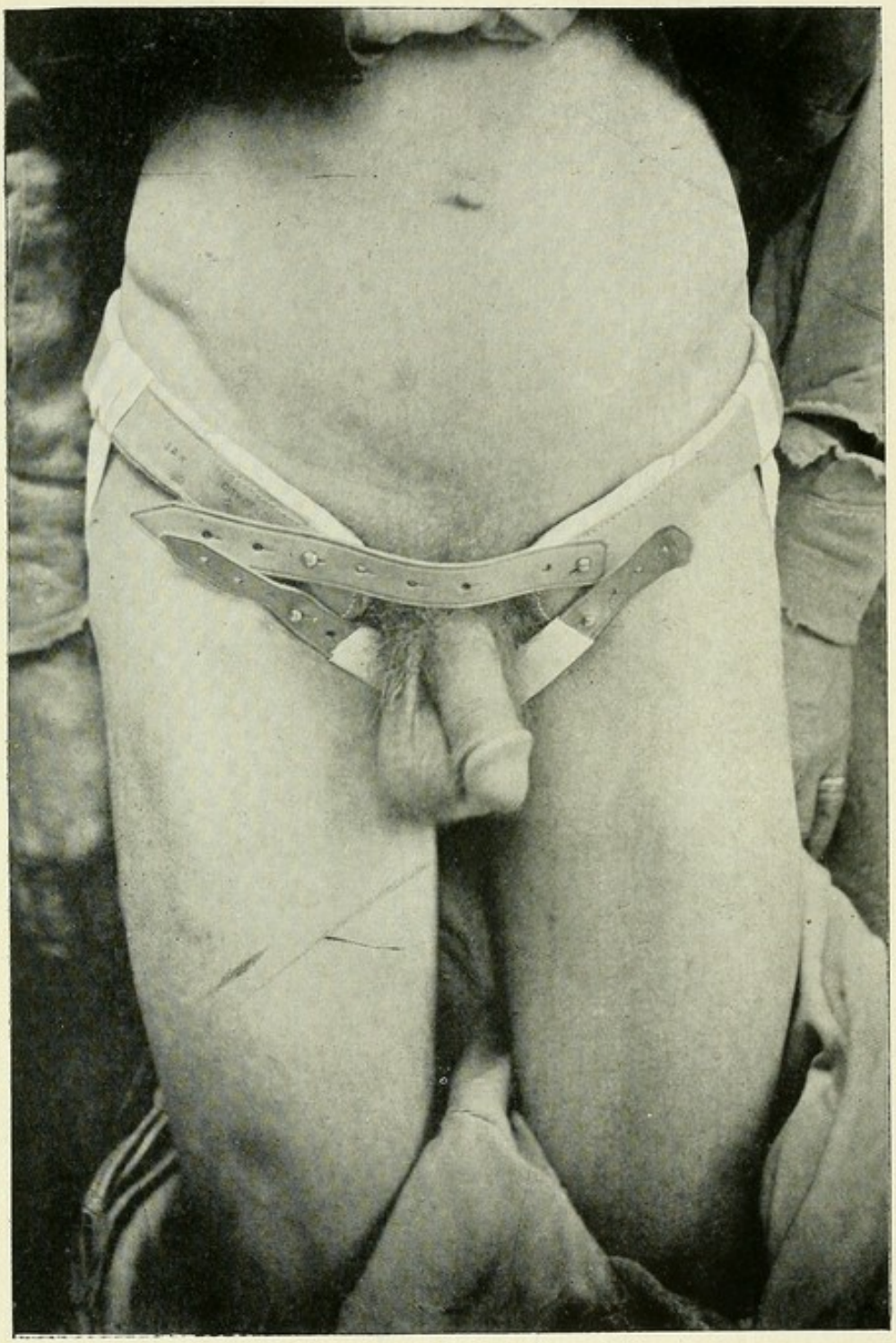

FIG. 39.—A DOUBLE ORDINARY INGUINAL TRUSS IMPROPERLY ADJUSTED, BEING PLACED AT TOO LOW A LEVEL.

To face p. 110.—II.

much below its proper level (Fig. 39). A properly made truss of the correct size falls naturally into position when applied around the pelvis. If an ordinary inguinal truss be worn in its correct position, it will be found that many a scrotal protrusion, as well as most bubonoceles, will be satisfactorily controlled; but others may need a rather more elaborate form of truss to efficiently retain them.

A **rat-tail**, sometimes known as a **scrotal, truss** is the variety which is most useful in such cases. In this the pad is fuller than in an ordinary inguinal truss, and there is in addition a tapering piece of soft material springing from the

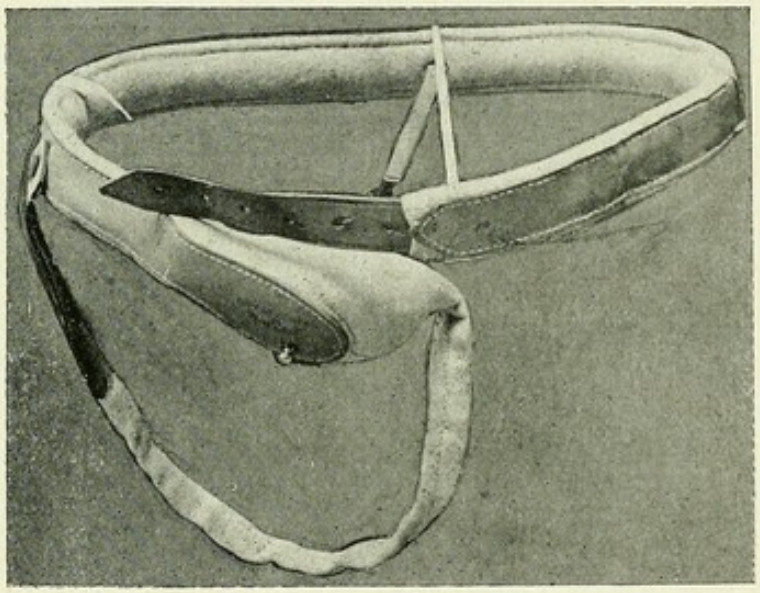

FIG. 40.—A RAT-TAIL TRUSS OF PROPER PATTERN.

lower part of the pad, and prolonged into a strap which takes the place of the usual under-strap, and is fastened to an immovable hook just behind the shoulder of the truss. It is very important that the iron of the pad should not pass down into the tail, for if it does the soft parts must necessarily be compressed between the metal and the bone, since the tail occupies a position over the superficial ring and the crest of the os pubis (Fig. 42).

This prolongation of the pad metal into the tail of the truss is very frequently met with in badly-constructed trusses, and is much to be deprecated, as also is the use of a movable buckle to which the termination of the tail is attached.

Seeing that in the upright position the rings and canal, particularly in a patient who is stout and whose abdomen sags forward, tend to assume a rather more horizontal plane, it is well that the steel of the spring just external to the place where it is riveted to the pad should be slightly cranked, so that the pad lies on a slightly anterior plane, and faces somewhat more upward than that of an ordinary instrument.

The spring of a rat-tailed truss may sometimes with advantage be made a little stronger than is usual in an ordinary inguinal truss. For an infant, a rat-tail truss should

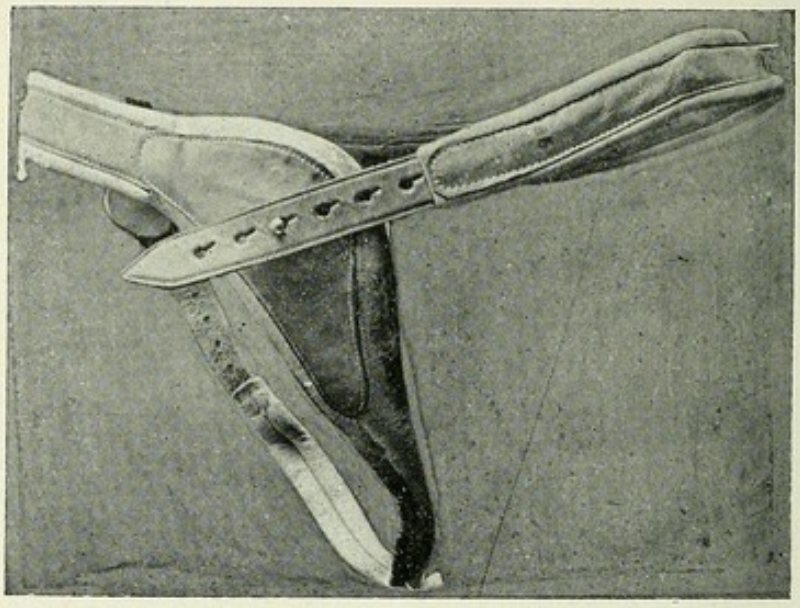

FIG. 41.—A RAT-TAIL TRUSS OF IMPROPER PATTERN.

be covered with pure rubber, and the tail fastened to the shoulder of the truss by means of a side tape (Fig. 30).

As has been mentioned above, it is preferable in ordering a single rat-tail truss to give one inch less than the actual measurement. The adjustment of a single rat-tail truss is very like that of a single ordinary inguinal truss, but it is well when the cross-strap has been fastened to grasp the tail and to draw it away from the surface so as to raise the whole pad slightly, and then to allow it to fall back so that the upper part of the tail fits comfortably into the groove between the scrotum and thigh.

The under-strap continuous with the cushion-like prolongation of the pad is carried along the perineum, round

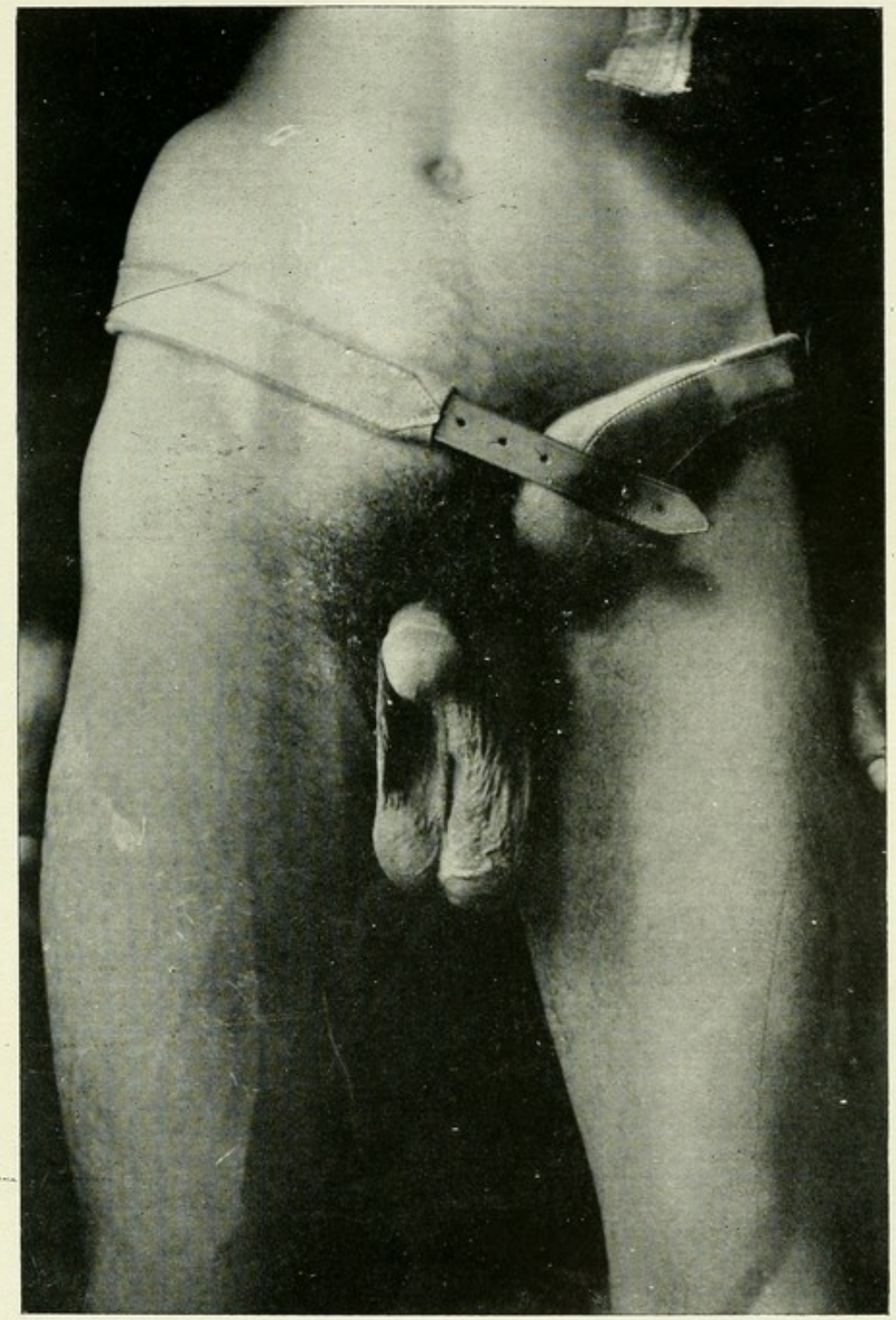

FIG. 42.—A RAT-TAIL TRUSS ADJUSTED.

To face p. 112.

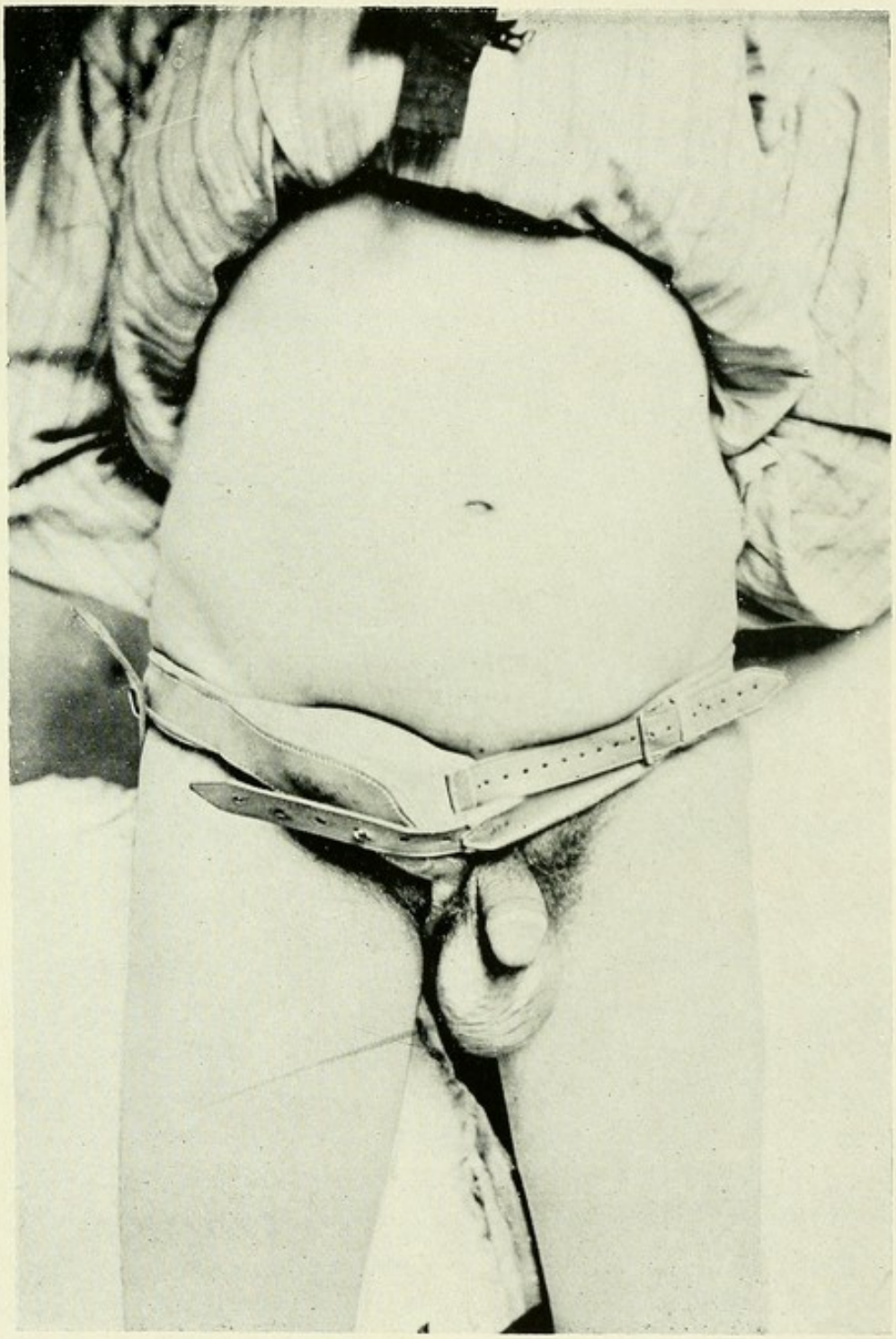

FIG. 44.—A SINGLE FORKED-TONGUE TRUSS ADJUSTED.

To face p. 112.

the gluteal fold, and is fastened to the fixed hook at the shoulder of the truss.

A rat-tail truss should be worn if possible at night as well as by day. There is no doubt that many cases of scrotal herniæ will, after some months of control by a tail truss, be so much improved as to become mere bubonoceles.

The **forked-tongue truss** is a modification of the rat-tail pattern. In this latter there is sometimes a tendency for the upper and inner part of the pad to be dragged downwards and outwards by the tail in spite of the cross-strap, so that the hernia is liable to protrude at the inner side, which is thus left unprotected. To obviate this fault an addition is made to the soft material of the pad at its upper and internal

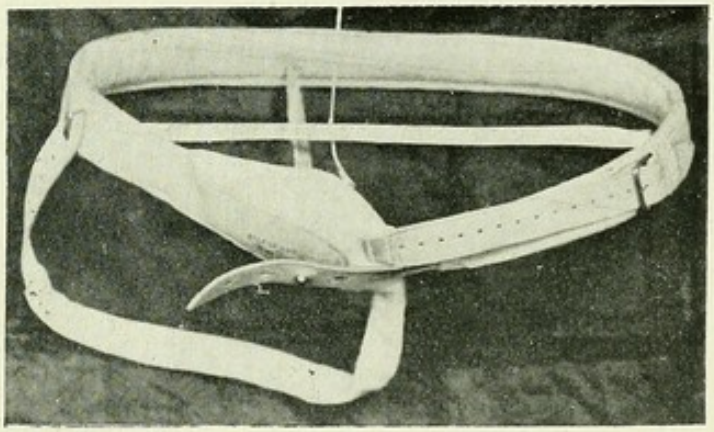

FIG. 43.—A RIGHT FORKED-TONGUE TRUSS.

angle. To this is attached a thong, which is carried across the trunk and fastened to an immovable buckle on the cross-strap, just in front of the anterior superior spine of the opposite side. This counteracts in great measure the downward pull on the pad. It is well in some instances to make a vertical aperture in the ordinary cross-strap through which the thong of the tongue may be passed on its way to the buckle.

The spring of a forked-tongue truss may also be made a little stronger than that of an ordinary instrument, and its pad made fuller and softer.

A double forked-tongue truss is the form most suitable for a double scrotal hernia, which is not efficiently retained by a double ordinary inguinal truss. The size for such an instrument should be one inch in excess of the actual measure-

ment, and it is important to remember that, as in a single truss, the iron of the pads must not pass into the tail portion, and that the under-straps are to be fastened to fixed hooks just behind the shoulders of the truss.

In some cases, particularly in feeble old men, the gluteal muscles are very poorly developed, and the buttocks therefore very flat. In such there is a great tendency for the double truss to slip down behind, and thus to cause much inconvenience and distress. This can be remedied to a considerable degree by the patient wearing a lifting strap

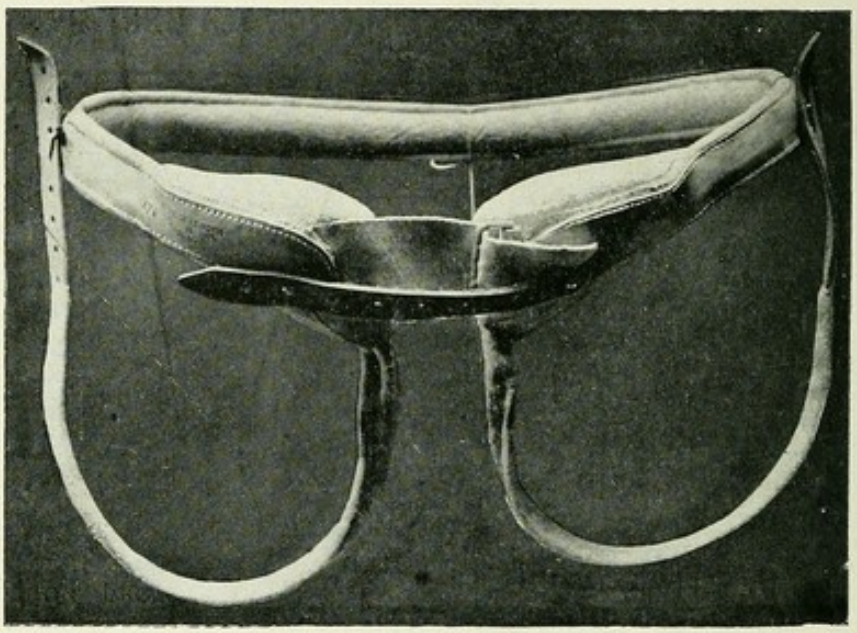

FIG. 45.—A DOUBLE FORKED-TONGUE TRUSS.

(Fig. 49), which passes over the shoulders in a similar manner to braces. It is fastened to the middle of the truss behind, and in front on either side just external to the pad.

The Treatment of Reducible Inguinal Hernia in Adult Females.

Most inguinal herniæ in females are incomplete, and therefore an ordinary inguinal truss is efficient. In some instances of labial herniæ a rat-tail truss is requisite. Both these trusses are adjusted in a similar manner as in the male subject.

Operative treatment of reducible inguinal herniæ in adult females is dealt with on p. 124.

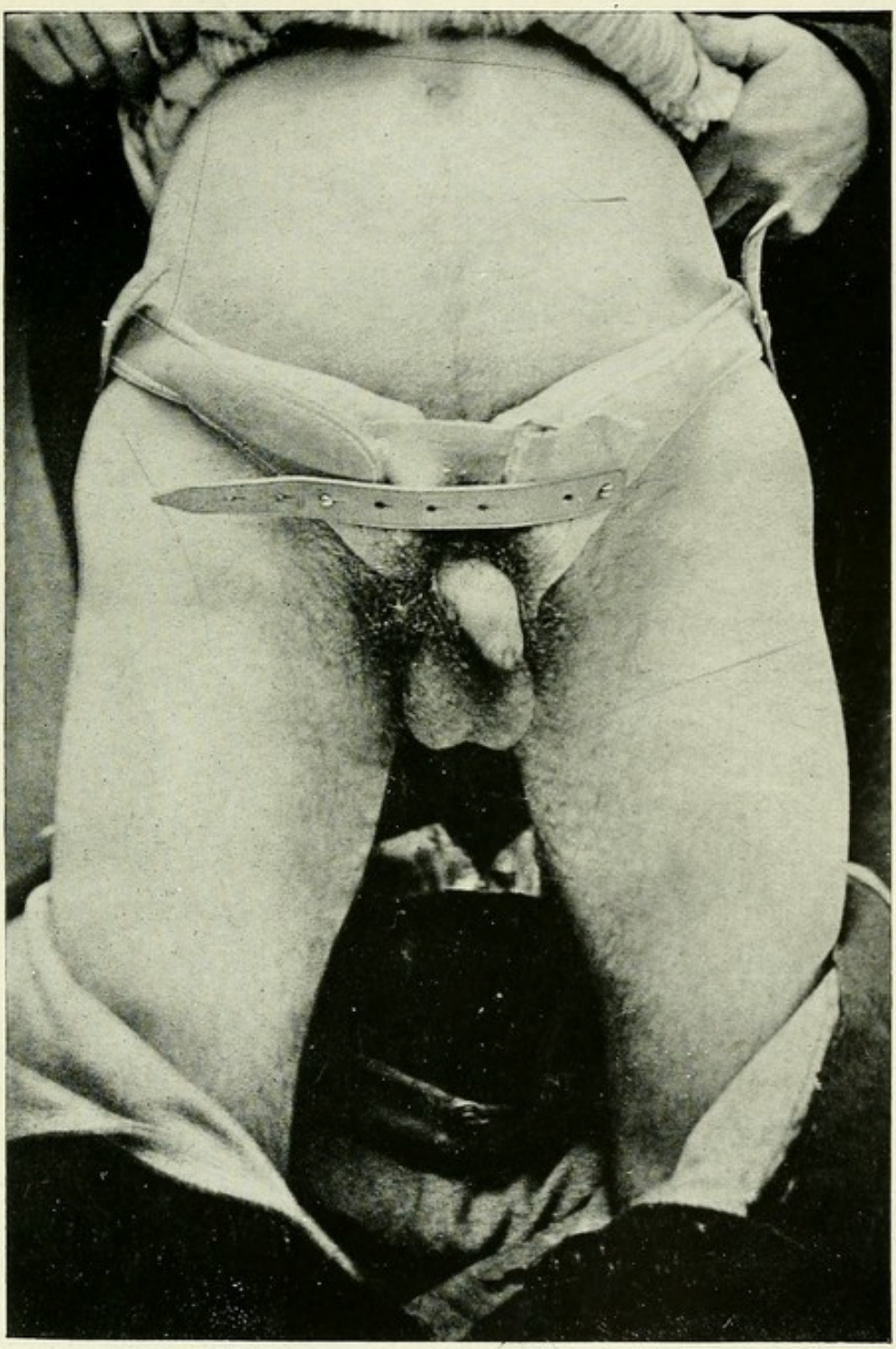

FIG. 46.—A DOUBLE FORKED-TONGUE TRUSS ADJUSTED.

To face p. 114.

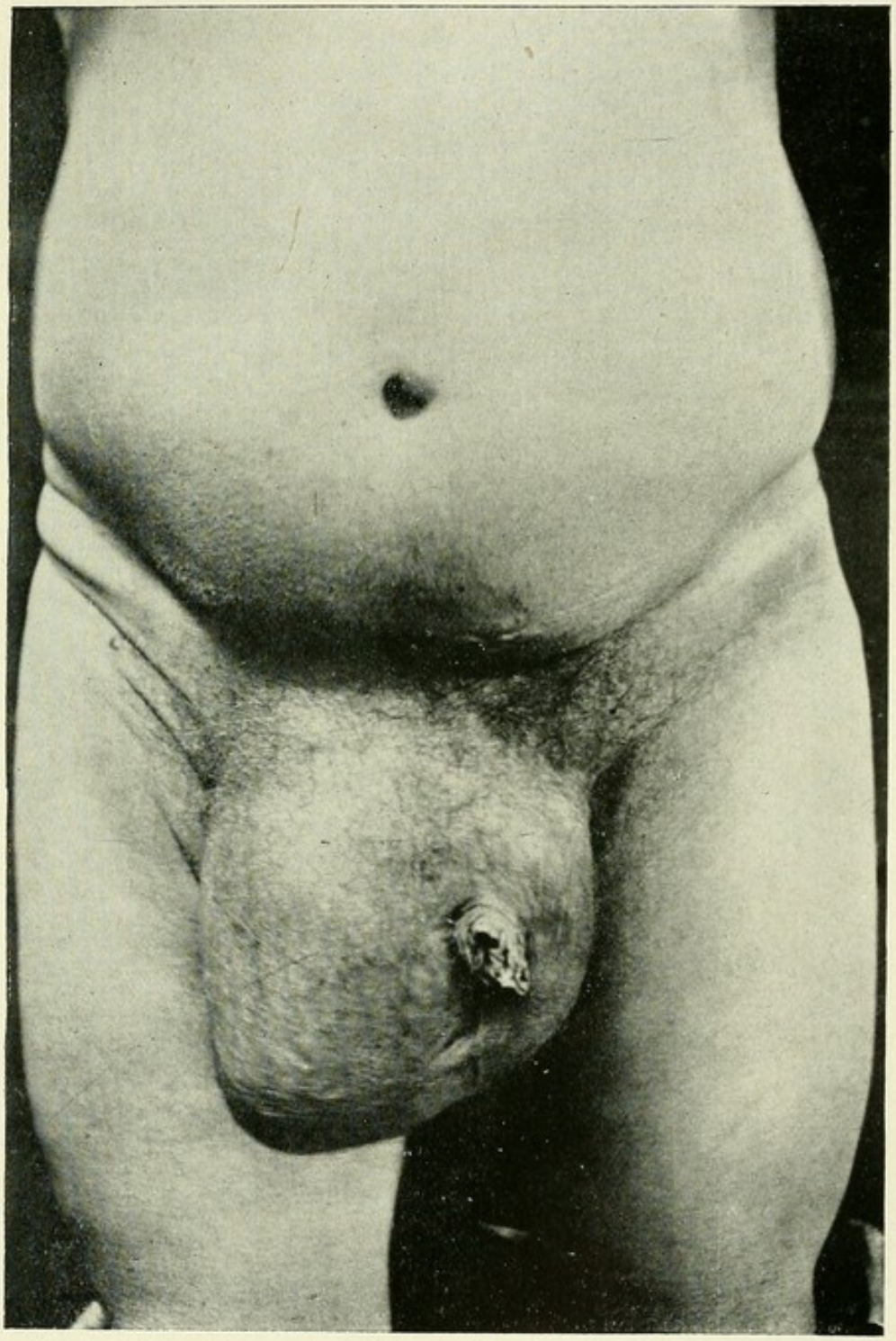

FIG. 47.—A RIGHT SCROTAL HERNIA, WITH A LEFT BUBONOCELE.

To face p. 114.—I.

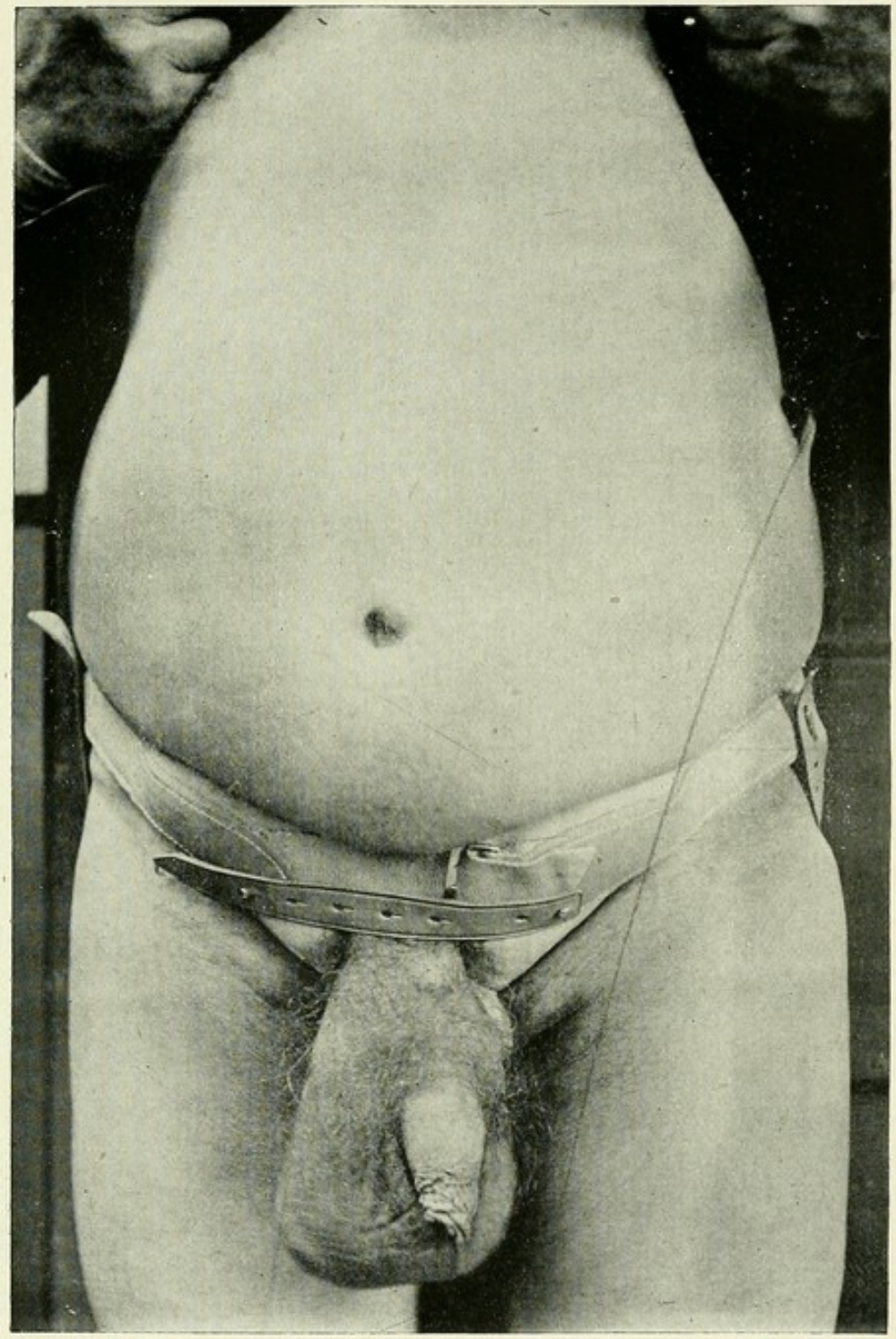

FIG. 48.—A DOUBLE FORKED-TONGUE TRUSS ADJUSTED TO SAME CASE.

To face p. 114.—II.

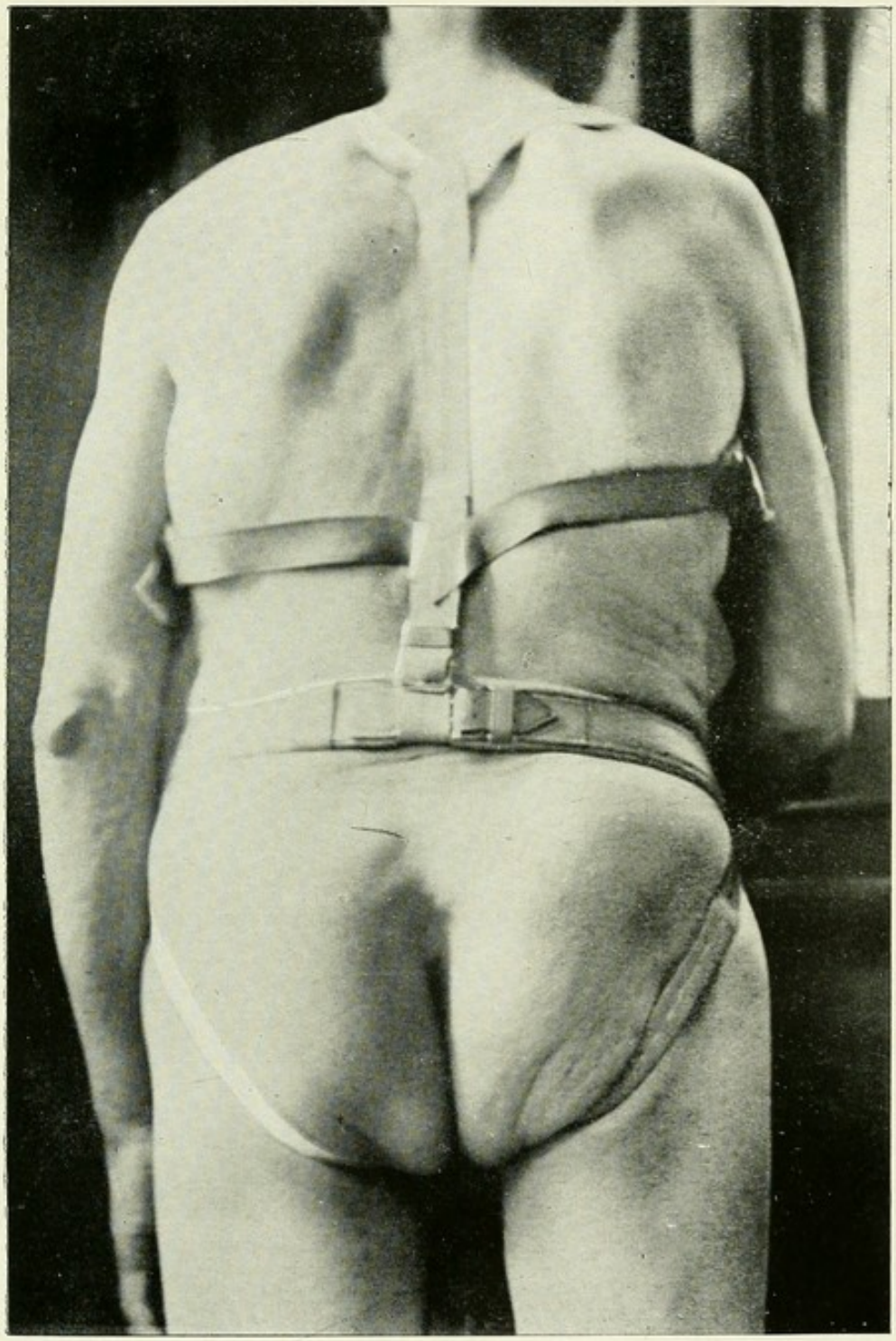

FIG. 49.—A LIFTING-STRAP ADJUSTED. (*See also Fig.* 53.)

To face p. 114.—III.

The Treatment of Reducible Inguinal Hernia associated with Reducible Femoral Hernia.

When an inguinal hernia occurs with a femoral, they are usually on the opposite sides of the body. If both protrusions are small and easily retained a double truss should be ordered, the pad on the one side being inguinal and that on the other being femoral in shape. The measurement for such a truss is similar to that for a double inguinal truss, and the adjustment is the same, with the observance of the correct disposition of the two pads.

If the inguinal hernia is one that requires a scrotal truss, then a forked-tongue should be on the inguinal side, and the

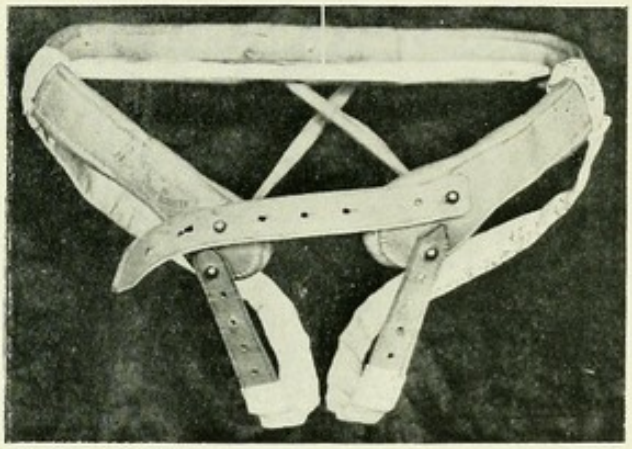

FIG. 50.—A TRUSS WITH AN ORDINARY FEMORAL PAD ON RIGHT, TOGETHER WITH AN ORDINARY INGUINAL PAD ON LEFT.

cross-strap of this must fasten to a buckle at the shoulder of the opposite side, so that it may not drag the femoral pad up, or fail itself to keep the inguinal pad in position. But should the femoral hernia be one that necessitates the addition of an inguinal fulness, then a cross-strap from this can fasten to a buckle attached to the forked-tongue.

A thigh-belt can be added to the femoral pad without any detriment to the inguinal, and it is often a useful addition, even when the femoral protrusion is not very severe.

In those instances in which a femoral hernia exists on the same side as an inguinal, it is necessary to order a truss with a femoral pad and thigh-belt, together with an inguinal fulness over (Fig. 54).

IRREDUCIBLE INGUINAL HERNIA.

The treatment by trusses of this form of inguinal hernia falls under three headings, in the same way as the treatment of reducible inguinal herniæ:

(*a*) The treatment in childhood.
(*b*) The treatment in adult males.
(*c*) The treatment in adult females.

The Treatment of Irreducible Inguinal Hernia in Childhood.

It is decidedly rare for an inguinal hernia in either sex to become irreducible during infancy, and it is not a frequent occurrence at any period before puberty. The apparent reason

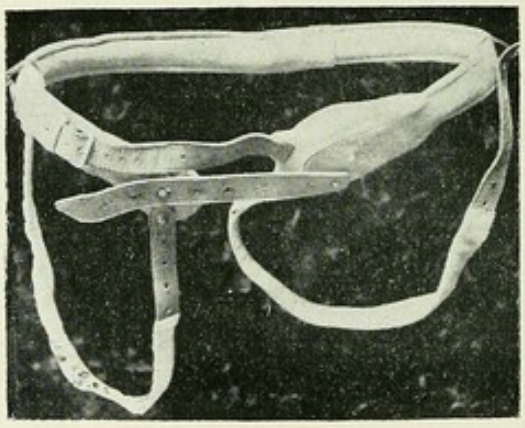

FIG. 52.—A TRUSS WITH AN ORDINARY FEMORAL PAD ON THE RIGHT AND A FORKED-TONGUE ON THE LEFT.

for this fact is that the omentum is but rarely found to any extent in the sac of a hernia in early life, and that there is but little tendency for the intestine to become adherent at such a tender age.

If irreducibility has occurred before eighteen months of age, it is probably best to advise that the protrusion should be treated by operation; but although this method of dealing with an irreducible inguinal hernia may also be considered by many to be the safest to adopt even in an older child, yet in the male subject at least the application of a hinged-cup truss, to be afterwards described, is an effective way of bringing about reduction, and that particularly if there is

FIG. 51.—A TRUSS HAVING AN ORDINARY FEMORAL PAD ON THE RIGHT AND AN ORDINARY INGUINAL PAD ON THE LEFT ADJUSTED.

To face p. 116.

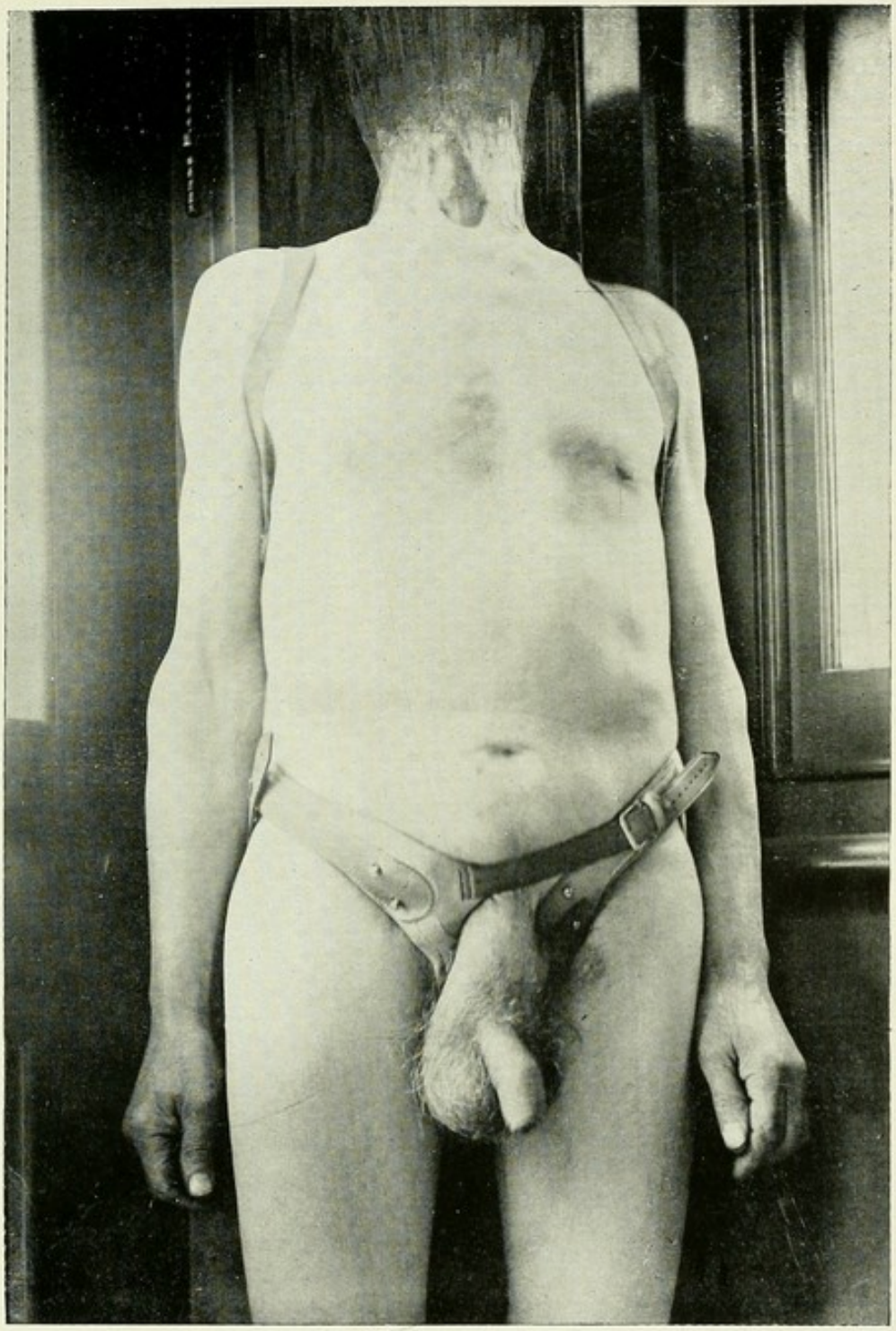

FIG. 53.—A TRUSS WITH AN ORDINARY FEMORAL PAD ON THE LEFT AND A FORKED-TONGUE ON THE RIGHT, ADJUSTED.

[This figure also shows a lifting-strap passing over the shoulders.]

To face p. 116.

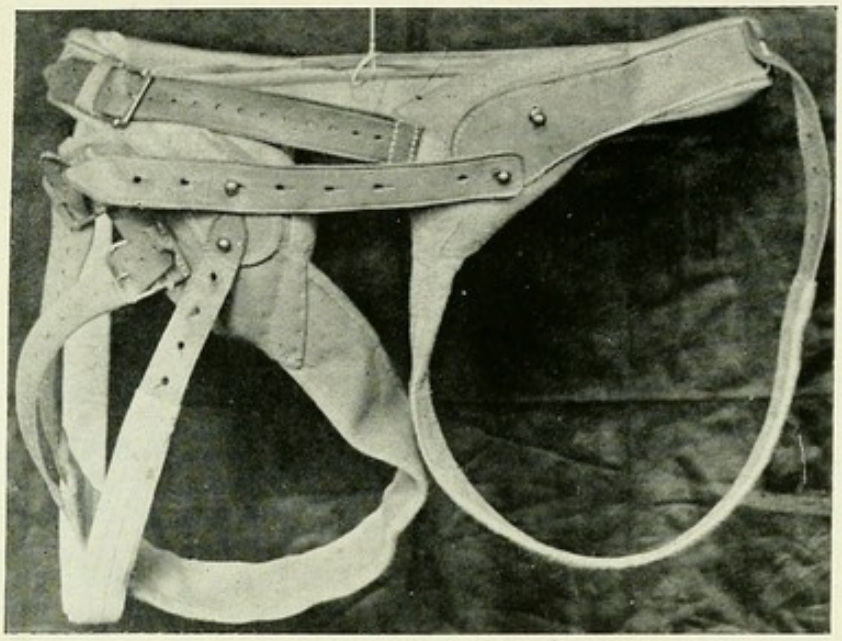

FIG. 54.—A RIGHT FEMORAL WITH THIGH-BELT AND A LEFT FORKED TONGUE TRUSS.

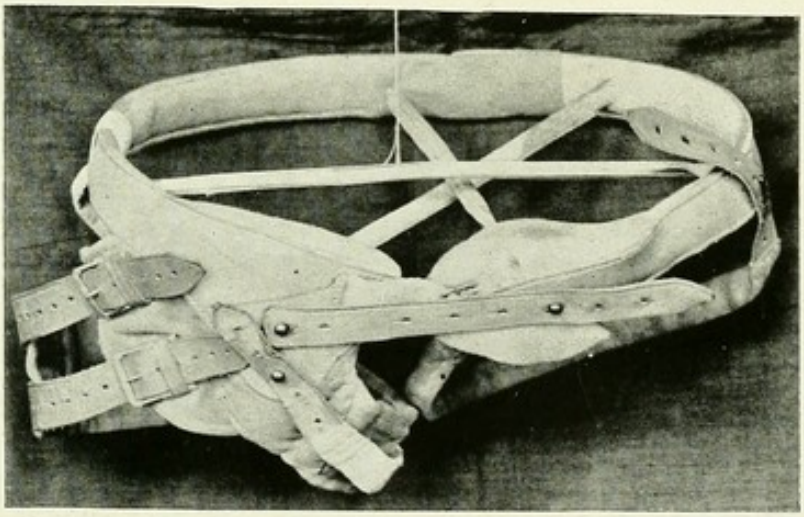

FIG. 56.—A TRUSS WITH A RIGHT FEMORAL PAD, WITH A THIGH-BELT AND INGUINAL FULNESS, TOGETHER WITH A LEFT FORKED-TONGUE.

To face p. 116.—II.

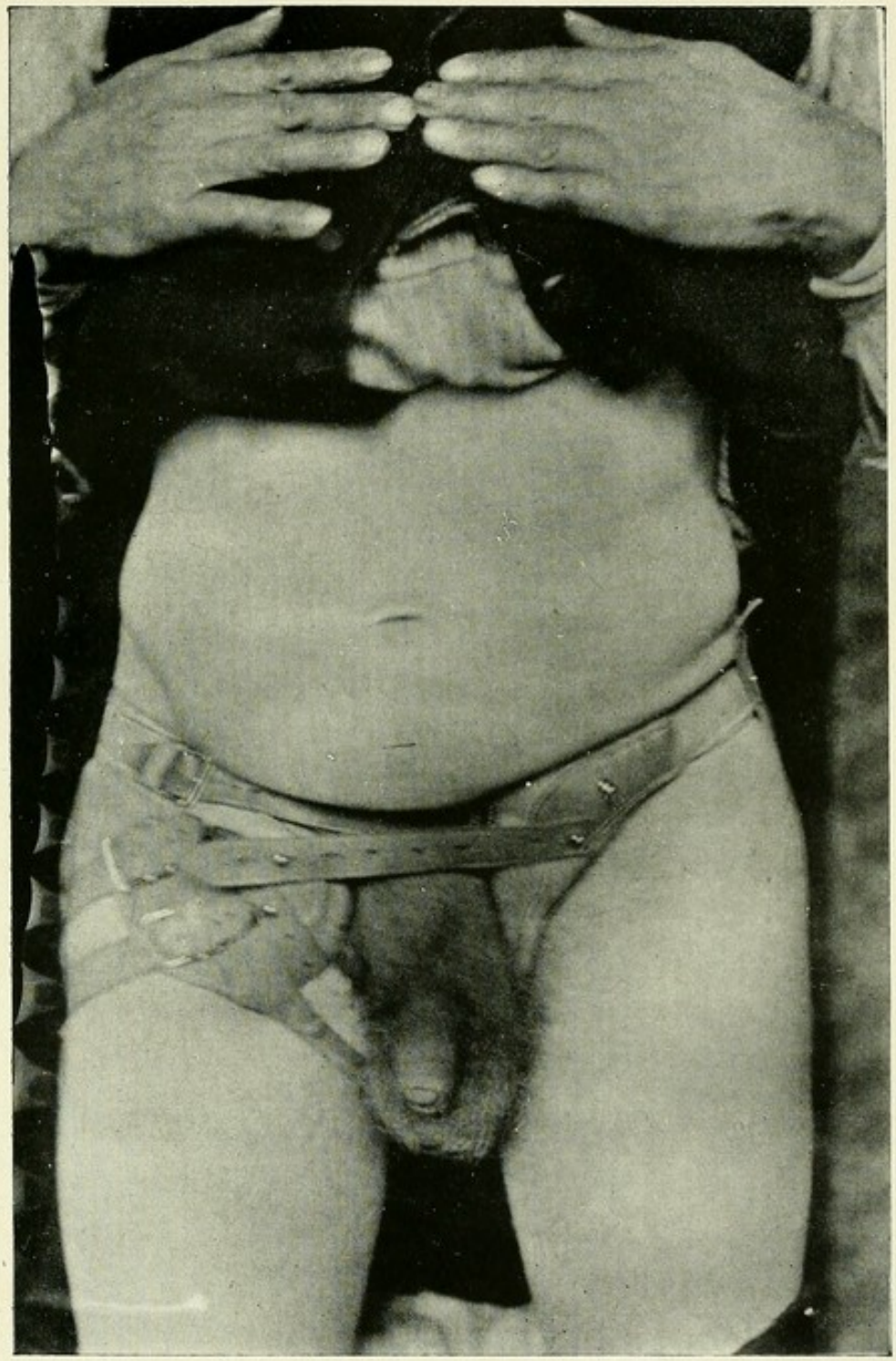

FIG. 55.—A RIGHT FEMORAL WITH THIGH-BELT AND A LEFT FORKED-TONGUE TRUSS ADJUSTED.

To face p. 116.—III.

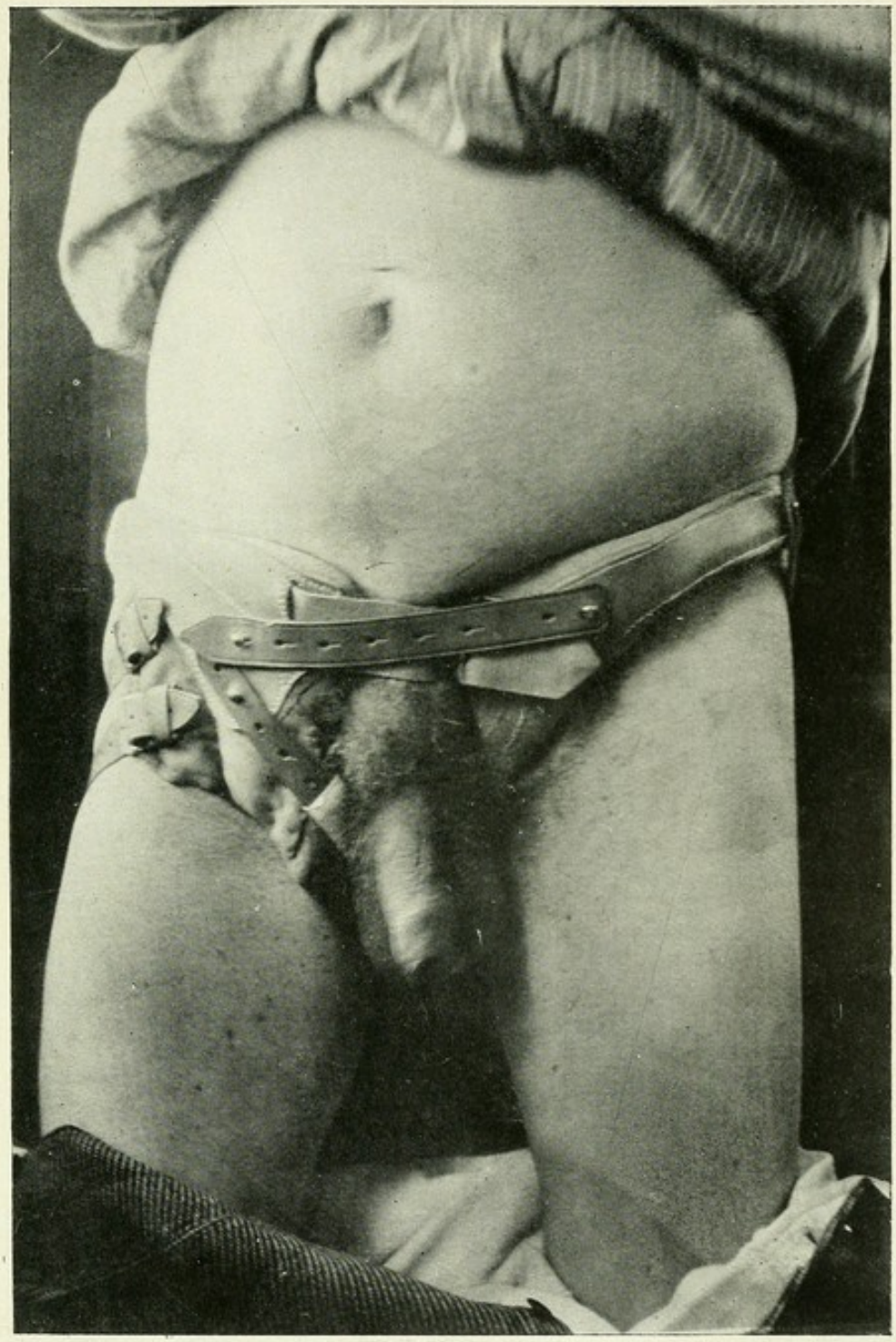

FIG. 57.—A TRUSS WITH A RIGHT FEMORAL PAD, WITH A THIGH-BELT AND INGUINAL FULNESS, TOGETHER WITH A LEFT FORKED-TONGUE, ADJUSTED.

To face p. 116.—IV.

some amount of fluid in the sac as well as the viscera. In a child with lung trouble, or any other contra-indication to operative measures, this form of apparatus is to be strongly advocated. When the hernia has been reduced, then the treatment resolves itself into that of a reducible hernia.

The Treatment of Irreducible Inguinal Hernia in Adult Males.

Continuous upward and outward pressure on the scrotal hernia of an adult will, in more than half the instances where it is irreducible, lead to the reduction of its contents sooner or later; for, as has already been emphasized, the condition of irreducibility is generally one of only temporary existence, and will give way to proper treatment.

It has been urged that pressure applied to an irreducible hernia is very liable to produce irritation of the contents and the sac-wall, and thus lead to inflammation and complications other than those of mere non-reduction. Such untoward effects, however, do not in reality occur if the pressure is of the right amount and is employed in a correct manner. To do its work this pressure must be continuous, and must be in a direction that is likely to tend to bring about the return of the imprisoned viscera into the abdominal cavity. Much good may at the same time be obtained if, while the pressure is being exerted, other means which facilitate the reduction are employed. These have been fully dealt with on p. 32.

The variety of truss that is most suitable for the treatment of an irreducible scrotal hernia is that which is known by the title of '**hinged-cup.**' This consists of an ordinary inguinal pad, with the addition of the forked-tongue piece, and the attachment by means of a horizontal hinge at the lower border of the pad of a triangular open 'cup' of metal covered by chamois leather. From the inferior angle of this metal-frame there pass two straps, which act as perineal bands, and are fastened to movable buckles on the circle of the truss. The upper free angle of the frame also has a strap which passes to a buckle on the cross-strap. The size of the cup should increase with the size of the truss, but it may need enlargement over and above this if the

scrotal swelling is excessive. The cup encloses the scrotum, and therefore the hernia. The penis protrudes over the upper limit of the cup.

It is important that a hinged-cup truss should be of full size, and that the cup itself should not be too large or too cumbersome. The adjustment of this form of truss needs particular care, otherwise it is apt to cause the wearer a

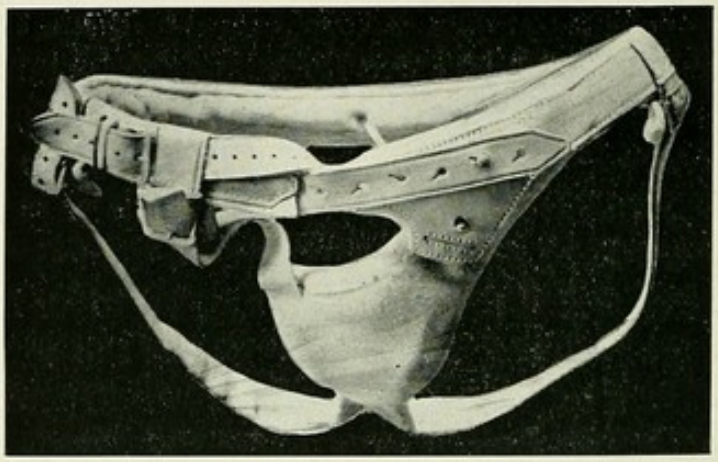

FIG. 58.—A LEFT HINGED-CUP TRUSS.

considerable amount of inconvenience. Its adjusted position is well seen in the accompanying photograph (Fig. 59). It is important to remember that the buckles on the spring of the truss, to which the perineal straps from the cup are fastened, are movable, for the reason that the nearer they are moved towards the shoulder of the truss, the greater is the pull backwards and upwards that they will exert. In this manner the amount of the pressure upon the sac and its contents can be regulated.

The truss has to be worn day and night, and is only to be removed for the purposes of cleanliness. If in warm weather there is any tendency to chafing, it is well for the skin in contact with which the truss comes to be rubbed over with methylated spirit, and then dusted with fine starch-powder. The effect of the constant steady pressure of the truss is to bring about reduction, at the same time preventing the descent of any further portions of viscera.

If the application of a hinged-cup truss, and its being worn without intermission for some six months, fails to

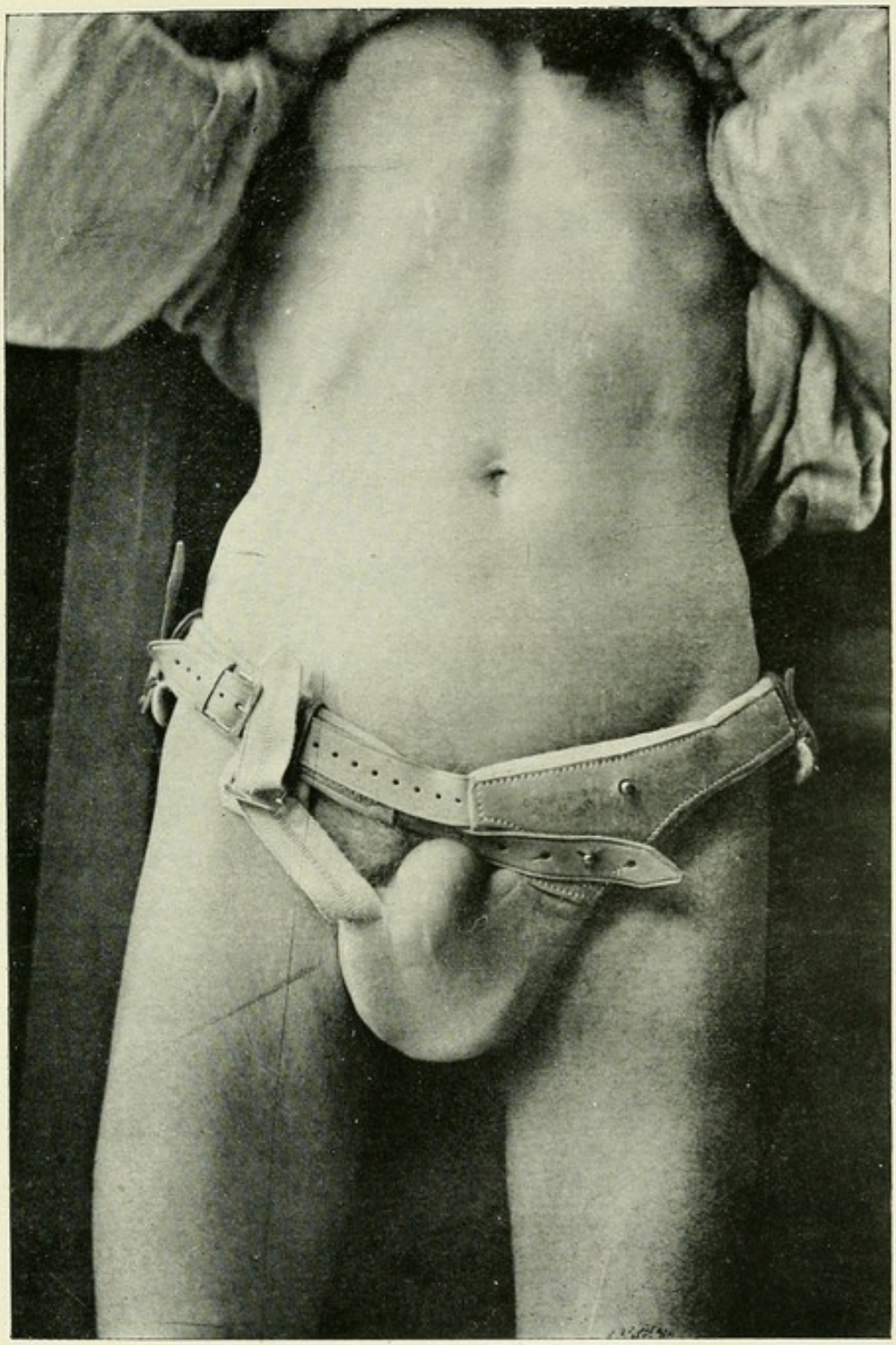

FIG. 59.—A LEFT HINGED-CUP TRUSS ADJUSTED.

To face p. 118.

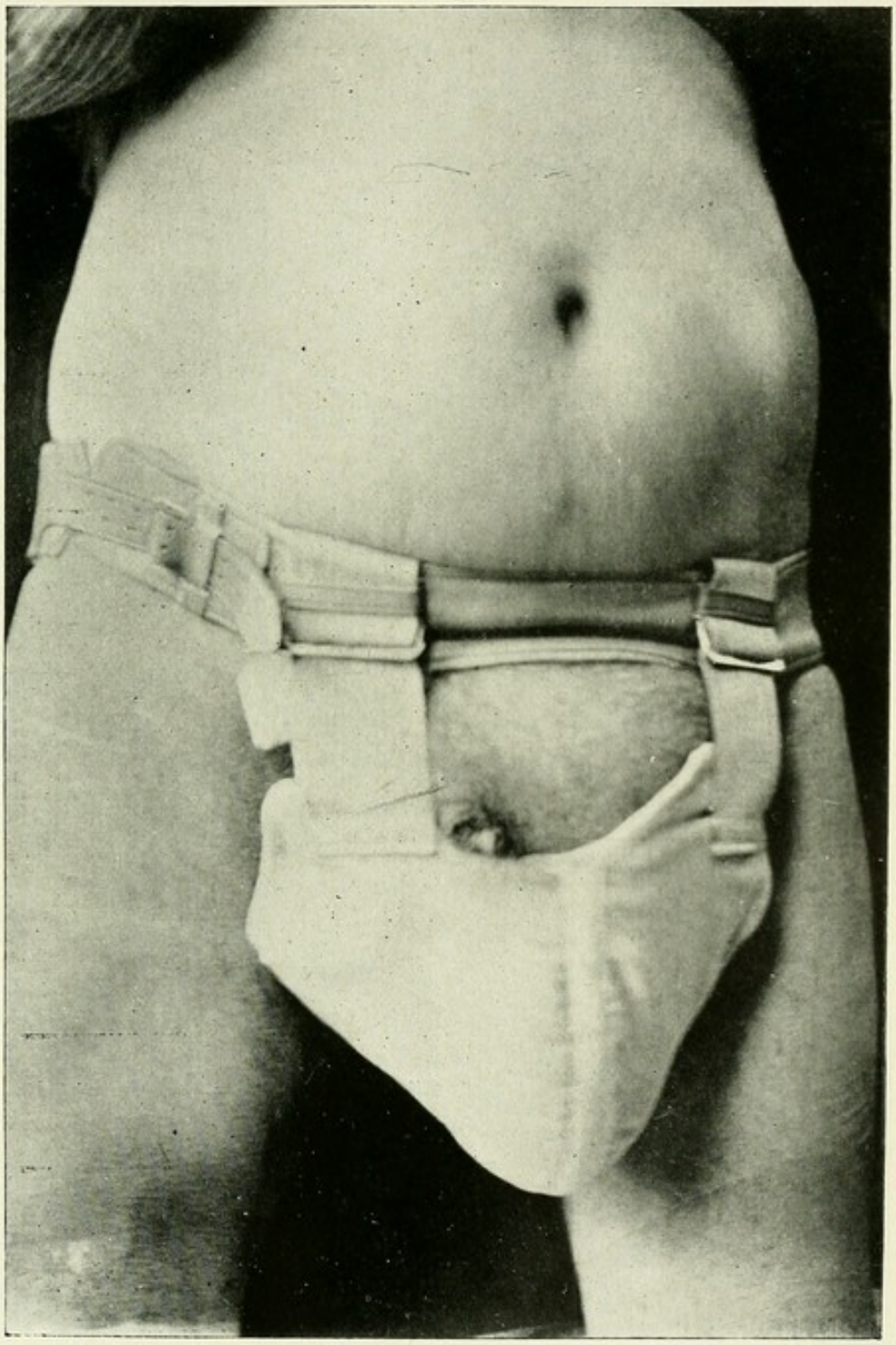

FIG. 60.—A BAG-TRUSS ADJUSTED.

To face p. 118.—I.

cause a return of the contents of the sac into the abdomen, an operation with a view to reduction is to be recommended, if not otherwise contra-indicated. This plan of treatment is dealt with in the next chapter. A double-hinged cup-truss is occasionally needed.

In a few cases the scrotal hernia is so bulky that a hinged-cup truss is not suitable, and the patient's general condition further negatives any operative procedures. In these instances the application of a **bag-truss** is justifiable. This form of apparatus cannot be considered as satisfactory, for it not only has no power to prevent the descent of more viscera into the sac, but it also entirely fails to bring about the return of any that were already prolapsed. It is, in fact, merely a palliative measure of very uncertain value, and should be employed only where all other means have failed.

In ordering a bag-truss it is necessary to determine the girth of the pelvis of the patient, in a manner similar to that employed for an ordinary inguinal truss, and then, having lifted the scrotal swelling, to measure its largest circumference, as well as the length of the line running from the root of the penis across the tumour to the perineum behind. These bag-trusses very quickly wear out, and need to be frequently renewed.

Occasionally a bubonocele becomes irreducible in either sex. Unless there are reasons why it should not be so dealt with, operation is the proper treatment. If, however, operation is out of the question, then the application of a hollow pad inguinal truss is indicated. This is measured for, and adjusted in exactly the same manner as is an ordinary inguinal truss.

The Treatment of Irreducible Inguinal Hernia in Adult Females.

If not otherwise contra-indicated, it is best to submit patients of the female sex who are the subjects of irreducible inguinal herniæ to treatment by operation. If, however, this is out of the question, then a hollow pad inguinal truss will act for an incomplete inguinal protrusion, but it is not

easy to adjust a hinged-cup truss in a woman. A modification of it may be devised, but is hardly ever completely satisfactory.

Treatment of Reducible Inguinal Hernia associated with Irreducible Femoral Hernia.

It is uncommon to find an irreducible inguinal hernia associated with an irreducible femoral, but an irreducible femoral may readily occur with a reducible inguinal. The treatment of such a combination by truss pressure is the same as has already been given in the case of both protrusions being reducible (p. 115), save that the femoral pad will require to be hollow, as is described under irreducible femoral hernia (p. 166).

CHAPTER IX.

INGUINAL HERNIA: ITS TREATMENT BY OPERATION.

THE operative treatment of inguinal hernia may be divided into (1) the radical operation for the cure of non-strangulated inguinal herniæ, and (2) herniotomy for the relief of strangulated inguinal herniæ.

RADICAL OPERATION.

A **Radical Operation** on a hernia has for its primary object the cure of the protrusion. But while this is alike the desire both on the part of the surgeon and of the patient, yet it must be confessed that many cases have even in recent years been operated upon in which no cure has resulted.

It is therefore well at the outset of the discussion of the radical treatment of herniæ to examine into the reasons of such failures.

These may be grouped thus: (1) Unsuitable cases. That is to say, operation has been undertaken on persons who, either on account of individual peculiarity, or because of the nature of their hernia, were such that no chance of cure could really be hoped for. (2) Inadequate operations. In other words, a thoroughly radical operation has not been performed. (3) Sepsis. Deep suppuration generally militates against a permanent success. (4) Recommencement of work of an arduous nature too early after the operation. This is especially the case with hospital patients. (5) The increased intra-abdominal pressure, the result of the return of a considerable mass of intestine or omentum or both, may

act in producing a recurrence of the protrusion. (6) The actual holes made by the needles used in the perforation of the tissues by the sutures may in a few instances be the site at which a weakness may remain, and a hernia develop.

It will thus be seen that there are a number of conditions which may cause a failure in the complete cure of a hernia; but the operation is not to be discarded because the result is not all that could be desired in every case, for even if an absolute cure is not effected, the condition of the patient after the operation, properly performed, is much improved in every way.

It is, however, expedient in cases where a complete cure is a matter of uncertainty—and these are unfortunately all too many—to avoid the use of the expression 'radical cure,' and to use the phrase 'radical operation.' This is that which is almost universally used on the Continent, and it is possibly more advisable to use the sentence 'radical operation with a view to cure' under every circumstance. It is hardly correct to speak of a failure as having been a 'radical cure.' The operation may indeed have been a radical one, but time alone must show whether or not a real cure has resulted. These strictures do not in the least limit the value of the radical operation on a hernia, but rather increase it, for they should make the surgeon select much more carefully the cases in which he may confidently predict a cure, and thus bring the operation into a better repute both with the profession and the public. To attempt to 'radically cure' every case of hernia that presents itself is obviously an error of judgment. It is perhaps fairer to the patient to err on the side of not operating, rather than to cause him to submit to a procedure which, according to the patient's ideas at least, is doomed to be a failure.

One more fact of interest must be mentioned here, and this is that it is not at all uncommon to meet with patients who, having undergone a radical operation for a hernia upon one side of the body, develop a protrusion on the opposite side, with or without a reappearance of the original hernia.

The occurrence of the second protrusion would seem to indicate one of two conditions, either that the patient has a

predisposition to acquire herniæ, or that the closure of one aperture has led to increased abdominal pressure, and thus to a hernia elsewhere.

In dealing with inguinal herniæ the surgeon is not only confronted with a variety of protrusion that is most frequently met with, but one which is probably the most readily and satisfactorily treated by operative measures.

The complete cure of an oblique inguinal hernia may be described thus: The removal of the entire neck of the sac flush with the parietal peritoneum, the obliteration of the natural depression in this layer of the peritoneum at the region of the deep abdominal ring, and the restoration of the inguinal canal. This should result in the obliteration of all localized protrusion on coughing or crying over the site of the deep ring. It must be confessed that such an ideal is not an easy matter to attain.

In tabular form the cases of inguinal herniæ which are likely to give the best results, and for which an **operation** should be **recommended,** are as follows:

Male Subjects.

1. Boys with congenital herniæ in whom a properly fitting steel spring truss, worn day and night for a period of at least three years, has not effected an obvious cure.
2. Young adults in whom an accurately adjusted truss of a suitable form fails to retain a reducible hernia, particularly if such is scrotal, or of the congenital variety.
3. Young adults in whom a truss is inefficient owing to a portion of the contents of the sac, especially omentum, being irreducible.
4. Young adults who are the subjects of a partially descended testis, which is either very imperfectly developed, or gives rise to much discomfort.
5. Adults who are desirous of entering the navy, army, post-office, or other public service, or who on account of the hernia are not eligible for the benefits of life assurance or of a club, or those who

are about to proceed to spheres where they will be far removed from medical skill.

6. Males in whom strangulation has occurred, or is actually present.

Female Subjects.

1. Girls in whom a properly fitting steel spring truss, worn day and night for at least three years, has failed to bring about an obvious cure of the protrusion.
2. Young adults in whom an accurately adjusted truss fails to retain a reducible hernia.
3. Young adults in whom a truss is inefficient owing to a portion of the contents of the sac being irreducible.
4. Young adults in whom there is a protrusion of the ovary.
5. Females in whom strangulation has occurred, or in whom it is actually in existence.

In all the above cases it is necessary that the general health of the patient should be such as would warrant the undergoing an operation of the nature required for his or her hernia.

Cases unsuited for operation will be found in those whose abdominal walls are fat, flaccid, or bulging, particularly in the inguinal regions in the manner alluded to on p. 14, in those past middle age, especially with over-full abdomens, and in those who are the subjects of any visceral disorder, particularly lung disease.

Undoubtedly the most favourable instances for operation are young adult males and females with congenital inguinal herniæ. In the latter there is every prospect of a cure, for the canal can be completely closed, since there is no need for any passage to be maintained as in the male.

The methods of operating that may be adopted in the various forms of inguinal herniæ are many, some of them being extremely simple, and others equally complicated. Again, one is suitable for one case, and another for a totally different one. It would be out of place and not needful to

even allude to all the operations that have from time to time been devised and have had their advocates, but it is essential that the fundamental principles involved should be followed out if success is to be achieved.

Asepsis is the initial object to be attained, then the proper performance of the removal of the neck of the sac, with the return of the contents, and the subsequent closure as far as possible of the hernial apertures.

1. Preparation of the Patient.

The cleansing of the patient's skin in the area of the operation is one of the most important details in the successful treatment of a hernia by operation, not only as regards the permanent result, but also in reference to the length of the convalescence. The inguinal region is a very septic part of the body. It is probable that it is impossible in a short space of time to render the skin, both its surface and its depths, truly aseptic—that is, devoid of micro-organisms of any kind—but it can be brought into such a condition that no bacteria which are harmful remain.

The surface of the integument is not very difficult to render surgically clean, but it is the glands in its depth that it is not easy to cleanse. It is therefore much more satisfactory to allow, if possible, a certain length of time to elapse before an operation is undertaken, so that these glands may secrete and bring their septic contents to the skin surface. This period should not be less than forty-eight hours. The plan to be adopted is this: Supposing that the operation is to be performed on a Wednesday morning at nine o'clock, the patient should take a hot bath on the Monday morning early. This should be immediately followed by the first cleansing of the skin of the operation area. Shaving the whole of the hair of the pubes in the adult, and a very thorough scrubbing with soap and water, is to be done. The soap is then rinsed off with water which has been boiled, and the parts rubbed over with ether or turpentine. If the latter is used, the excess should be washed away with sterile water. This having been finished, the skin of the operation region is to be treated with a solution of 1 in 1,000

biniodide of mercury, and directly afterwards covered with a dressing of the double cyanide of mercury and zinc gauze. This dressing must be securely fastened and left in position until the second cleansing is carried out. There is in most cases no reason why the patient should not be allowed up during the rest of the day, though in some a rest of a day or two in bed is advisable previous to the operation.

On the Tuesday morning an aperient should be administered, so that a free action of the bowels may be obtained in the daytime, and thus the patient will not be disturbed in the night, an event which is so likely to occur if the laxative is given on the evening before the operation day.

The process of cleansing above described is to be repeated as on the previous occasion, great care being taken that the dressing is carefully applied so that it will not alter its position.

On Wednesday morning, about an hour before the operation, the patient should be given an enema to clear out the lower bowel, and this is particularly desirable if the laxative has not acted freely.

On the operation table, and immediately previous to the operation, the dressings are to be removed, and the area again thoroughly washed with an antiseptic solution. The external genitals in both sexes should be completely covered with antiseptic gauze, and a large pad of the same material may with advantage be placed between the upper part of the thighs, to absorb all the moisture that may reach that region.

These details are perhaps such as may be considered out of place in a work of this nature, but the inguinal region is one that is more prone to be the seat of failure in asepsis than almost any other part of the body, the axilla possibly excepted, and since the success of the radical operation is to a great extent dependent upon primary union in the deeper parts of the wound, the preparation of the patient is of vital importance. Many would advocate the use of stronger antiseptics, but personal experience has proved that the method of preparation as here described is a most effective one, and without many of the disadvantages that are often associated

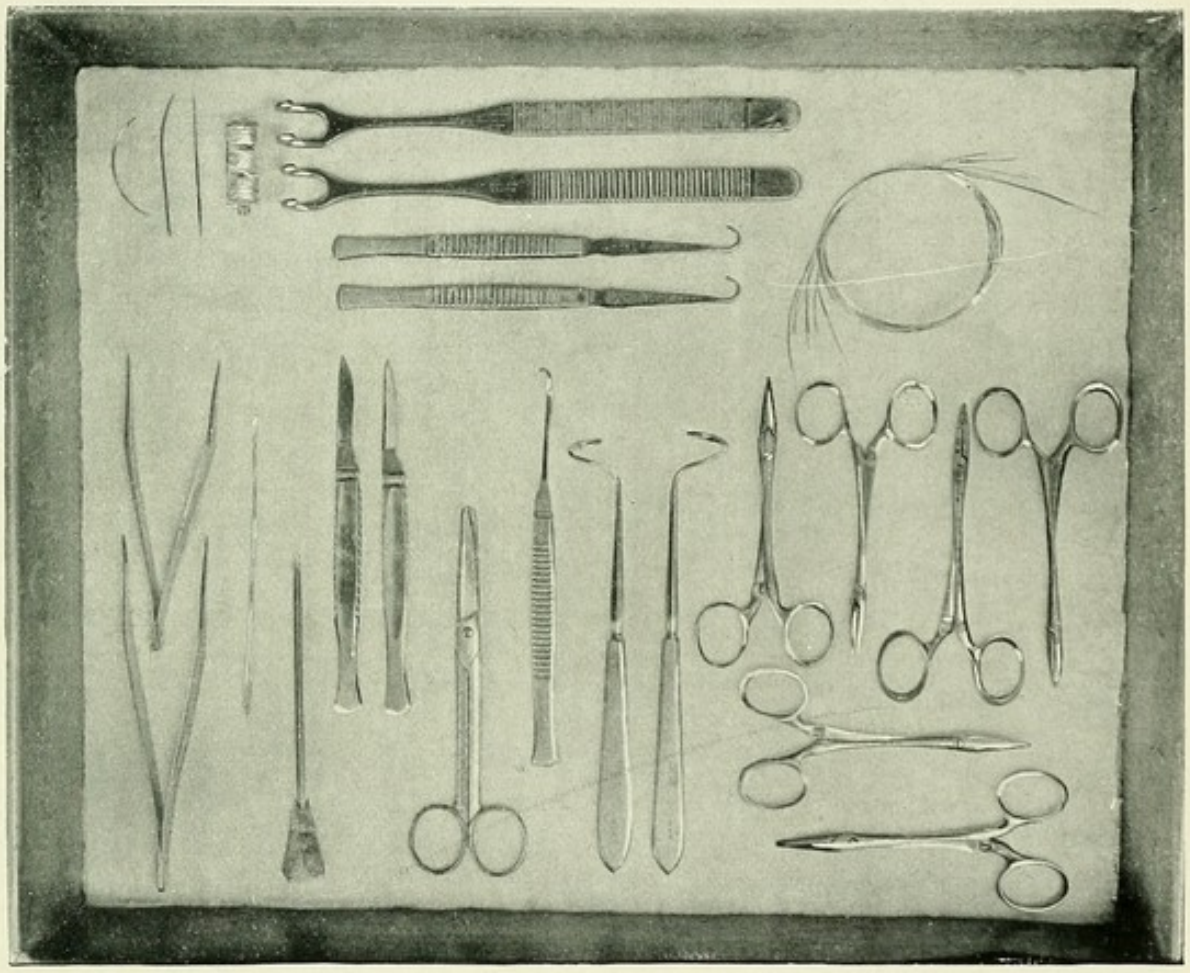

FIG. 61 —THE INSTRUMENTS REQUIRED FOR A RADICAL OPERATION UPON A HERNIA.

To face p. 126.

with other modes of cleansing. A strong antiseptic solution is liable to cause considerable irritation of the skin without in any way producing a greater certainty of asepsis.

2. The Instruments Required.

The sterilization of the instruments, etc., used, and the preparation of the surgeon's hands and those of his assistants, are precisely the same as that for an operation elsewhere than in the inguinal region.

The **Instruments** that are required for the performance of a radical operation upon an inguinal hernia are as follows: Two pairs of dissecting forceps; at least six pairs of pressure forceps; a director; a medium-sized scalpel; a pair of blunt-pointed scissors with the ends not too broad or too rounded; a pair of blunt hook retractors; a pair of hernia needles, one for each side of the body—these should not be too blunt nor too heavy in their make—an aneurism needle; thoroughly sterile silk, of the twist pattern, fine for any vessels that may require ligature, and coarser for tying omentum and for suturing the layers of the abdominal wall by buried sutures; four straight needles about 1½ inches long, two half curved and two fully curved of the same size; and a hank of sterilized silkworm gut.

Ordinary sponges may be dispensed with, and swabs of absorbent cotton-wool which has been soaked a considerable time in an antiseptic solution used in their place.

The instruments should all be made wholly of metal, and should be boiled just before use, and if there is need for them to be conveyed for some distance, they should be wrapped in carbolic gauze after they are taken from the water in which they have been boiled, and the gauze containing them should be placed in an air-tight tin box.

The silk and silkworm gut may be rendered sterile by boiling for at least half an hour in plain water, and then by preserving them in a solution of one part of carbolic acid in twenty parts of water.

3. The Performance of the Operation.

The actual **operation** is best performed about nine o'clock in the morning, for then the best light is available, and the

patient need not be kept in suspense for a long period after the night's rest, and is therefore mentally in a condition in which he will stand the operation better. No food in the majority of cases is needed before the anæsthetic if it is administered at this early hour, but if the operation is deferred till later in the day, it is advisable that a small amount of liquid food should be allowed, not less than four hours previous to the administration of the anæsthetic.

The choice of the particular **anæsthetic** to be employed is of some importance. If there is the least tendency to any form of lung mischief, ether is to be avoided, for if it is used there is a great liability for an irritation of the air-passages to follow.

Chloroform is often by far the most satisfactory of reagents to employ, notwithstanding its somewhat greater risk. Possibly in a few instances nitrous oxide with oxygen may be suitable.

The patient having been placed under the influence of the anæsthetic, and upon the operating table, the protective antiseptic dressing, as has been previously said, is to be removed, and the parts again subjected to a cleansing with turpentine and an antiseptic solution. Care must be taken to insure against any possibility of infection from the external genitals. The region around the operation area is to be protected with towels either sterilized by hot air, or wrung out of an antiseptic solution.

The instruments, etc., are placed in a tray and completely covered with a warm solution of 1 in 40 carbolic acid. It is advisable that only the smallest surface of skin that is absolutely necessary should remain exposed, and since the incision is to be made well away from the scrotum or the labium, this area need not be at all extensive. The exact site of the **skin incision** will differ somewhat in different cases. In an ordinary oblique inguinal hernia, particularly a congenital one, where there has been no dragging of the deep ring downwards and inwards so that it comes to lie behind the superficial one, the incision is to be made, in either sex, through the skin and subcutaneous tissues in a line which is a finger's breadth above Poupart's ligament and parallel with

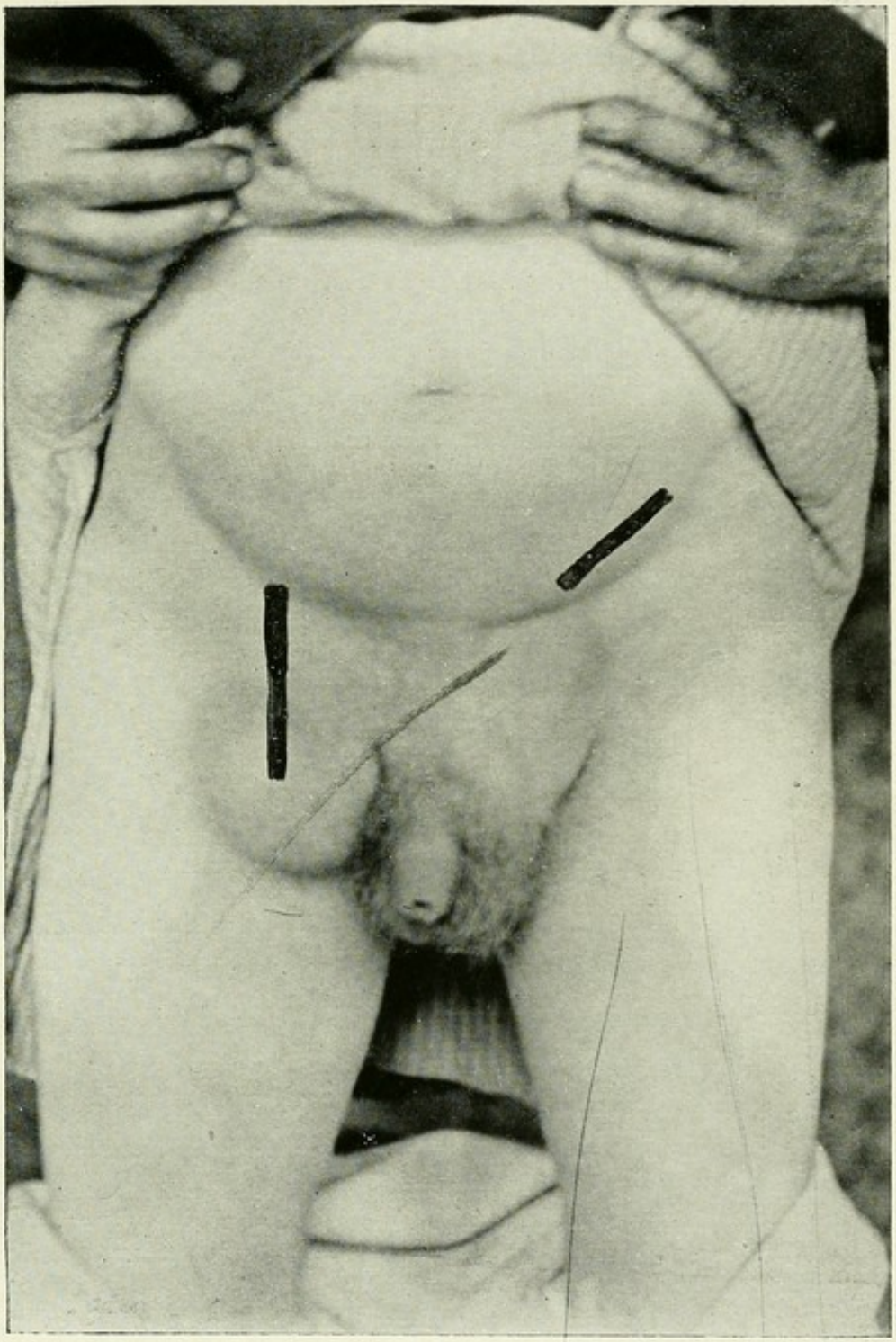

FIG. 62.—LINES OF INCISIONS FOR OPERATIONS UPON A LEFT OBLIQUE INGUINAL HERNIA, AND UPON A RIGHT FEMORAL HERNIA.

To face p. 128.

its inner half. Thus it will be seen that this incision is not longer in the majority of cases than about 2 to 2½ inches. Sometimes where much omentum, in a large scrotal sac, has to be dealt with, it will be found necessary to prolong the incision into the upper part of the scrotum.

In the division of the skin and two layers of superficial fascia down to the anterior surface of the external oblique aponeurosis, some small bloodvessels may be cut. Usually the superficial epigastric and sometimes the superficial external pudic arteries are severed. All the bleeding points should at once be seized with pressure forceps, as it is important to prevent any infiltration of the loose areolar tissue with blood.

The aponeurosis of the external oblique muscle is now freely exposed, and on it can be seen the intercolumnar fibres and the external spermatic fascia proceeding from the edges of the superficial abdominal ring. The direction of the main fibres of the external oblique being downwards and inwards, they lie in the line of the incision. In order to open the inguinal canal these fibres have to be separated, and it is preferable that this separation should be made at a somewhat higher level than the line of the skin incision. The division of the aponeurotic fibres should be continued the whole length of the inguinal canal and into the superficial ring. Each edge of the incision thus made should be taken up at one point by a pair of pressure forceps, so that the margin may be subsequently easily recognised and dealt with.

There will now be exposed, lying in the inguinal canal, the ilio-inguinal nerve and the neck of the hernial sac, the latter covered by the cremasteric and infundibuliform fasciæ, the spermatic cord in the great majority of instances having a posterior relation to the sac. At this stage it is well to attempt to reduce any contents that may still be within the sac.

By a careful dissection the neck of the sac is separated from the tissues surrounding it, great care being exercised not to damage those which lie behind, particularly the spermatic cord in the male.

In dealing with the congenital inguinal herniæ of young

subjects, some considerable difficulty may be experienced in this separation of the neck of the sac from the cord, and there is a real danger of the vas being injured. The neck of the sac has to be thoroughly freed right up to the site of the deep ring, which position is clearly indicated by the definite collection of extra-peritoneal fatty tissue found at this spot. In some cases it is necessary to draw the fibres of the internal oblique and transversalis muscles upwards and outwards so as to clearly expose the region of the deep ring. No division of these fibres is ever necessary, and to cut them through is a serious mistake, and one which will most certainly militate against the success of the operation.

The neck of the sac has now to be opened in order to ascertain without any possible doubt that it is the sac itself, and to make sure that every portion of the contents have been reduced. If the case is one of a completely or partially irreducible hernia, caution must be taken in opening the sac so that no damage may be done to its contents.

Generally the irreducible portion consists of **omentum**, which may be adherent in various degrees. When there is but a small amount adherent, or if the adhesion is only a single one, it is usually possible to draw the strip of omentum up from the scrotal portion of the sac into the inguinal wound, and there to deal with it. Any adhesion must be carefully separated, or if this cannot be accomplished without some risk, a ligature may be placed around the omental tissue close to the adherent part, and this cut through. After the omentum has been freed below, it should be securely ligatured just below the site of the deep ring, and the excess cut away, and the stump returned within the abdominal cavity. The tying of the omentum is an important step in the operation, for some disasters have arisen from want of care in this proceeding.

When there is a narrow portion only that has to be removed, it is sufficient to transfix it, cut the loop of the ligature, interlock the two lengths, and finally to tie one on either side, and carry one round the whole stump, and again tie. Before the ligated portion is cut away, it is advisable to place a pair of pressure forceps close to the ligature, but

on the distal side, so that a firm hold may be retained on the omental stump, and thus any failure in the constriction that it has been subjected to can be remedied ere the stump retracts within the abdomen.

On the other hand, a large mass of omentum will require a somewhat different treatment, and it is a matter of some moment that its removal should be carried out with caution, otherwise serious hæmorrhage may follow. As far as possible the mass should be unravelled, and then by a series of interlocked ligatures the whole may be secured with medium-sized silk. A blunt aneurism or hernia needle, having a large eye, is passed through the omentum, about three-

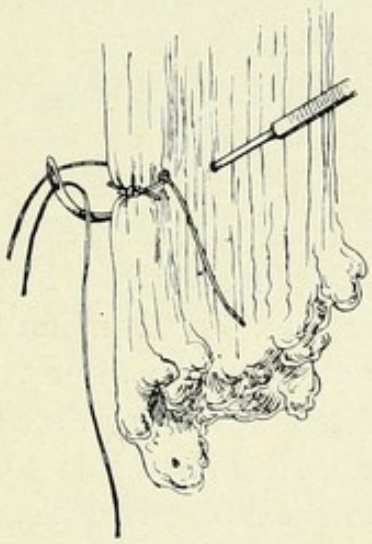

FIG. 63.—METHOD OF LIGATURING OMENTUM.

quarters of an inch from its edge, care being taken to avoid a vein. Two pieces of silk, each about 10 inches long, are threaded into the protruding eye of the needle, and the needle withdrawn and unthreaded.

The two ligatures are now interlaced, and one tied tightly round the omental border, and the ends of this cut short. The needle is then again thrust through the omentum at about 1 inch further on, and the eye threaded with one end of the untied ligature already in position, together with one end of a fresh length of silk, and withdrawn. The needle is then unthreaded and the second ligature interlocked with the third, its two ends firmly tied and cut short. The same process should be repeated until the opposite edge of the

omentum is reached. When all the ligatures are secured, at least two pairs of pressure-forceps should be applied on the distal side, and the sheet of omentum cut away beyond them. Provided that all the vessels are efficiently controlled, the stump of the omentum is to be gently insinuated back into the abdominal cavity through the hernial opening. It may, in rare cases, be necessary to enlarge this somewhat, in order to give enough room for the return of a bulky stump.

Where it is impossible to unravel thickened and adherent omentum, it is right to transfix it, and to tie a considerable mass with very stout silk, but the proceeding is always a somewhat dangerous one. In other instances, again, the omental adhesions may be so firm that it is almost impossible to separate them from about the neck of the sac without doing a considerable amount of damage to the surrounding tissues. In such cases it may be advisable to merely ligature the omentum at the site of the deep ring, and cut the protruding mass away, leaving the stump fixed in the mouth of the sac. If from any cause hæmorrhage occurs from an omental stump after its return within the abdomen, it is absolutely necessary that the vessels are again exposed and secured. Nothing leads to more fatal bleeding than uncontrolled omental bloodvessels. Possibly the stump may be brought down again through the hernial aperture; but if it is not easily reached, it is preferable to make a fresh incision higher up on the abdominal wall, so as to expose the retracted and bleeding omentum.

If **intestine** remain in the sac, its irreducibility will usually be caused by adhesions, either to the sac-wall or to omentum. An attempt must be made to separate these, bearing in mind that the bowel may be very readily injured if care is not exercised. Occasionally, in large herniæ, the return of the bowel is distinctly difficult, even although adhesions are not existent. It is well to remember that the posterior portions of the contents of a hernial sac are the parts which are most easily reduced first, and an endeavour should be made to return these parts at the beginning.

Adhesions may be slight and separated without trouble,

or they may be dense and very firm, and it is probably safer under such conditions to leave a portion of the sac-wall adherent to the gut, rather than to run the risk of damaging the intestine in persistent attempts to free it.

In other cases, again, particularly in congenital cæcal herniæ, or in very large protrusions where there has been much displacement of parietal peritoneum, the viscera may be adherent on account of the natural want of serous membrane. Some of the cases give rise to insurmountable difficulty, and in a few instances the surgeon may be justified in going to the extreme measure of resecting a portion of the bowel. Usually, however, if the parietal peritoneum has been divided about half an inch below the adherent intestine, the latter may be pulled up and pushed within the abdominal wall, and the gap in the peritoneum sutured at the deep ring.

Besides omentum and large and small intestine, hernial sacs in the inguinal region may contain other viscera less frequently. The occurrence of these and the method of dealing with them is discussed in Chapter XVII. The whole of the contents of the sac having been reduced, it becomes necessary to bring about the complete closure of the mouth of the sac.

In the majority of instances it is only needful to transfix the free peritoneum forming the neck of the sac while it is on the stretch, at the level of the deep ring. The needle is threaded with two fine silk ligatures, and having been withdrawn, is unthreaded. The two lengths are then interlocked and tied one on either side of the process, and finally one length is carried round the whole and again tied, and the ends cut short. No twisting of the sac is necessary, and in some instances such a manœuvre has led to disaster, owing to the bladder or other viscus being drawn into the twisted part.

The neck of the sac on the side distal to the ligature is now completely severed, and the stump of the sac allowed to retract, which it will do so that the end cannot any longer be seen. If this procedure is performed on the dead subject, and the inner surface of the peritoneum afterwards examined,

it will be found that there is no depression left on the parietal peritoneum.

The stump of the sac will be found in congenital inguinal herniæ, and in acquired forms where the deep ring has not been dragged down so as to lie directly behind the superficial one, to be now in a position posterior to the arching fibres of the internal oblique and transversalis muscles at their origin from the outer half of the inguinal ligament. There is therefore no need in such cases to transplant the stump of the sac by perforating the abdominal wall from within outwards, above and to the outer side of the region of the deep ring. In other instances, however, where there has been much dilatation of the hernial aperture, or in which the arciform fibres are but poorly developed, it may be well to leave the ends of the ligature on the neck of the sac uncut, and to thread one of them through the eye of a hernia needle, and to pass this through the transversalis fascia, transversalis and internal oblique muscular fibres, and the aponeurosis of the external oblique muscle, well above and to the outer side of the region of the deep ring, the skin and subcutaneous tissues having been displaced to allow of the passage of the needle-point.

The needle is now unthreaded and withdrawn, and then threaded with the other end of the suture, and once more passed through the abdominal wall in a similar manner, but about a third of an inch away from the first puncture. The needle is again unthreaded and withdrawn, and the two projecting ends of the silk are tied together, not too tightly, and cut short.

In other instances, where the mouth of the sac is of very large size, it is better to deliberately sew the two margins of parietal peritoneum together by a continuous suture of fine silk, in a manner similar to that which would be employed in an ordinary laparotomy wound. In such cases it is not usually feasible to draw this large sutured mouth of the sac away from the position which it occupies, but an attempt may be made to do so, the two ends of the suture being left long for this purpose, and dealt with as above described. Generally there is no need to disturb the body of the sac,

particularly if this lies in the scrotum. As a rule, there is no collection of blood or serous fluid within it subsequent to the operation.

The next step after the mouth of the sac has been closed is to bring about the narrowing or obliteration of the aperture in the abdominal wall through which the hernial protrusion has occurred. The plan of procedure necessary to accomplish this differs considerably in the various cases that have to be operated upon.

In the congenital herniæ of boys, where the parts have not been allowed to become much dilated by the protrusion of the viscera, there is no need, as a rule, to pass any suture to diminish the size of the inguinal canal; in fact, if there is good development of the arciform fibres of the internal oblique and transversalis muscles, the insertion of such sutures may be considered to be actually harmful. Besides being an unnecessary introduction of foreign material, these stitches will have the effect of binding down these fibres and preventing their natural and beneficent sphincter-like action. Moreover, it is probable that even in congenital cases, where the arching fibres have been displaced upwards, they will readily and rapidly recover their natural position and function as soon as the stretching force has been removed.

It is only, therefore, in those cases of neglected congenital herniæ that sutures would appear to be necessary. The same remarks apply, only with even greater force, to congenital inguinal herniæ in females.

In acquired herniæ, on the other hand, in the majority of instances a very different condition of parts exists. In these it is often a failure in the proper development or tone of the arching fibres of the internal oblique and transversalis muscles that has in some degree accounted for the appearance of the hernial protrusion.

It is therefore very desirable in them that an artificial method should be adopted, whereby the gap caused by their weakness or displacement may be overcome. In the female subject this can be readily and efficiently carried out, for there is no necessity to leave any gap whatever, seeing that no structures need to pass uncompressed through the ab-

dominal wall. In the male, however, the spermatic cord must have a free exit, whether such be at the normal or an unnatural position.

It must be fully recognised that in bringing the fibres of the internal oblique and transversalis muscles down, and fixing them to the inner half of Poupart's ligament, the cord must in no way be constricted. Normally this structure lies behind and deep to these muscular fibres, and it would seem better therefore that it should be left in a position that is as near as possible the natural one. In some methods of suturing the walls of the canal the spermatic cord is dis-

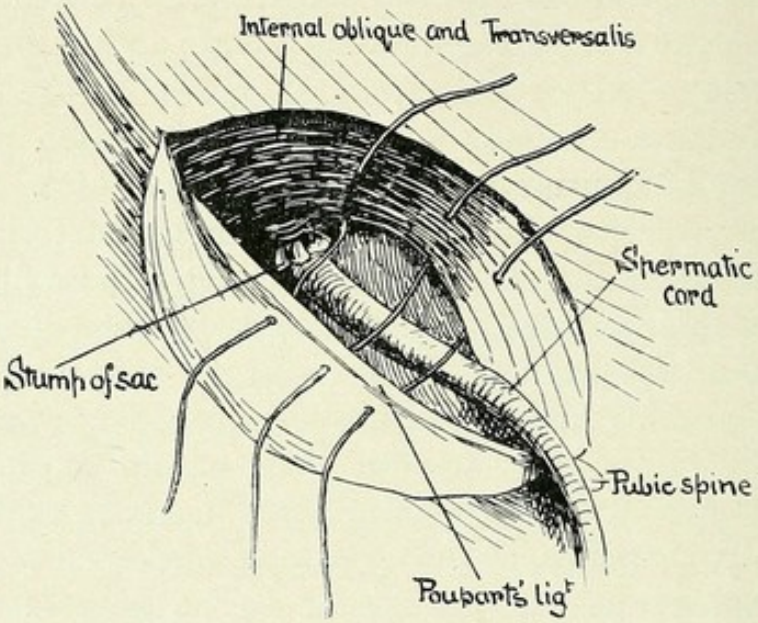

FIG. 64.—CLOSURE OF THE INGUINAL CANAL.

placed, so that it comes to lie in front of the internal oblique and transversalis, passing through beneath the lower edge of these fibres opposite the site of the deep ring. Again, it should be borne in mind that even in acquired herniæ the sphincter-like action of the fibres may be regained, especially in the recently developed herniæ of young adults, and it is well therefore that the sutures which may be inserted in such cases should not be tied too tightly, so as to interfere with their valve-like action, for the cure that it is hoped will follow the operation should rather be dependent upon the living contraction of muscular tissue than the inanimate strength of silk sutures.

In acquired herniæ that have been in existence for many years, or in those which have developed in later life, the sphincter-like action of the arciform fibres may be lost never to be regained, and it is in these cases that sutures carefully introduced and firmly tied may act as a barrier, though by no means a sure one, against the recurrence of a hernia.

It will be seen from the above remarks that a uniformity of procedure in suturing the canal implies that all inguinal herniæ are alike, and require similar treatment—a fact which experience entirely and necessarily discredits, each case having to be dealt with on its own merits.

When it is decided that the case is one which requires sutures in order to strengthen the inguinal canal, their insertion is a matter of some care and precision. The easiest, and probably one of the most successful methods by which to insert the sutures and diminish the gap, is as follows. A hernia needle is taken unthreaded, and is passed through the fibres of the internal oblique and transversalis muscles, about a third of an inch from their free border, the peritoneum and vascular tissues being protected from damage by the tip of the surgeon's left forefinger. The point of the needle is then carried across the inguinal canal in front of the cord, and made to take up the deep aspect of Poupart's ligament. In passing the most external stitch it is necessary to exercise caution, so that no damage may accrue to the femoral vein, which lies so closely behind the ligament. The eye of the needle is now threaded with fairly strong silk-twist, and the instrument withdrawn, carrying with it the suture.

A similar stitch is inserted in the same manner internal to the first. In the majority of cases two such sutures will be found to be amply sufficient to close the gap so far as it is possible without unduly pressing upon the spermatic cord in the male.

The parts having been cleansed of all blood-clot, and thoroughly dried, the aponeurosis of the external oblique muscle is now sutured either with a continuous suture of fine silk, or by as many interrupted stitches as may be needed to bring the divided edges into accurate apposition.

In performing this stage of the operation, it is important to see that the pillars of the external ring are not so closely approximated as to cause much pressure upon the spermatic cord in the male; in the female subject, on the other hand, this aperture may be entirely obliterated. It now only remains to accurately adjust the skin and subcutaneous tissue, which may be done with silkworm gut, or strong horse-hair sutures. These superficial stitches will not have any strain thrown upon them, and they play little or no part in the subsequent prevention of the return of the hernia, but are of considerable importance in the prevention of septic infection. It will be seen that there is no mention made of the use of a drainage-tube, or other means for the exit of fluids from the wound. In fact, in the majority of cases there is no need whatever to provide for this, seeing that the amount of material secreted will be but slight, and will cause no harm. If, however, all hæmorrhage is not efficiently controlled, and if there has been much irritation of the tissues by the application of antiseptic solutions, it may in some cases be well to drain for the first thirty-six or forty-eight hours; but it should be always borne in mind that a drainage-tube is ever a channel of likely infection, and a foreign body in a wound which had certainly better not be there.

4. The Dressing of the Wound.

The wound is now ready for the dressings. It is not well to sprinkle iodoform over the surface; it is of little use in preventing the entrance of organisms, has a most disagreeable odour, and may cause considerable irritation. For the same reason iodoform gauze is not to be recommended as a dressing. Double cyanide of mercury and zinc gauze wrung out of a 1 in 4,000 biniodide of mercury solution is perhaps the most suitable of dressings. This is placed next the skin, without any protective intervening, and over it several layers of dry gauze of a similar kind. In a child, and also in many cases in adults, a very efficient dressing is obtained by the application of a narrow strip of two or three thicknesses of moist antiseptic gauze placed accurately along the line of

the wound, and over this a layer of dry gauze, and the whole fixed in position with a thick layer of flexible collodion. Above the gauze should be applied a substantial layer of antiseptic wool—possibly sal alembroth is as useful as any. The whole dressing is then firmly kept in place by a groin spica bandage evenly applied. This will also tend to bring about an amount of pressure over the operation area that will thoroughly suffice to adjust all the deeper parts of the wound.

It is important that the dressing should be ample in size and quantity. Not only must the region of the wound itself be fully protected, but it is essential that the dressing should extend as high as the umbilicus, across the middle line, and down on to the upper part of the thigh.

In young children it is advisable to apply some protective over the surface of the bandage, so that fouling of the dressing by urine may be less likely to occur. In some instances it is well to apply a double spica in order that there may be no possibility of the dressing becoming displaced in the movements of the child.

5. The After-Treatment of the Case.

Occasionally some male patients have difficulty in **micturition** after the radical operation, amounting even to actual retention, requiring the use of a catheter. This is partly due to the position that they have to assume, and partly, perhaps, to reflex inhibition. It is better that there should be a relaxation of the strict dorsal posture, and the patient allowed to turn or be moved over on to his side in order to pass his urine, rather than that he should be unable to do so, or run the risk of fouling his dressings.

The **pain** following the operation is generally but little; where, however, much omentum has been ligatured, or has merely been handled, pain is apt to be severe, and is felt in the abdomen, chiefly behind the site of the umbilicus. It is rare that any anodyne is necessary, and morphine should be avoided unless it is absolutely essential.

As a rule the **bowels** may be left to act of their own accord, but if they have not done so by the third day after the opera-

tion, no harm will result from an enema being administered, or even by the exhibition of a mild purgative, in an ordinary case. Infrequently it happens that, after bowel has been dealt with, a form of intestinal paralysis, followed by meteorism, ensues. This is best combated by the administration of small doses of strychnine fairly often repeated, together with saline purges.

The temperature and pulse after the operation should cause no anxiety, for as a rule the temperature seldom rises above 100° F. at any time, or the pulse over 80.

The **dressings** should be left undisturbed, unless there are any untoward symptoms, until the eighth or ninth day, when they may be removed and the superficial sutures cut out, the parts being immediately redressed in a manner similar to that in the first instance, though not quite so heavily. It is not usual to have any sign of inflammatory action about the line of the scar when the stitches are removed.

The question as to the **length of time** that a patient should be **confined to bed** after the operation is one which is variously answered by different surgeons. Provided that suppuration has not occurred, there would seem to be no risk in allowing the patient to be moved on to a couch at the end of a fortnight. Walking may be commenced a few days later, and at the end of a month the patient may resume his normal habits of life, presuming that his occupation is not of a very arduous nature. If, on the other hand, the operation has been performed on a hospital patient whose work necessitates a considerable strain upon the abdominal parietes, it is advisable that he should have three to four weeks at a convalescent home if possible before restarting his occupation.

It cannot be considered altogether a wise proceeding to keep a muscular labouring man in bed for weeks, for in so doing there is a tendency to greatly diminish the power and tone of the abdominal as well as his other muscles.

The Employment of a Truss after a Radical Operation.—The question as to the advisability of ordering a truss after a radical operation upon an inguinal hernia depends upon a considerable number of circumstances. As a rule it can,

and should, be settled before the operation is undertaken, for the patient will be disinclined to wear a truss, even when such is a necessity, if he has undergone the operation with the conviction that he would never again need the appliance.

To review the question somewhat briefly, the following may be stated to be the cases in which no truss as a rule is required, and those in which it is desirable.

1. The cases of inguinal hernia in which a truss does not usually need to be advised after operation are as follows:
   - (*a*) Children of both sexes, provided that the abdominal muscles did not show any marked want of development when exposed at the time of the operation, and in whom there is no family history of hernia.
   - (*b*) Young male adults, whose occupation is not laborious, particularly if the hernia was of congenital origin.
   - (*c*) Young female adults, provided that muscular development is good.
2. The cases of inguinal hernia in which a truss should be ordered after operation are as follows:
   - (*a*) All cases where there has been suppuration during the process of healing, particularly where a deep suture has been cast out.
   - (*b*) All cases where the operation has had to be undertaken hurriedly, as in certain instances of herniotomy for strangulation.
   - (*c*) Children of both sexes where previous to the operation the hernia has been neglected, so that the apertures have become much dilated; in those whose abdominal muscles are poorly developed; and in those in which there is a marked family history of hernia.
   - (*d*) Adults of both sexes where the hernia was of acquired origin and of some considerable standing.
   - (*e*) Women during pregnancy and parturition.

(*f*) Persons of both sexes whose occupation is very arduous, such as gas-stokers, navvies, char-women, etc.

(*g*) All those subjects whose abdominal walls are fat, overhanging, or otherwise abnormal; in other words, all cases in which the operation has been undertaken not so much with a view to complete cure as to relief.

(*h*) All cases after operation upon direct inguinal herniæ.

In all cases where it is possible, muscular development should be encouraged after operation by the use of suitable exercises, especially those which tend to bring into action the muscles of the abdominal wall.

In this relation the question of cycling is not infrequently raised at the present day. This exercise promotes muscular development, and so far is beneficial, but there should be an avoidance of strain, as in hill-riding. Cycling, moreover, should not be indulged in until a period of at least six weeks has passed after the performance of the operation.

The subject of the radical operation with a view to cure in cases of inguinal hernia should be concluded with a few remarks as to the peculiarities of some of the operations of other surgeons which are at the present time looked upon with favour. **Halsted**, of Baltimore, considers that the spermatic cord in its usual position is a great bar to effective suturing of the canal, and upon these sutures he relies in a very great measure for the success of his method of operating. He therefore brings the cord out through the fibres of the internal oblique and transversalis muscles close to the site of the deep ring, and then through the outermost part of the incision in the aponeurosis of the external oblique muscle, so that when the inguinal canal has been sutured, the cord will be found lying, as it were, in the subcutaneous tissue in front of the aponeurosis. Further, in order to diminish the size of the spermatic cord as far as is possible, he advocates the removal of most, if not all, of the spermatic plexus of veins. Although there is no doubt but that he has obtained a considerable percentage of apparent cures, his method may be

said to have the objection that it still leaves the site of the deep abdominal ring unprotected, and makes the cord have its exit just at this very spot. Surely Nature has made the exit of the cord at the position which it is safest for it to pass out through the abdominal wall, and it is well to allow it to maintain as closely as possible its normal relations.

Bassini, who, at about the same time as Halsted brought forward his method of operating, considers that it is best to bring the spermatic cord in front of the sutured internal oblique and transversalis muscles, but not out in front of the aponeurosis of the external oblique. There can be no doubt that in some instances where there has been a great displacement and stretching of the arciform fibres of these muscles, this procedure will be followed by the greatest measure of success. This operation, if applied to all forms of inguinal hernia, has most, though not all, the objections which might be urged against Halsted's method.

Macewen's operation is not very frequently practised in the present day. It consists chiefly in throwing the sac of the hernia into a series of folds by the introduction of a suture along the length of its long axis, and then of fixing the retracted sac into the tissues near the site of the deep ring, together with subsequent canal sutures.

Kocher, of Berne, makes an incision through the aponeurosis of the external oblique muscle of the abdomen above and external to the site of the deep ring, sufficiently large to introduce a pair of forceps down the inguinal canal. With these forceps he catches hold of the sac, which has been separated from the tissues in which it lay, and drags it bodily upwards and outwards through the aperture in the aponeurosis, and fixes it there in front of this layer by means of a suture. The inguinal canal is then partially closed.

It is convenient to describe the modification of the operative procedures in the case of a **direct inguinal hernia** at this stage, although this form of protrusion has yet to be noticed.

When the sac has been exposed at the site of the superficial ring, it is necessary to trace it backwards through that

opening until its junction with the parietal peritoneum lining the general cavity of the abdomen is reached. The sac should then, after opening, be removed flush with this, either by transfixion and ligature, or by cutting it away with scissors, closing the consequent aperture in the peritoneum by sutures. The opening in the abdominal wall through which the hernia has protruded has now to be dealt with. Frequently the conjoined tendon has been much displaced upwards and inwards, or is found to be very imperfectly developed. In either case it is requisite that its lower edge should be made to approximate the inner part of Poupart's ligament by inserting one or more sutures. These are passed close to the margin of the tendon, and through the posterior aspect of the ligament in a manner very similar to that described when an oblique inguinal hernia was being discussed. The spermatic cord, as a rule, should be left to pass in front of the conjoined tendon as it normally does.

If the aperture through which the hernia has protruded is that of a rent in, or separation of, the fibres of the tendon itself, it is needful, after the removal of the sac, to firmly suture the edges of the opening.

All cases of direct inguinal hernia should be advised to wear a truss after operation, for some of the worst relapses have apparently been in this variety of hernia.

CHAPTER X.

INGUINAL HERNIA: ITS RARER FORMS AND THEIR TREATMENT.

DIRECT INGUINAL HERNIA.

Anatomy.—About 7 per cent. of inguinal herniæ are of the direct variety, and, as has been stated, this form of hernia is one that leaves the abdomen in the inguinal region, but internal to the deep epigastric artery, and therefore through the triangle known as Hesselbach's. This triangle, it will be remembered, is crossed from below upwards and inwards by the obliterated hypogastric artery, and the hernial protrusion may be formed either internal or external to this vessel. It must be confessed, however, that such a distinction is of but little practical importance, since it is only by dissection that the fact can be determined with certainty. If the sac be protruded internal to the hypogastric artery—that is, through the innermost of the three fossæ (p. 78)—it will lie close to the external border of the rectus abdominis muscle, and will therefore in reality be more of a hernia in the linea semilunaris than strictly in the inguinal region (p. 85). It is this fact that aids considerably in the diagnosis of such a hernia.

Signs.—Clinically, a direct inguinal hernia of the more common variety is always an acquired hernia, is generally seen in the male subject, and presents as a protrusion quite at the inner part of the inguinal region. It is most usually more rounded or globular than is the indirect variety. Moreover, it has a very decided tendency to remain in evidence

even when the patient assumes the horizontal position. Reduction is comparatively easy, owing to the large size of the aperture through which the protrusion escapes, and for the same reason the swelling readily reappears when external pressure is relaxed.

Diagnosis.—If the finger be introduced into the superficial ring, either by invaginating the scrotum in the male, or directly in the female, it will be found that there is no posterior wall to the canal, and that the conjoined tendon has been either pushed aside or has been traversed. The outer edge of the rectus muscle will be felt very distinctly if the patient, while recumbent, is asked to raise the head and shoulders from the pillow, so as to put the recti into action.

To determine absolutely the fact that the hernia is a direct inguinal protrusion, it would be necessary to discover its relationship, or rather that of its neck, to the deep epigastric artery. This, however, can only be done by means of dissection, except in a few instances in which the exploring finger can feel the pulsation of the vessel.

One other point which may aid in arriving at a conclusion that the hernia is a direct one is the fact that a line drawn vertically upwards in the long axis of the swelling will be parallel with the linea alba, and will show no inclination outwards (Figs. 26 and 65).

Therefore, although a case may be thought to be of the direct variety, it is very difficult to prove definitely that it is so without exposing the parts by operation or post-mortem dissection.

The protrusion is most commonly met with on the right side of the body, but is frequently double, and perhaps proportionately more often so than is the indirect form. The spermatic cord is at first external to the hernia, then behind it, but never so intimately associated with it as in an oblique inguinal hernia.

The **coverings** of a direct inguinal hernia are from without inwards:

(*a*) Skin.
(*b*) Superficial fascia.

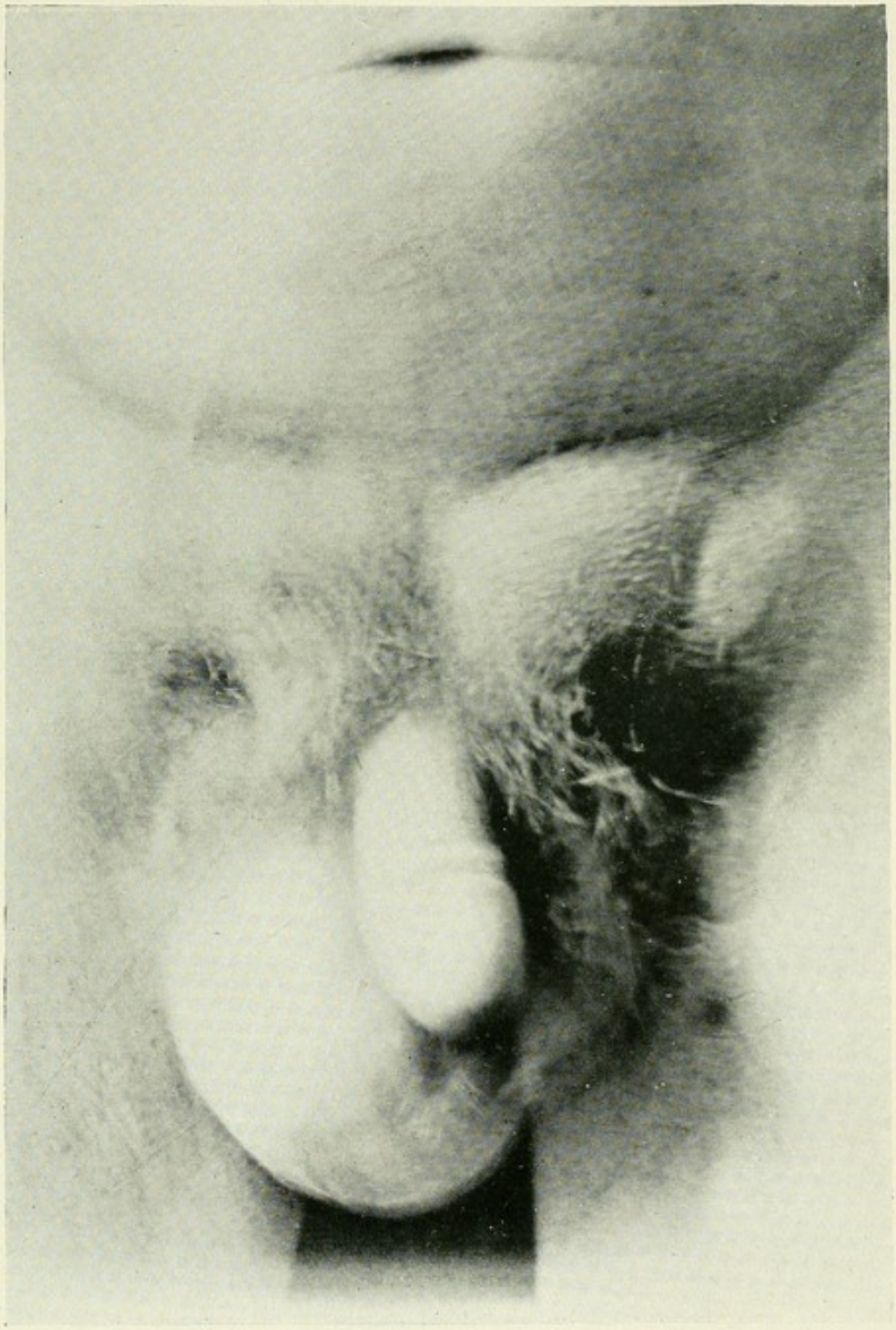

FIG. 65.—A DIRECT INGUINAL HERNIA.

To face p. 146.

(*c*) Intercolumnar fascia.
(*d*) Conjoined tendon, or this may be perforated, and thus absent as a layer.
(*e*) Transversalis fascia.
(*f*) Extra-peritoneal tissue.

It has been suggested that the protrusion may be caused by a weak state of the conjoined tendon, or by its rupture, or on account of its absence. If this latter or the second condition is in evidence, then the hernia may have been produced suddenly, and would be one that might with some reason be designated a 'rupture.'

Direct inguinal herniæ are not apparently so prone to strangulation as are the indirect variety, but they are a source of considerable annoyance on account of the great difficulty that is often experienced in efficiently controlling them. Moreover, they are much less easily cured by operation, or considerably improved by truss pressure, than are oblique inguinal herniæ.

Treatment of Direct Inguinal Hernia.—In the majority of cases a direct inguinal hernia requires the application of a rat-tail or a forked-tongue truss in order to secure the retention of the viscera within the abdomen. For operative procedures see p. 143.

INTERSTITIAL INGUINAL HERNIA.

This class of inguinal protrusions require a separate examination, partly owing to their interest from an anatomical point of view, and partly because of their great importance clinically.

The term 'interstitial' implies that the sac lies in one or other of the planes of the abdominal wall. There are, however, three of these which are the most frequent situations of the sac of an interstitial hernia:

(*a*) Between the external oblique and the internal oblique muscles.
(*b*) Between the aponeurosis of the external oblique muscle and the skin.

(*c*) Between the transversalis fascia and the peritoneum.

The first position named is the most usual, whilst the last is the least so. Interstitial herniæ occur in both the sexes, but relatively more frequently in the female.

Various theories have been put forward as to their causation. In the male the very common accompaniment of a partially descended testis would indicate that there is some causal connection between the two. It may be that the testis, if it has been arrested at the site of the superficial ring, will prevent the viscera in the funicular portion of the processus vaginalis from descending into the scrotum, and

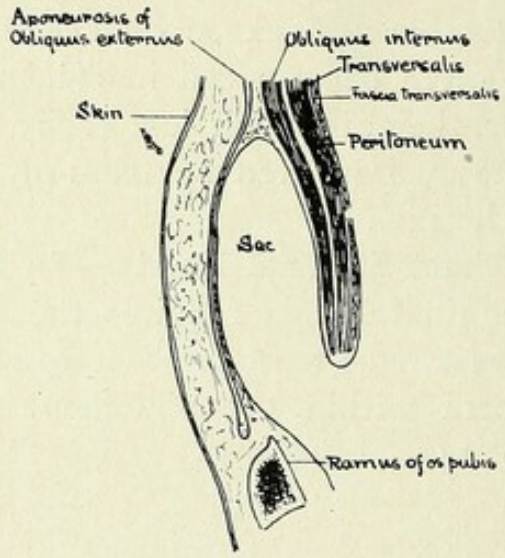

FIG. 66.—FIRST VARIETY OF INTERSTITIAL HERNIA.

cause them to push the peritoneum forming their covering into the space between the two outer abdominal muscles. Again, in women the less patent condition of the superficial ring may make the planes of the abdominal walls of lower resistance than even the aperture itself. Possibly in both sexes there is some additional congenital defect than a persistent processus vaginalis, or canal of Nuck.

Moreover, it is conceivable that forcible attempts at reduction often repeated may be a factor in the production of the part of the sac which comes to be abnormally placed. In all the three varieties of interstitial herniæ there is a part of the sac which will be found in the usual position, namely,

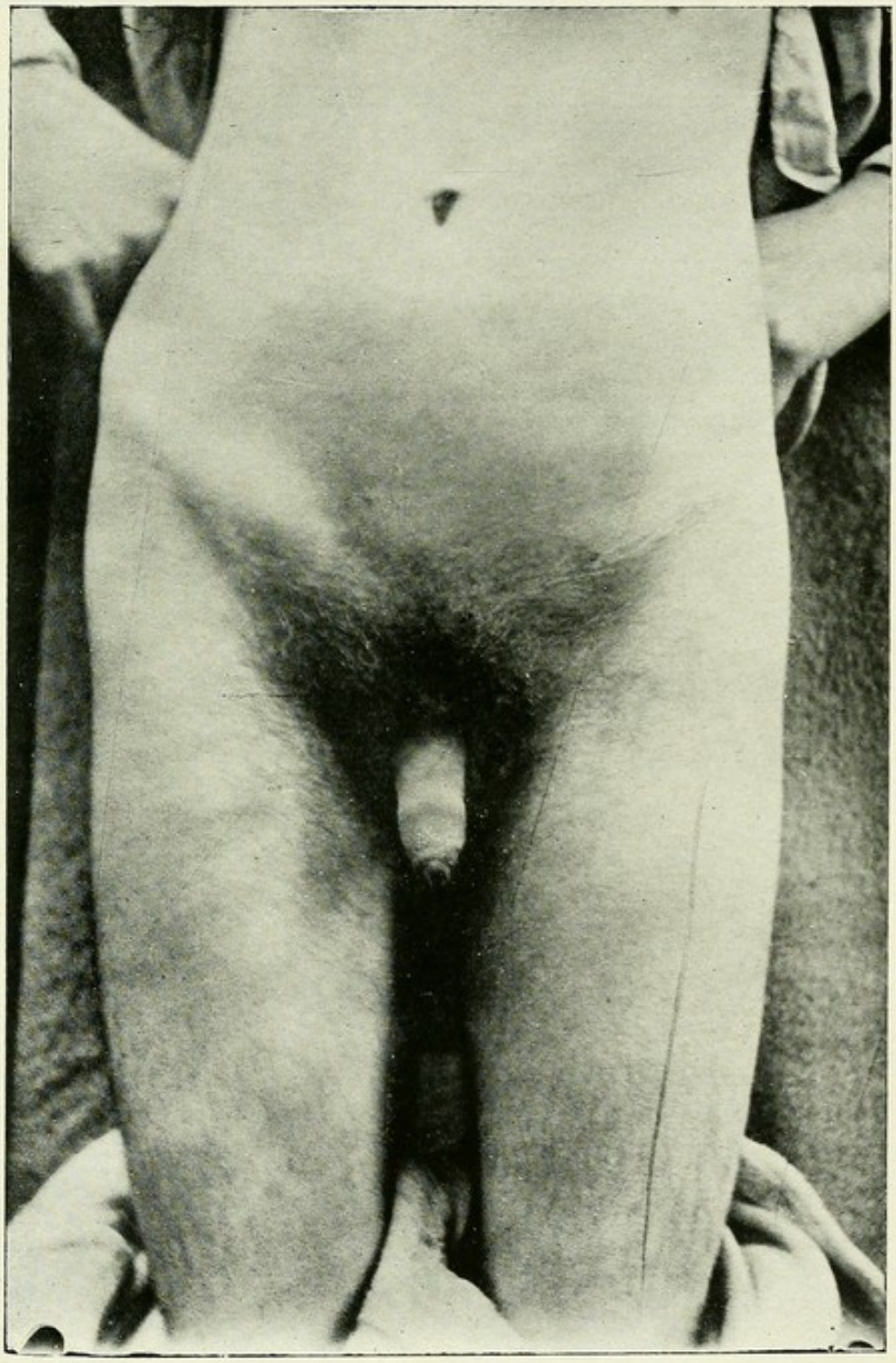

FIG. 67.—A RIGHT INTERSTITIAL INGUINAL HERNIA, WITH, IN ADDITION, THE LEFT TESTIS AT THE SITE OF THE DEEP ABDOMINAL RING.

To face p. 148.

the inguinal canal or scrotum, and the super-added diverticulum springs from it.

The **first variety of interstitial hernia** is that in which the secondary sac lies in the anterior abdominal wall in the interval between the internal and the external oblique muscles. If all the herniæ in male infants be carefully examined, and especially those which are associated with an arrested testis, it will be found that a proportion of them are in reality of this form of inguinal hernia. Again, in some adults who are also the subjects of a partially descended testis a secondary sac may be found to be developing, or in marked evidence. In females it is not usual for the hernia to assume this variety until adult life has been reached.

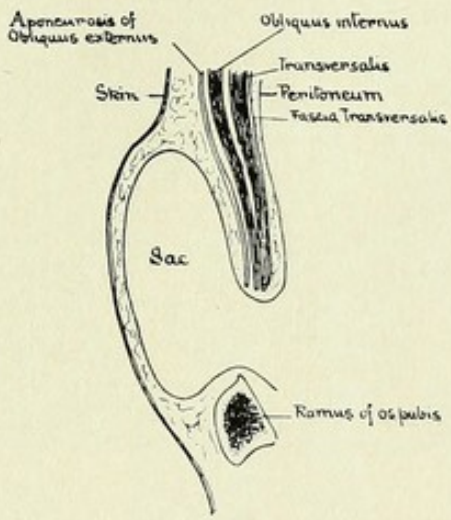

FIG. 68.—SECOND VARIETY OF INTERSTITIAL HERNIA.

Interstitial herniæ are more common on the right side of the body, possibly on account of the fact that arrest in the descent of the testis on that side is more usual than on the left.

When the hernial sac has left the internal or deep ring, it enters the inguinal canal, but instead of escaping at the superficial ring, the peritoneum mounts upward generally in a direction towards the anterior superior spine of the ilium between the two superficial muscles of the abdominal wall. The protrusion will be observed as an oval swelling lying parallel to Poupart's ligament, and directly above it. It does not project much from the surface, and appears as if flattened. Occasionally a part of the sac passes into the

scrotum or the labium, and in such instances there is often a very distinct groove between the two parts of the hernia. The muscles between which the protrusion is lying are not infrequently atrophied to a considerable degree.

The **second variety of interstitial hernia** is that in which the sac lies in front of the aponeurosis of the external oblique muscle of the abdomen, and the sac is therefore close beneath the skin.

This form is more often accompanied by a sac in the scrotum than is the variety which has just been described.

The protrusion must have passed the limits of the canal, and after having issued from the superficial ring the peri-

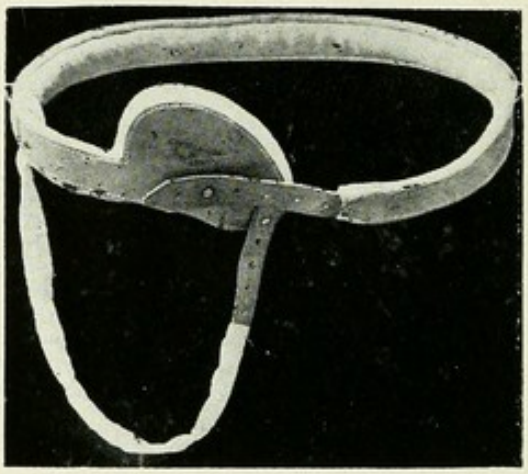

FIG. 69.—A TRUSS WITH AN INTERSTITIAL PLATE.

toneum separates the loose tissues in front of the external oblique and worms its way into this plane of the abdominal wall. There is commonly more projection from the surface in this form than in the first variety, and the swelling takes the same course, namely, upwards and outwards. Occasionally it may be so large as to hang down into the upper part of the thigh, in front of Poupart's ligament, and thus to simulate a femoral hernia. It is rather difficult to arrive at a conclusion as to the exact cause of this form of interstitial hernia. It is possible that adhesions at the upper part of the scrotum, or about the superficial ring, may be the determining influence in preventing the sac from reaching the scrotum and in its being pushed into the plane referred

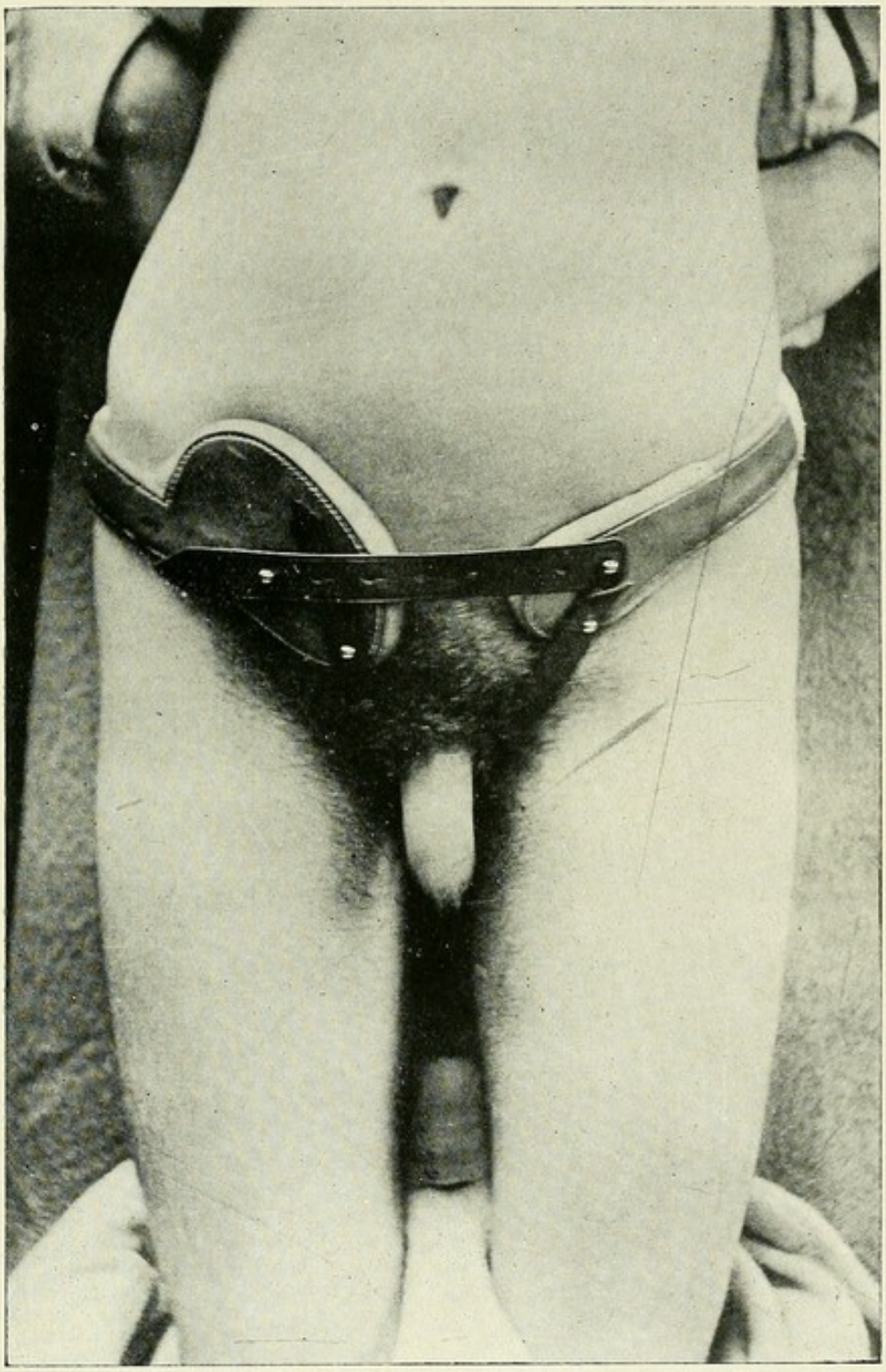

FIG. 70.—A TRUSS WITH AN INTERSTITIAL PLATE ON THE RIGHT AND AN ORDINARY INGUINAL PAD ON THE LEFT, ADJUSTED.

To face p. 150.

to. Both the first and the second varieties of interstitial herniæ can be efficiently retained by a properly formed truss, which has its pad much larger than an ordinary inguinal pad, and extending upwards and outwards in the direction in which the hernia that it has to control passes. This pad is often styled an 'interstitial plate.' But in the majority of cases in young subjects a radical operation should be advised (see p. 121).

The **third form of interstitial hernia** is that which does not present any ventral swelling as the other two do. In it the sac lies for the most part in the extra-peritoneal tissue, generally in the iliac fossa, but sometimes behind the body

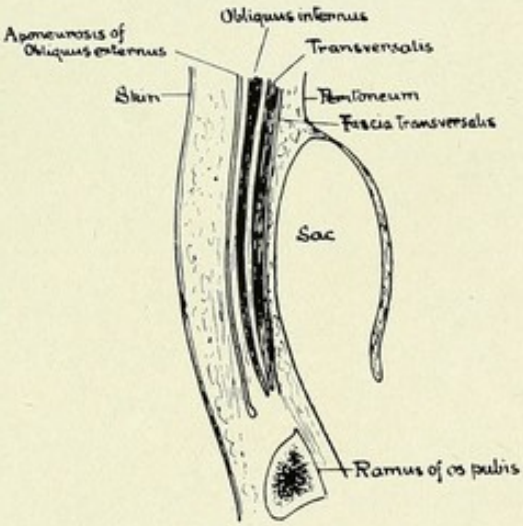

FIG. 71.—PRO-PERITONEAL HERNIA.

of the os pubis. It is known as a 'pro-peritoneal' hernia. There is almost always a part of the sac in the scrotum or the labium. This form of interstitial hernia is but seldom recognised during life, except when an operation is being performed for the relief of strangulation, or with a view to cure.

All three varieties of interstitial herniæ are liable to 'reduction en masse,' but it is particularly this third form that is most prone to be so replaced. Bowel lying in the lower scrotal portion of the sac may be strangulated, and the surgeon may reduce it within the abdominal wall, but in reality he has pressed the contents out of one part of the sac into another lying hidden behind the os pubis. Thus it

comes that the gut still remains nipped at the common mouth of the sac, although it is within the abdominal wall and free from the pressure of the superficial ring. This occurrence is a most fatal one if it be not discovered. It is one of the reasons why symptoms will continue after the apparent reduction of the contents of the sac of a strangulated hernia by taxis.

CHAPTER XI.

FEMORAL HERNIA: ITS ANATOMY, CAUSATION, SIGNS, SYMPTOMS, AND DIAGNOSIS.

DEFINITION.

A **Femoral Hernia** is a protrusion through the femoral ring into the femoral canal. The term 'crural,' so often used in dealing with the subject of femoral herniæ, is a misnomer.

ANATOMY.

The **anatomy** of the femoral region requires to be reviewed in order to understand the main facts concerning the development of a femoral protrusion.

Behind the innermost part of Poupart's ligament, and a little below and external to the spine of the os pubis, is a potential opening, made patent by the scalpel or a femoral hernia, the so-called **femoral ring**.

This is the upper or abdominal entrance into the femoral canal. Its shape is oval, with the long axis transverse, and in the erect position its plane is nearly horizontal.

Its boundaries are:

1. Internally, Gimbernat's ligament, which is in reality the triangular internal attachment of Poupart's ligament. Its apex is connected with the pubic spine. Two of its borders are attached, the one anteriorly to Poupart's ligament, and the other posteriorly to the inner part of the ilio-pectineal line, whilst the third border is free, and forms the inner boundary of the femoral ring.
2. Externally, the femoral vein.

3. In front, Poupart's ligament, and a thickened portion of the transversalis fascia, at this spot attached to the ligament, and sometimes spoken of as the deep crural arch.
4. Behind, the pectineus muscle, covering the horizontal ramus of the os pubis, and a band of fascia named Cooper's ligament.

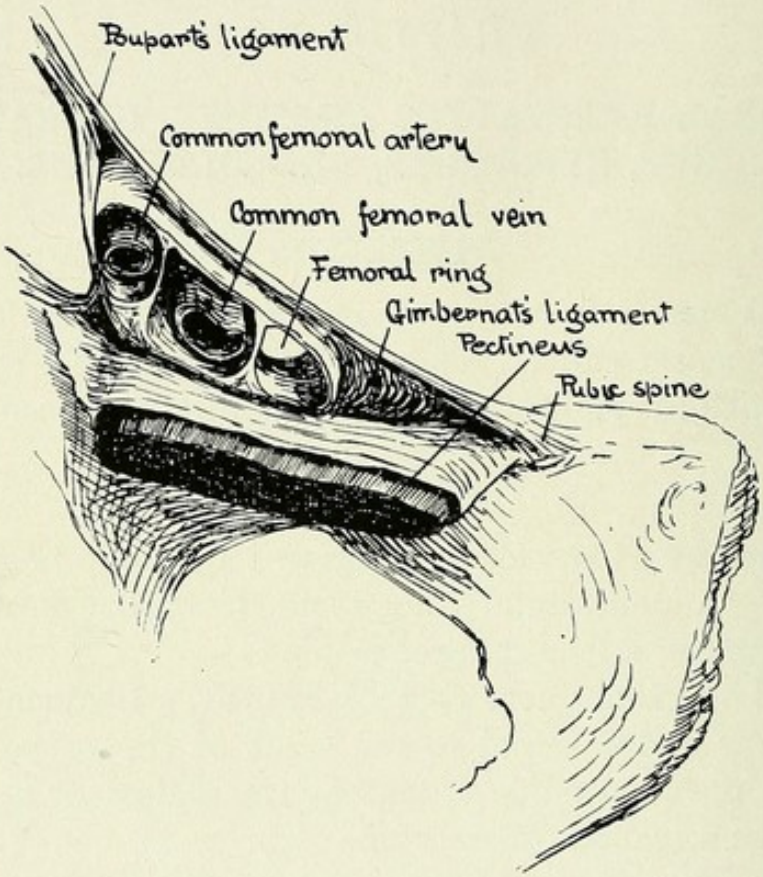

FIG. 72.—THE FEMORAL RING.

5. Above, it is covered in by a layer of fascia spoken of as the septum crurale, which is in reality a part of the extra-peritoneal tissue, and is perforated by lymphatic vessels passing from the superficial to the deep lymphatic glands.

The femoral ring opens into the **femoral canal**, which is the most internal division of the femoral sheath, and is composed anteriorly of transversalis fascia and posteriorly of iliac fascia. The sheath encloses three compartments, the most external for the femoral artery, the middle for the femoral vein, and the internal—the femoral canal—for lymphatics.

There is no true canal, unless it be made by dissection or by the dilating force of a hernial protrusion. The shape of the space is roughly triangular, and its length in the adult about three-quarters of an inch.

It lies deep to the saphenous opening, which in a sense forms its lower aperture or exit; the entrance, as already stated, being the femoral ring.

The boundaries of the canal are:

1. Anteriorly, fascia transversalis.
2. Posteriorly, fascia iliaca.
3. Externally, the septum separating the space from that for the vein.
4. Internally, the meeting of the fascia transversalis with the fascia iliaca.

Within the canal are found cellular tissue and fat, embedded in which are lymphatic vessels passing from the superficial to the deep lymphatic glands, with sometimes a lymphatic gland itself.

Superficial to the femoral canal is the **saphenous opening**, a term which is wholly a misnomer. There is no true opening, and it is therefore not an evident one. It lies at the upper and inner part of the thigh, in the adult 1½ inches below and external to the spine of the os pubis. It is formed between the two layers of the fascia lata of the thigh, known as the iliac or anterior, and the pubic or posterior portions. It gives passage to the internal saphenous vein. Its shape is oval or semilunar, with its long axis downwards and outwards.

The outer edge of the opening has its upper extremity attached to the anterior aspect of Gimbernat's ligament and the lower border of Poupart's ligament, whilst its inferior extremity is at the spot where the two parts of the fascia lata meet. The inner edge of the opening is on a posterior plane to the outer margin, and is much less prominent and defined.

This pseudo-opening is covered in by the cribriform fascia, so named because of the numerous apertures in it for the passage of small vessels. This fascia is in reality part of the deep layer of the superficial fascia of the thigh.

The **coverings** of a femoral hernia are from without inwards as follows:

1. Skin.
2. Superficial fascia, composed of two layers, the deeper of which forms the
3. Cribriform fascia.
   These coverings are derived as the hernia passes through the outlet of the femoral canal.
4. Fascia transversalis.
   This layer is obtained from the wall of the canal itself.
5. Septum crurale.
6. Extra-peritoneal tissue.
   The peritoneum deep to this is the sac-wall proper.
   These layers are acquired as the sac is entering the canal.

When actually cutting down on the sac of a femoral hernia, these various coverings, so clear on paper, are very difficult or well-nigh impossible to differentiate, nor is it necessary, indeed, to do so.

Whilst the sac of a femoral protrusion is traversing the femoral canal, it takes a vertical direction, and lies to the inner side of the femoral vein and the femoral artery, and its neck is external to the spine of the os pubis. In the male subject the spermatic cord is above—that is, on a higher level than—the femoral ring. The deep epigastric artery lies on the outer side, and also on a level which is higher. Its pubic branch passes downwards and backwards on the outer side of the neck of the sac, to anastomose with a similar branch derived from the obturator artery on the upper surface of Gimbernat's ligament. In two cases out of every seven this anastomosis is so enlarged as to form the origin of the main portion of the obturator vessel. When this 'abnormal' origin of the obturator artery is present, in 10 per cent. of the instances the vessel runs over the anterior or upper margin of the femoral ring, and then down along its inner border to reach the obturator foramen. In another 37 per cent., it passes across the femoral ring, and in 53 per cent. it arrives at the obturator aperture by skirting the

external side of the femoral opening. Thus it will be seen that if a femoral hernia becomes strangulated, the artery will be liable to injury if the knife be used, in at least 10 per cent. of all cases where its abnormal origin is present. Moreover, if the neck of the hernial sac in its descent pushes the artery over, when lying across the ring, to the inner side, it will again become placed in a position of danger.

THE CAUSES OF FEMORAL HERNIA.

There are certain causes of femoral protrusions beyond those of herniæ in general. It is doubtful whether a femoral hernia is ever truly congenital, although instances of its presence at a very early age are on record. It does occur rarely in both sexes before the period of puberty, but it is most frequently in evidence after the age of twenty years.

It affects women relatively more commonly than men, and among women, those who have borne children are somewhat more prone to it than the nulliparous.

In this connection attention should be given to the fact that if all ages of females be taken it will be found that inguinal herniæ are more usual in them than femoral.

In the male sex, femoral protrusions are liable to occur in those who follow certain lines of employment where straining efforts are made in a stooping posture, such as bakers, gardeners, and sometimes stokers. Generally males the subjects of femoral herniæ have passed middle life, and often are of slight build and short stature.

The structure and form of Gimbernat's ligament may have some influence on the occurrence of femoral hernia. In male subjects it is usually a well-formed, strong, and firmly attached ligament; but in females it may be but poorly developed, or even altogether absent. Thus it will be seen that the so-called femoral ring is not infrequently proportionately larger in women than in men.

Until the pelvis has reached its full size, there is practically no femoral ring or canal, hence the rarity of femoral herniæ before puberty. Probably in some cases a rapid loss of adipose tissue may tend to the production of a femoral protrusion, owing to the removal thereby of some of the

material which helps to support the abdominal aspect of the region of the ring.

Advancing age may be a predisposing factor, since all fascial structures then tend to degenerate and become less resistant.

For the occurrence of femoral with other forms of herniæ, see p. 89.

THE SIGNS AND SYMPTOMS OF A FEMORAL HERNIA.

A femoral hernia develops insidiously, and in its early stages is said to produce less distress than an inguinal, and thus the hernia may remain unnoticed by the afflicted person until the very time that strangulation occurs. The overlooking of a small femoral hernia is particularly liable to happen in the case of women who are obese, and in men where its existence is put down to an inguinal protrusion.

In other cases pain, local in position and of a burning character, may be present, whilst other patients complain of a sense of numbness in the thigh, or of weight in the whole limb. Œdema of the leg from pressure upon the femoral vein is but very rarely in evidence. Not infrequently the lymphatic gland lying over the region of the canal is found to be enlarged.

There are three chief types of the form of the protrusion in femoral herniæ. In the first there is a rounded, and later a distinctly globular, swelling, lying below the inner end of the groove formed by Poupart's ligament. In the second the hernia, after it has passed the confines of the femoral canal, tends to descend the thigh, and gives rise in the upright posture to a somewhat overhanging mass. In the third there is the reverse of this, for the hernia mounts upwards in front of Poupart's ligament, obscuring as it were its inner half. Such cases are not nearly so common as is generally supposed; but when present they may be a source of considerable uncertainty as to whether an incomplete inguinal or a femoral protrusion exists, and this is especially so in the case of women.

Another form of this third variety of femoral hernia is the one which passes upwards and outwards towards the anterior

FIG. 73.—A RIGHT FEMORAL HERNIA OF THE USUAL FORM, TOGETHER WITH DOUBLE INGUINAL HERNIÆ OF SMALL SIZE, THE LINE OF POUPART'S LIGAMENT SEPARATING THE RIGHT INGUINAL FROM THE RIGHT FEMORAL.

To face p. 158.

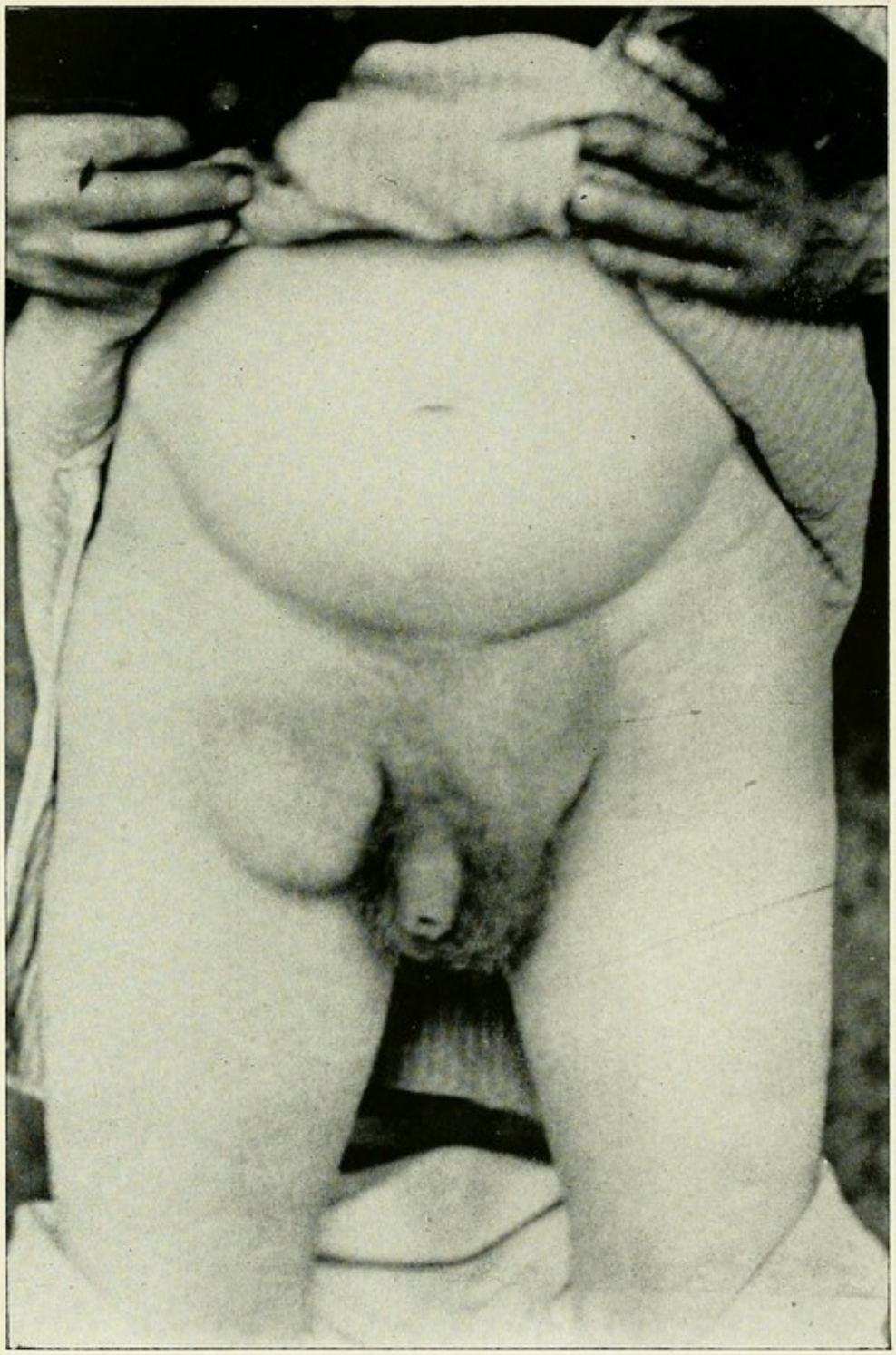

FIG. 74.—A RIGHT FEMORAL HERNIA PASSING DOWN THE THIGH, TOGETHER WITH A LEFT INGUINO-SCROTAL HERNIA.

To face p. 158.—I.

FIG. 75.—A RIGHT FEMORAL HERNIA MOUNTING UP IN FRONT OF THE INNER END OF POUPART'S LIGAMENT.

To face p. 158.—II.

superior spine of the ilium, thus acquiring an oblique direction, which is again liable to be confused with that of an inguinal hernia. After operations on femoral herniæ, the protrusions may assume quite unlooked for and even fantastic shapes, and enlarge in very unnatural directions, passing in some instances into the scrotum or labium.

THE DIAGNOSIS OF FEMORAL HERNIA.

1. The Diagnosis of Reducible Femoral Hernia.

There are three chief conditions that a reducible femoral hernia has to be distinguished from, namely: (1) Incomplete reducible inguinal hernia; (2) Varicose saphena vein; and (3) Psoas abscess, presenting in the thigh.

As a rule the differential diagnosis is comparatively easy; but, as has already been observed, the distinction from incomplete inguinal hernia may be a somewhat difficult matter.

The comparison and contrast of the four lesions are briefly given in tabular form on the next page.

DIAGNOSIS OF REDUCIBLE FEMORAL HERNIA.

	Reducible Femoral Hernia.	Incomplete Reducible Inguinal Hernia.	Varicose Saphena Vein.	Psoas Abscess.
1. *Position:*	Below, or below and in front of, Poupart's ligament.	Entirely above Poupart's ligament.	Below, but never in front of, Poupart's ligament.	Below and above Poupart's ligament.
2. *Consistence:*	Elastic, but often with feeling of contained solid.	Elastic, but often with feeling of contained solid.	Not elastic, and no solid felt.	Usually elastic.
3. *Impulse on cough:*	Expansile.	Expansile.	More a fluid thrill, or even a distinct 'purr.'	Expansile, but not well marked.
4. *Fluctuation:*	None.	None.	May be obtained.	Usually present.
5. *Percussion:*	May yield a resonant note if intestine is present.	May yield a resonant note if intestine is present.	Dull.	Dull.
6. *Auscultation:*	Gurgling may be heard if intestine is present.	Gurgling may be heard if intestine is present.	Dumb.	Dumb.
7. *Other conditions:*	Reduction is effected in a direction backwards and upwards.	Reduction is effected in a direction outwards, upwards, and backwards.	Other varicosed veins present.	Disease of spine present.

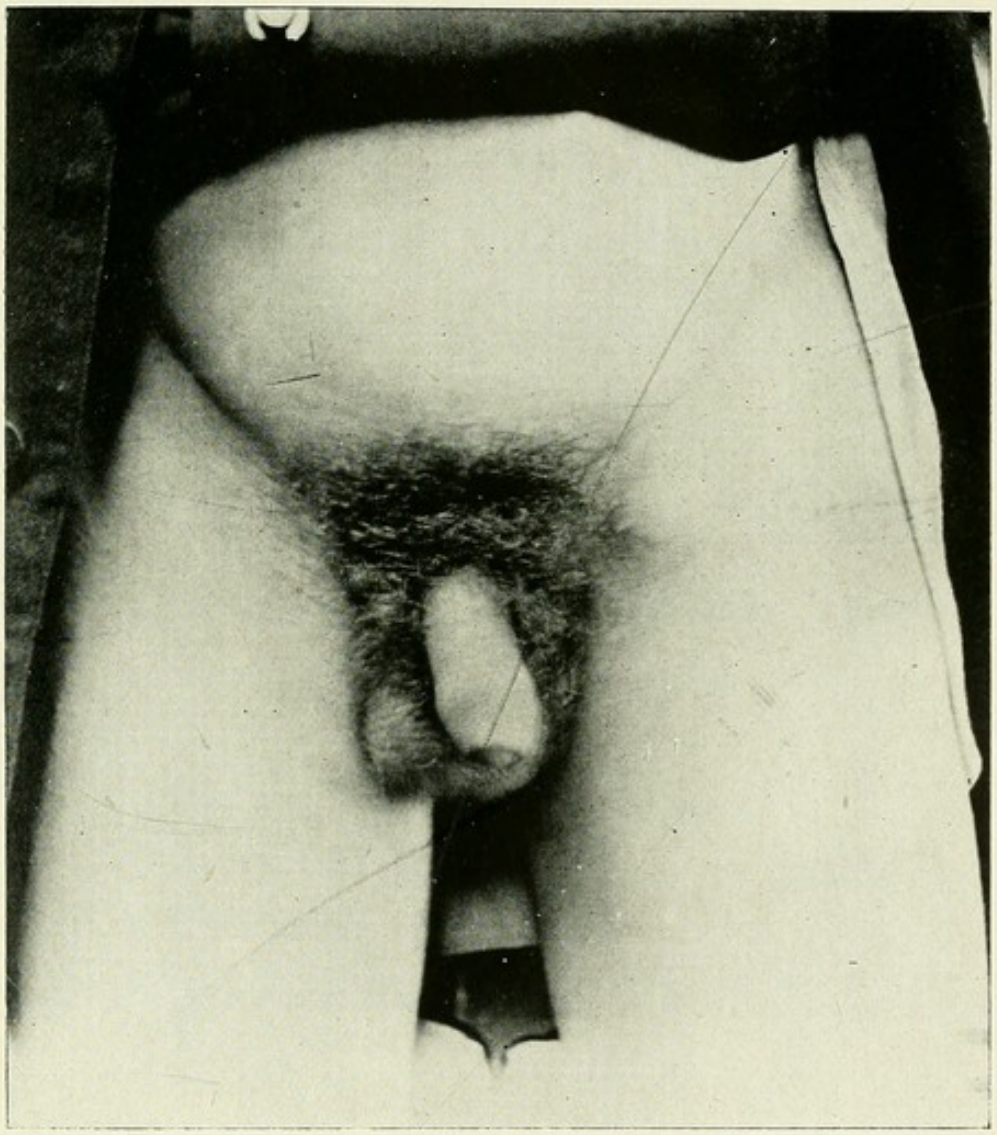

FIG. 76.—A LEFT VARICOSE SAPHENA VEIN.

To face p. 160.

2. The Diagnosis of Irreducible Femoral Hernia.

The most usual lesion that is confused with an irreducible femoral hernia is that of enlarged femoral lymphatic glands. These occur so frequently in the hernial region that it is not surprising that now and again they are mistaken for a hernia, or a hernia confused with them.

The differential diagnosis is of the greatest importance, for the one trouble—the adenitis—need not be a serious matter, while the other—the hernia—may be a matter of life or death.

In addition to the glandular enlargements, other swellings occur in the femoral region that may cause some uncertainty. These are lipomata, fibromata, bursæ, cysts, exostoses, aneurism, etc.

Most of them are comparatively rare, and it is not necessary to enter fully on the diagnosis, but fatty tumours are sufficiently common to warrant the mention of a few points of distinction.

	Irreducible Femoral Hernia.	Femoral Lipoma.
1. *Position:*	Is usually placed at the site of the saphenous opening.	Is often external to the femoral vessels.
2. *Impulse on cough:*	As a rule has an expansile impulse on cough.	Has no impulse.
3. *Connections:*	Has deep connections which can be made out.	Appears entirely superficial.

CHAPTER XII.

FEMORAL HERNIA: ITS TREATMENT BY TRUSSES.

THE treatment of femoral herniæ by means of trusses may be considered under the two divisions of the reducible and the irreducible protrusions.

REDUCIBLE FEMORAL HERNIA.

If a femoral hernia is completely reducible and of small dimensions, it can be efficiently controlled by a suitable truss properly adjusted.

An ordinary simple femoral truss is fashioned on the same

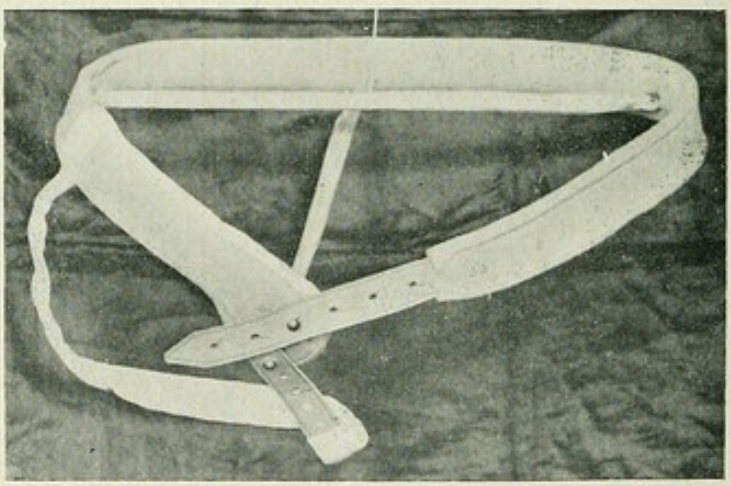

FIG. 77.—A RIGHT ORDINARY FEMORAL TRUSS.

lines as an inguinal, with one or two points of important difference: the pad is smaller, depends somewhat more from the lower border of the spring, and that part of the

FIG. 78.—A RIGHT ORDINARY FEMORAL TRUSS ADJUSTED.

To face p. 162.

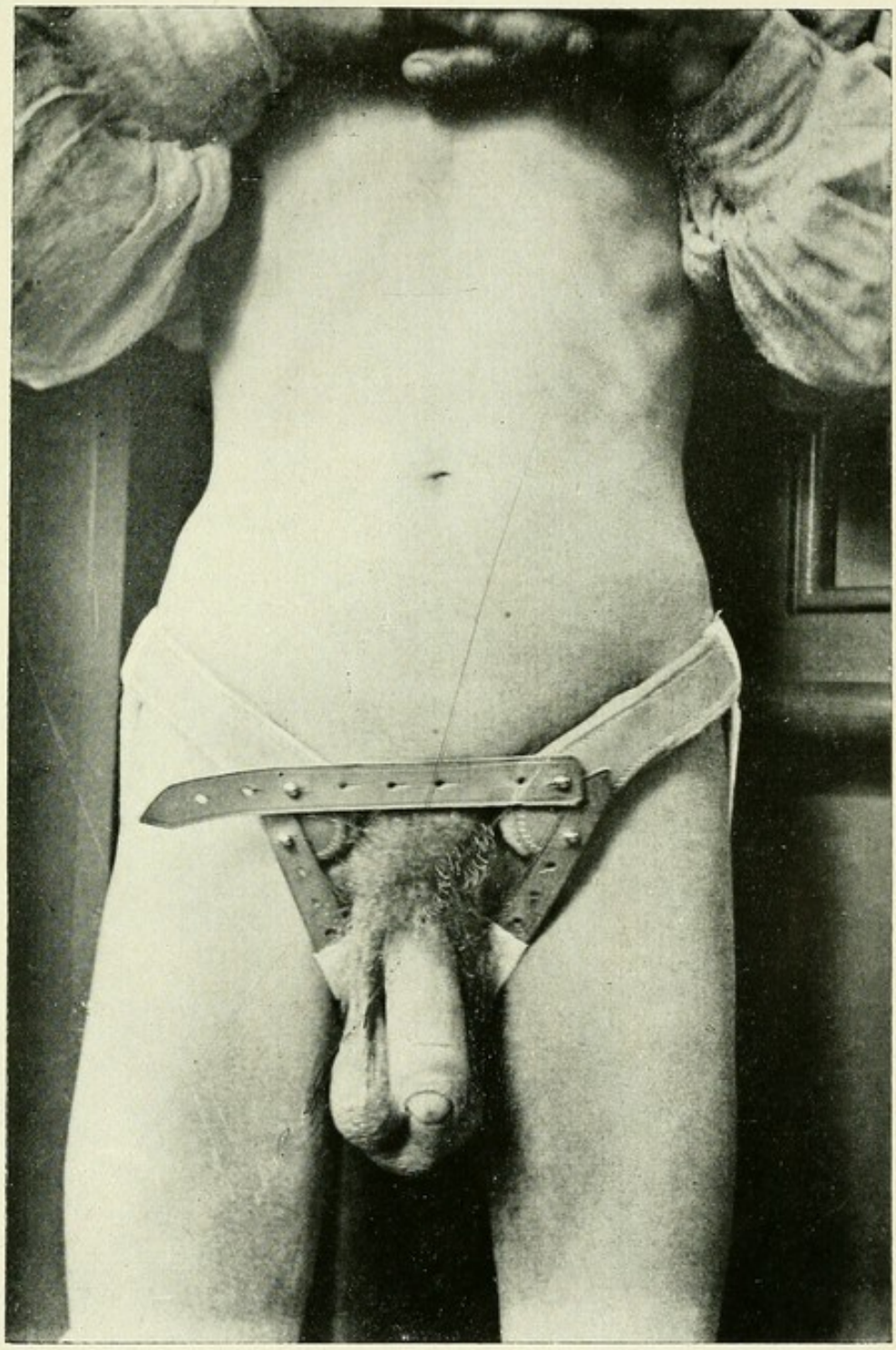

FIG. 80.—A DOUBLE ORDINARY FEMORAL TRUSS ADJUSTED.

To face p. 162.—I.

spring from the shoulder to the pad is more oblique than in an inguinal. The under-strap should be placed further forward than in the inguinal pattern—that is, at or a little in front of the shoulder of the truss, just beneath the anterior superior spine of the ilium, and when the truss is adjusted, the fixed portion of the under-strap is clearly seen in an anterior view of the patient. All these points are well depicted in the accompanying figures.

The method of measuring for an ordinary femoral truss is precisely similar to that for an inguinal instrument. A tape is to be carried round the pelvis obliquely, half-way between the crest of the ilium and the top of the great trochanter to

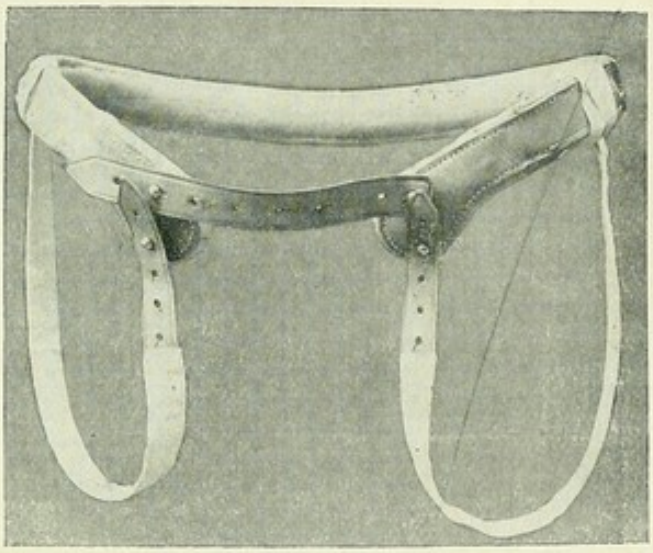

FIG. 79.—A DOUBLE ORDINARY FEMORAL TRUSS.

above the symphysis pubis in front, the tape lying across the base of the sacrum behind. An exact measurement is very essential, and the truss should be of that size. It will be noticed that there is no reference to the site of the femoral ring or canal in taking the measure for a femoral truss, just as in the case of an inguinal truss there was no allusion to the inguinal rings (Fig. 36, p. 108).

The adjustment of such a truss of the right form and size is simple, for it will fall of itself into the proper position as soon as it is passed round the pelvis, when it will be found that the pad will lie accurately over the site of the femoral ring and canal without impinging upon the spine of the os pubis. If the truss is even half an inch too large, there will

be a tendency for the inner edge of the pad to rest against the spine, and so produce great misery and actual harm to the patient. In many cases, by attaching the under-strap to the upper stud on the face of the pad, the lower edge of this latter will be slightly tilted so as to act still further in supporting the almost horizontal femoral ring.

In a double femoral truss the mode of measurement and adjustment are the same as that for a single truss, except that it is often well to add one inch to the actual number of inches obtained by the tape. In some cases a femoral protrusion is so small, and the force with which it is protruded is so slight, that an even lighter form of femoral truss than

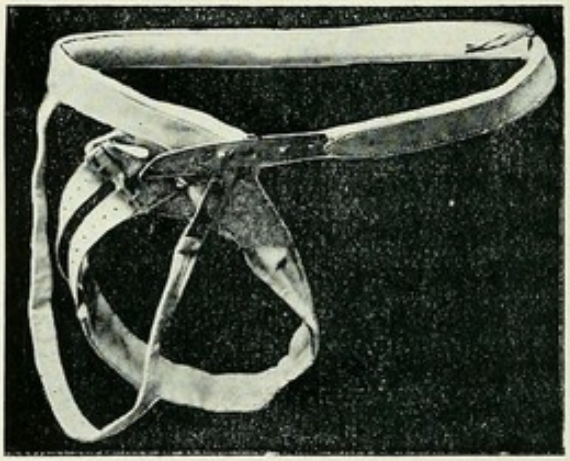

FIG. 81.—A FEMORAL TRUSS WITH A THIGH-BELT.

the ordinary one can be prescribed. As soon, however, as a femoral hernia has reached somewhat larger dimensions from neglect than that of the typical small rounded protrusion, the ordinary truss will probably be inefficient, and in these instances it is necessary to order the addition of a thigh-belt.

In this form of truss the pad is prolonged vertically downwards in a peaked manner, and the prolongation consists of soft material firmly stuffed. The triangular addition should adjust itself to the hollow in Scarpa's triangle produced by the hernial protrusion. To it should always be attached a thigh-belt, consisting of jean, and so fashioned and stitched to the pad as to pass round the inner side of the thigh with-

FIG. 82.—A FEMORAL TRUSS WITH A THIGH-BELT ADJUSTED.

To face p. 164.

FIG. 84.—A RIGHT FEMORAL TRUSS WITH A THIGH-BELT AND AN INGUINAL FULNESS ADJUSTED TO SAME CASE AS IN FIG. 75.

To face p. 164.

out rubbing against the scrotum or labium. Thence coming up on the outer side, it bifurcates into two straps, which are fastened to an expansion of the material on the outer side of the prolongation of the pad. The measurement for this belt is taken by passing the tape horizontally round the thigh as high up as the fork between it and the scrotum or labium will allow. The object of the thigh-belt is to prevent the extended pad from being lifted out of position whenever the thigh is flexed.

In those somewhat rare cases in which the femoral protrusion mounts upwards, so as to encroach upon the inguinal

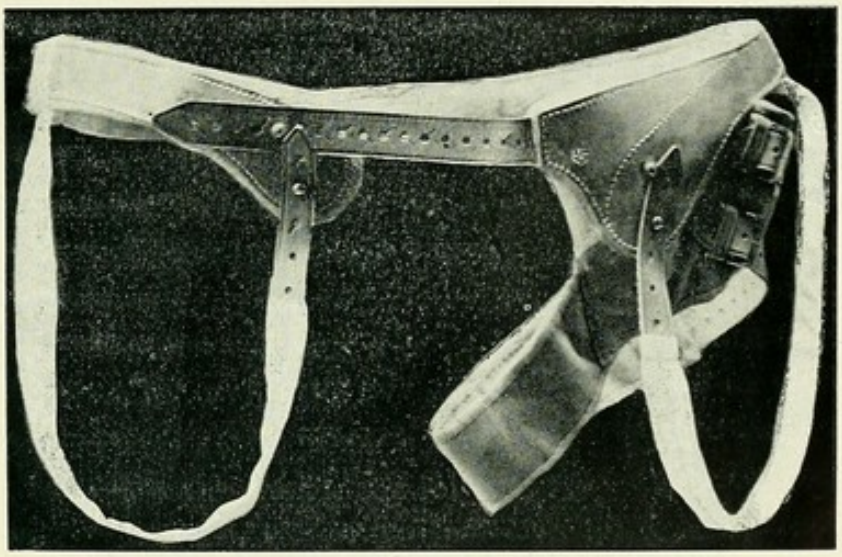

FIG. 83.—A FEMORAL TRUSS WITH A THIGH-BELT AND AN INGUINAL FULNESS ON THE LEFT SIDE.

region, it may be necessary to add still further to the ordinary femoral pad in the way of an inguinal fulness over it. This addition corresponds in shape more or less to the upper part of the forked-tongue inguinal truss, and the strap attached to it should be fastened to the shoulder of the opposite side in a single truss, thus tending to keep the inner and upper angle of the pad from being pulled downwards by the thigh-belt. In a double truss with an inguinal fulness on each side, the cross-strap would be buckled as in a double forked-tongue truss (Fig. 45).

When an inguinal fulness is required, it is also necessary to have a thigh-belt; but a thigh-belt may be attached

to a femoral pad without the addition of an inguinal fulness.

The inguinal fulness will also in many instances prevent the descent of an inguinal protrusion, where such exists together with a femoral on the same side of the body (p. 115). Femoral trusses with these additions should always have the ordinary under-strap, which is to be adjusted as in the less elaborate form of instrument.

IRREDUCIBLE FEMORAL HERNIA.

Although it will be at once conceded that many irreducible femoral protrusions should be submitted to operation, yet there are numerous instances in which this method of treatment is out of the question, or is likely to be so dangerous

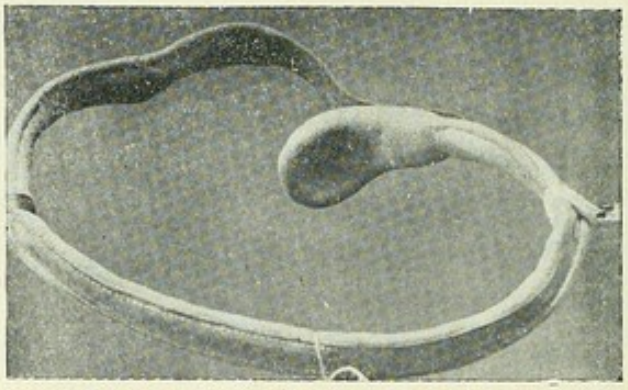

Fig. 85.—A Femoral Truss with a Hollow Pad.

as to be hardly justifiable. The adjustment of a suitable truss is then called for.

In the slighter forms, where a small mass, generally of omentum, remains irreducible in a femoral sac, the application of an ordinary femoral truss the pad of which is concave instead of being convex will frequently bring about the reduction of the contents of the sac, and that without the descent of any more. It is often well to fill in the hollow in the pad as the imprisoned viscera are gradually reduced.

In larger irreducible femoral herniæ, the form of femoral truss with the addition of the thigh-belt will be necessary, the pad again being made concave, and an inguinal fulness

may also be added. In still larger protrusions it may be necessary to apply some form of bag truss, but this can never be really satisfactory.

The treatment of cases in which inguinal herniæ are combined with femoral herniæ has already been discussed on p. 115.

CHAPTER XIII.

FEMORAL HERNIA: ITS TREATMENT BY OPERATION.

WHEN the anatomy of the femoral ring is reviewed, it will be readily seen that the approximation of its sides is a matter of considerable difficulty, since three of these are composed of unyielding structures, and externally lies the femoral vein in close proximity. It follows, therefore, that the best that can be attempted is to draw together the edges as far as possible, or to close the ring by fixing across it a layer of resistant tissue.

The cases in which an operation with a view to cure may be entertained are as follows: (1) Reducible femoral herniæ in young persons of either sex; (2) irreducible or strangulated femoral herniæ in adults; and (3) in small rather than large femoral protrusions.

But the operation should be undertaken only with the patient's or her friends' full knowledge that a cure cannot be confidently promised, and that a truss will have to be worn, at any rate for some length of time after the operation has been done. The relapse which occurs after a radical operation upon a femoral hernia is unfortunately frequently the beginning of a much more severe protrusion than the original hernia.

The **preparation** of the patient for the operation should be carried out on the same lines as for an inguinal hernia, especial care being taken to avoid the infection of the femoral wound from the adjacent genital organs. The **instruments** are the same, and the general arrangements similar to those in the instance of the inguinal operation (p. 125).

The **dressings** can usually be securely kept in place by a groin spica. The **skin incision** should in the majority of cases be a vertical one. Its length depends on the size of the hernia and the amount of fat in the subcutaneous tissue. Generally in an adult one commencing a little above Poupart's ligament and extending 2, or it may be 3, inches vertically down the thigh will be sufficient. It should be made over the most convex part of the swelling, though it may be well to let it be rather to the outer than to the inner side, so as to have it as far as possible away from the labium or scrotum (Fig. 62, p. 128).

In the primary incision it may be necessary to secure the superficial external pubic artery; after this the hæmorrhage is not likely to be troublesome. Care, however, must be taken to avoid any injury to the internal saphenous vein.

It is not infrequent to meet with some matting of the superficial tissues in cases where a truss has been previously worn, and in others, again, one or two lymphatic glands may be encountered, and should be removed.

A considerable amount of adipose tissue surrounds a femoral sac—in fact, so great may this be, particularly that derived from the extra-peritoneal layer, that it may be thought that a lipoma exists, and the peritoneal sac might therefore be overlooked. The fat should be carefully cut through until the sac itself is reached.

The serous protrusion is then dissected up until its neck lying in the femoral ring is laid bare. It is not unusual to find the sac thinned and even loculated, so that care must be exercised in separating it on the outer side, where there is some danger of damage being done to the femoral vein. When the sac has been freely exposed, an attempt should be made to reduce any contents that may still remain within it, provided that the case is not one of strangulation.

When that is the case the sac itself should be opened in a manner similar to that described when a strangulated hernia was dealt with (p. 71). If there is fluid within the sac, its escape will prove that the sac has been opened into; but in certain cases it may be a very difficult matter to determine whether or not the peritoneum has been incised, especially

where there is much fatty tissue, and when the omentum is adherent.

Adhesions within the femoral sac are rarely met with in the case of intestinal contents, except in those somewhat rare instances in which the vermiform appendix alone occupies the sac.

Omentum, on the other hand, is frequently found adherent, and its separation may be by no means easy, and sometimes impossible. It is important, however, that an attempt should be made to freely detach it, if feasible, and then to draw it down before it is ligatured, and cut away. All the remarks made when inguinal protrusions were being discussed apply with equal force in operations upon femoral herniæ (p. 130).

Some amount of difficulty may be experienced in the reduction of the omental stump through the femoral ring. No incision of the unyielding margins of this aperture is permissible, but they can be somewhat stretched without any harm being done. It is well, therefore, to so plan the ligation of the omentum as to insure its ready return within the abdomen. Its contents having been reduced, it now remains to deal with the sac. It is necessary that its neck be freed by the finger right up to, and even within, the femoral ring. The sac is to be then grasped, but in no way twisted, and drawn downwards, great care being taken that no viscera have again slipped into it. While it is on the stretch, it should be transfixed with a needle as high up as possible, and from without inwards, that is, away from the femoral vein. The needle is then threaded with fairly strong twist silk, and the loop drawn through and cut, after which the needle is removed. The two portions of silk are now interlocked and tied on the opposite sides of the neck of the sac. Finally one length, carried completely round the neck, is again tied, and all four ends cut short. The neck of the sac is then divided about half an inch below the site of the ligatures, and the stump allowed to retract of its own accord within the abdominal wall. In the majority of cases it is not necessary to deal with the stump of the sac further than this. If, however, the neck of the sac cannot be readily put on the stretch when it is being tied, it may happen that it

will not spontaneously disappear from view, and it is well then to leave two ends of the ligature long. These should be threaded through a herniotomy needle, the point of which is to be carried up through the femoral ring and made to traverse the tissues of the abdominal wall opposite the middle of the inguinal canal, and at least a finger's breadth above Poupart's ligament, the skin and subcutaneous tissues having been displaced to allow this. The needle is then unthreaded and withdrawn, and the free ends of the silk firmly tied in front of the aponeurosis of the external oblique muscle.

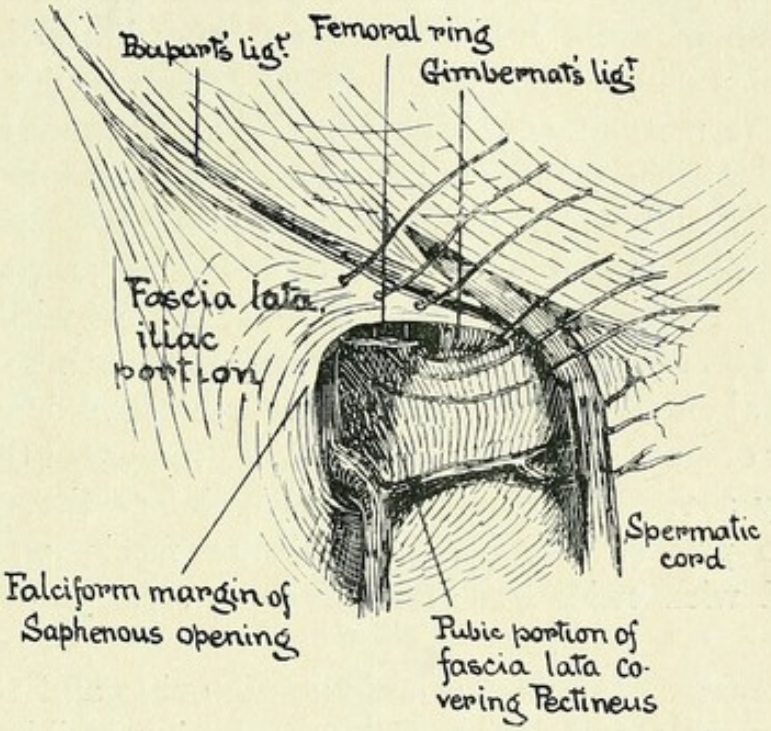

FIG. 86.—CLOSURE OF THE FEMORAL RING.

Care must be exercised in the male subject not to include any portion of the spermatic cord during this procedure.

The next step in the operation is the closure, as far as is practicable, of the femoral ring. When discussing the anatomy of femoral hernia, mention was made of a band of very strong fibres passing from the posterior aspect of the body and spine of the os pubis, outwards along the ilio-pectineal line, in front of Gimbernat's ligament, as far as the pectineal eminence. In addition there was noticed the upper curved margin of the saphenous opening, formed by the iliac portion of the fascia lata of the thigh attached to

the anterior aspect of the spine of the os pubis. It will be noticed that the former of these two ligaments, often styled Cooper's ligament, lies behind; and the other, sometimes designated Hey's ligament, lies in front of the femoral ring.

It is by attempting to bring these two portions of almost unyielding tissue as closely as possible into apposition that an effort is made to close the femoral ring in the best way. Even when this has been accomplished successfully, complete closure of the ring cannot always be guaranteed, partly because of the want of elasticity of the structures, and partly because no pressure can be allowed on the femoral vein. It is in some of these instances that it may be advisable to bring a flap of pectineal fascia upwards across the femoral ring. The method employed to approximate the ligaments may be described as follows: A curved hernia needle is taken unthreaded and passed through the fascia a little above the upper margin of Hey's ligament, close to the spine of the os pubis; on the right side this may be best done with the left hand. It is carried backwards until its point touches Cooper's ligament, behind which it is thrust, from above downwards, a matter of some difficulty owing to the firmness of the fibres. Then, by a twist of the handle, the point of the needle is made to project through the pectineal fascia, when it is threaded with twist silk and withdrawn, carrying the silk with it.

In certain cases where a large hernia exists and the parts have become much stretched, it may be impossible to pass the needle in one sweep as suggested. It will then be necessary to insert the suture in two stages, and it is probably easier to push the point of the needle, threaded with the silk, upwards through Cooper's ligament, and then to unthread and withdraw the needle. After this another needle having the opposite curve should be passed through Hey's ligament from before backwards, then threaded with the upper end of the suture already inserted, and withdrawn.

Two or even more of these closing sutures will be needed in the majority of instances, and they should all be placed in position before any are knotted. These are then tied so as to approximate the structures through which they pass.

Unfortunately, in some subjects, it is almost impossible to get a firm hold of Cooper's ligament on account of its being so tightly fixed down to the bone, and the operator has to be content with inserting a stitch through the more yielding pectineal fascia and muscle.

The superficial wound is closed with silkworm-gut sutures, and no drainage tube as a rule used. A dressing of the double cyanide of mercury and zinc gauze is to be accurately and firmly applied, so that by its means and that of the spica bandage, pressure may be brought to bear on the hollow from which the hernial sac has been removed.

Provided that matters progress satisfactorily, the wound should be examined about the eighth day, the superficial stitches removed, and the wound redressed. It is advisable that patients should be kept at rest in bed for at least sixteen days after the operation. They may then be allowed on a couch, and shortly after this resume their normal habits, avoiding, however, any great strain on the parts.

It is always advisable to order a light form of femoral truss after a radical operation, and a heavier one if no attempt has been made in cases of strangulation to thoroughly obliterate the aperture. Where the patient is over twenty years of age, it is not safe to discard the truss, unless there is good evidence that there is no inherent tendency to hernial protrusions. It should always be remembered that a perfectly-fitting femoral truss is very little irksome to the wearer, although an ill-shapen and improperly adjusted one will cause untold misery.

CHAPTER XIV.

UMBILICAL HERNIA: ITS ANATOMY, CAUSATION, SIGNS, SYMPTOMS, AND TREATMENT.

Definition.—An **umbilical hernia** is a protrusion at the congenitally weak spot on the anterior abdominal wall, where originally the umbilical cord was attached.

During the process of development the two lateral halves of the parietes of the abdomen approach one another and ultimately coalesce, save for the aperture through which pass the umbilical vessels. This opening is closed by scar-tissue subsequent to the fall of the cord.

The **Anatomy** of the umbilicus in the first few weeks after birth shows an arrangement of fibres of semi-elastic tissue in the form of a sphincter. These tend to become less elastic and more fibrous, so that they gradually contract, and, as it were, cut through the structures which originally traversed the opening.

At the same time the vessels become obliterated and themselves converted into a mass of scar-tissue, at first weak, but later of considerable denseness and firmness.

In adult life the umbilicus shows two sets of fibres about it, one decussating across the middle line, and the other of circular direction around the aperture or pseudo-aperture itself. These form the so-called ring, which is stronger at its lower than at its upper part. The scar-tissue in the upper margin of the opening is less firm than that in the lower, owing to the fact that in the former region there are only the remains of the umbilical vein, while in the latter are found the obliterated urachus and the arteries.

Umbilical herniæ may be classified as follows:

1. Congenital.
2. Acquired:
   (*a*) Infantile.
   (*b*) Adult.

CONGENITAL UMBILICAL HERNIA.

This form of umbilical hernia is the outcome of a failure in development, whereby the anterior abdominal wall fails to close at the region of the umbilicus, and thus leaves a

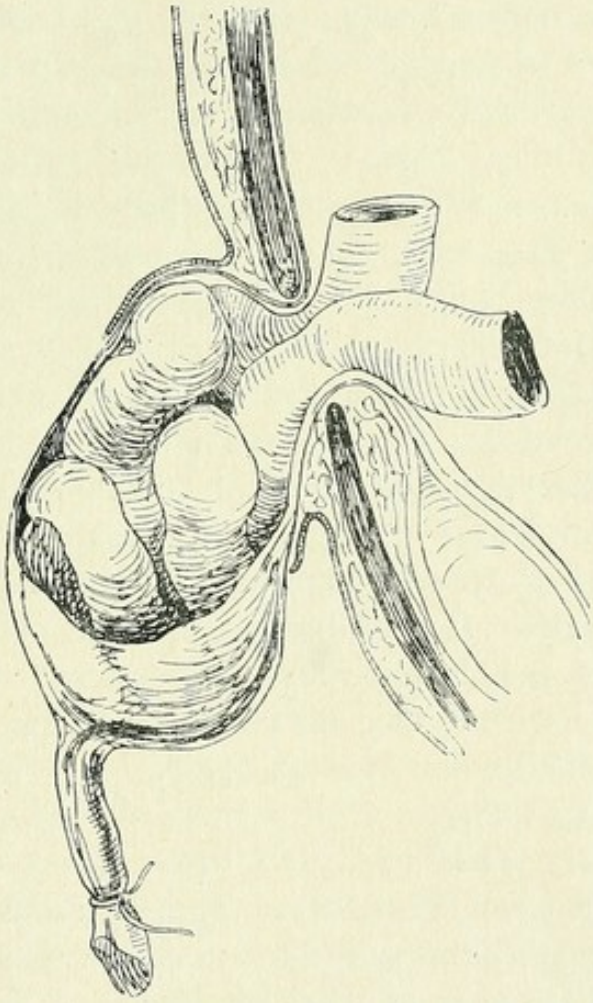

FIG. 87.—A CONGENITAL UMBILICAL HERNIA.

larger gap than is normal. In such cases the congenital want of closure will result in a deficiency which differs very considerably in its length, and which allows the abdominal viscera to push forward the material forming the base of the cord.

A congenital umbilical hernia may be aptly compared with a spina bifida. In both there is a failure of the lateral halves of the body-wall to coalesce, and in both there occurs a tendency to a protrusion more or less marked. In these umbilical herniæ there may be present merely a small projection of a knuckle of bowel, or Meckel's diverticulum, in a pouch at the base of the umbilical cord, and they then constitute herniæ at the root of the cord. The umbilical cord close to where it is attached to the abdomen will be found to be larger than normal, appearing as if it were distended. On pressure with the fingers the small portion of bowel can be reduced, often with the characteristic gurgle. It is the failure to discover such a condition which may lead to the very untoward circumstance of including the loop of gut if the umbilical cord is tied closely to the abdominal wall. Further, even if the cord has been ligatured at a safe distance from the abdomen, yet there is a tendency for the stump while separating to allow the intestine to become exposed, and fatal peritonitis to occur. But some of these less severe cases of congenital umbilical herniæ may survive if properly cared for. The cord should be tied at least 3 inches beyond the spot where it ceases to be of greater size than normal, and during the process of its separation the greatest precautions must be taken to rigidly exclude sepsis by the application of dry antiseptic dressings.

Possibly in some of these less pronounced cases a radical operation may with safety be undertaken, especially if the infant has reached a few months of age.

There are two forms of the more extensive congenital umbilical herniæ—one in which there is a moderate-sized protrusion of a sacculated nature, and the other where there is a wide gaping in the middle line of the abdominal wall, sometimes spoken of as an eventration.

In the former the skin at the base of the swelling is normal, but it very quickly and abruptly passes into the amniotic layer of the cord. Such herniæ are nearly always translucent, and frequently the contained viscera themselves can be seen. The umbilical cord will be found entering at the summit of the protrusion, though not usually in the

centre, being in most cases somewhat to one or other side and below. In some instances the bowel is the only viscus found in the sac, but in the larger forms other viscera may be present.

If subjects of this variety of congenital hernia are to be saved from death, the utmost care must be exercised to prevent ulceration of the thin coverings, in a manner similar to that which is adopted in cases of spina bifida. An antiseptic dressing should be applied in such a way that the stump of the cord protrudes through an orifice in it. The dressing may be kept in position—at any rate, around the base of the swelling—by the application of collodion. At the same time, some pressure by means of an elastic abdominal belt may be tried to prevent an increase in the extrusion. If the contents of the sac are maintained in their natural position within the abdomen, there is a tendency for the abdominal walls to close in from either side of the aperture. In certain favourable cases, where the child attains an age which will render an operation justifiable, say six months or more, removal of the sac-wall and suture of the edges of the gap may lead to a permanent cure.

In the third variety of congenital umbilical herniæ there is in reality an ectopia viscerum, or an eventration. In these instances a much more extensive failure in the closure of the anterior abdominal wall exists, and such is sometimes associated with a divided symphysis pubis and extroversion of the bladder. It is stated that many of these cases of large congenital umbilical herniæ are accompanied by defects in the development of the intestines, particularly that of the large bowel. As has already been indicated, infants who are the subjects of this extensive failure in the union of the two halves of the abdominal wall almost invariably succumb, either because of their not being viable on account of other defects, or because the sac gives way before, during, or after birth. There is the bare possibility that an operation might lead to a preservation of life.

ACQUIRED UMBILICAL HERNIA.

Infantile Variety.

It not infrequently happens that after the fall of the cord the cicatrix which is left becomes distended by the intra-abdominal pressure during the first few months of life. By this means a true hernial sac is formed, the parietal peritoneum having been pushed into the stretched and thinned cicatricial tissue, and into this sac viscera may protrude.

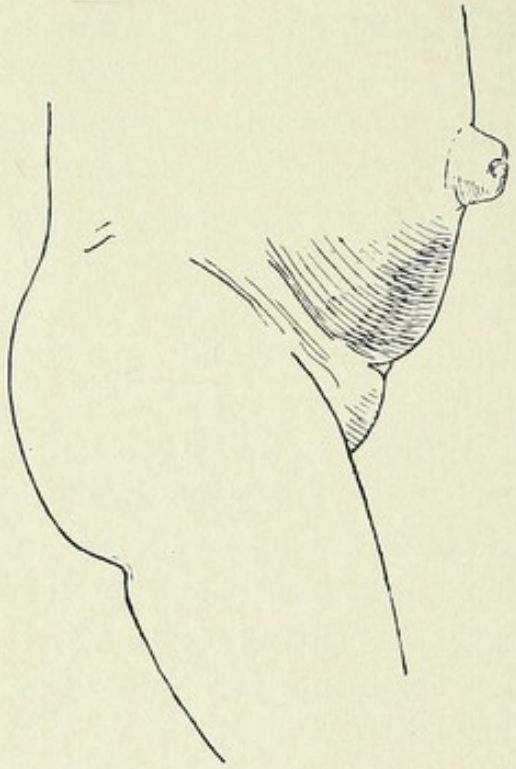

Fig. 88.—An Infantile Umbilical Hernia.

Causation.—The hernia is no doubt to a very large extent determined by intermittent acts of straining, such as are the outcome of constipation, phimosis, etc.; but improper feeding tends to produce a large quantity of gas in the intestines of infants, and thus it plays a considerable part in the formation of these protrusions.

It has been suggested that traction on a short umbilical cord, either before or subsequent to birth, may bring about an infantile umbilical hernia. The two sexes seem to be nearly equally affected.

Signs and Symptoms.—Infantile umbilical herniæ appear as conical, or in some cases cylindrical, protrusions, not unlike the short finger of a glove. When the child cries or strains, the increase in their size may be considerable. The contents of the sac are most commonly intestine, but omentum may also be protruded in some instances. They are practically always reducible, and but little inconvenience seems to arise from their presence.

Prognosis.—It is very rare to discover subjects in which the hernia has persisted from infancy into adult life, for in the majority of cases the protrusion disappears, spontaneous cure being the rule. They but seldom become the seat of strangulation.

Treatment.—In the treatment of infantile umbilical herniæ the factor of causation must be carefully taken into account and dealt with. Phimosis should be cured by circumcision. Errors in diet, leading to constipation and flatulency, must be corrected, and all conditions that tend to the increase of intra-abdominal pressure avoided. So usually is the natural termination one of cure, that but little more than the removal of the cause is required to bring about the disappearance of the lesion. However, it is generally advisable to apply some form of apparatus in order to hasten the desired end. If the contents of the sac be kept reduced, the quicker will the natural repair take place, for as long as the protruding viscera lie in the ring, just so long must the aperture remain patent.

There is one form of truss which has been frequently and strongly recommended, namely, that possessing a rounded pad, on the abdominal surface of which there is a small conical prominence. This is intended to fit into the ring of the umbilicus, and thus to press back the contents of the sac. It is obvious that if this projection did actually remain in the aperture it would effectually defeat the natural closure of the same. Fortunately, when such an instrument is applied to the infant's abdomen it but rarely preserves its position. This apparatus should be discarded.

Probably the best form of truss to use is a small umbilical one, fashioned after the same model as that which is neces-

sary in the adult (p. 183). The centre of the pad in the case of the child should lie directly over the umbilical aperture. In cases, however, where this form of truss is not well tolerated, owing to the tendency that it has to shift its position, a pad of soft material, such as lint, may be fixed over the opening by means of two strips of adhesive strapping. One of these is applied to the abdominal wall on the right side of the navel, and then brought over the pad, while the other is placed on the left side in a similar manner. Thus the two halves of the abdominal wall will be drawn together, and pressure maintained over the hernia.

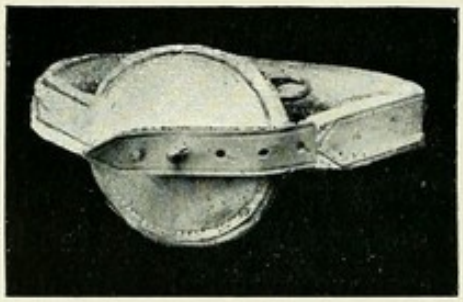

FIG. 89.—AN UMBILICAL TRUSS FOR AN INFANT.

Acquired Umbilical Hernia in Adults.

Protrusions at the umbilicus after infancy are extremely rare until the age of twenty-five has been reached, and then, when they begin to be more frequent, they occur much more commonly in the female than in the male sex.

Causation.—The causation of this form of umbilical hernia is mostly dependent upon obesity, which produces a considerable amount of increase in the intra-abdominal pressure from the deposition of fat in the omenta and mesenteries.

In the female subject, in addition, pregnancy plays an important part in the production of umbilical herniæ. The protrusion escapes through the umbilical ring, raising the umbilical scar on its summit, but frequently throwing it over to one or other side. It is only when the sac finds its way through the navel itself that it should be designated umbilical, for ventral herniæ may occur close to the umbilicus,

passing through the linea alba. The muscular tissues of the abdominal wall in persons who are the subjects of acquired umbilical herniæ are generally flabby and stretched, and the abdomen seems overfull. This form of hernia, at first small and button-like, may attain enormous dimensions, and afford lodgment to a large proportion of the great omentum and the subjacent bowel. It is not infrequent to have the transverse colon, in part or as a whole, and even the stomach in the sac.

In large umbilical herniæ the peritoneum forming the sac-wall becomes much thinned, and in certain cases fenestrated, whereby the contents have a great tendency to become adherent to the tissues without the sac. The sac moreover is not uncommonly divided into loculi—a fact which it is important to remember, since intestine may be strangulated in one of these loculi, and perfectly free in another. In other instances the omentum may form an almost complete lining to the peritoneal sac, and within this omental sac may lie the bowel.

Signs and Symptoms.—These acquired umbilical herniæ in adults appear as rounded or transversely oval swellings in the region of the umbilicus, but with a marked tendency to hang or sag down towards the symphysis. They are often lobulated in form, and in some instances show very distinct prominences at certain places. To the touch they are of varying consistency, being tense and elastic in some parts, and harder and less elastic in others. There is usually an impulse on coughing of an expansile nature.

Pain is not an infrequent symptom, and there is generally much digestive disturbance in the form of nausea, actual vomiting, constipation, or even diarrhœa. A sense of heaviness and dragging is greatly complained of in some cases.

Prognosis.—An umbilical hernia cannot be lightly estimated, since it is very liable to grave complications which may put life itself in danger. Irreducibility of this form of hernia is extremely common, and arises from the same causes that are at work to produce it in other varieties of hernia. Increase in the bulk of the contents of the sac after they have been

protruded, the formation of adhesions between the sac-wall and its contents, or between the contents and the tissues without the sac, or of adhesions between the different parts of the contents themselves, all tend to bring about irreducibility. Since omentum is so generally to be found within the sac of an umbilical hernia, its increase in size by the deposition of fat will soon render it incapable of being reduced. Inflammation of umbilical herniæ, owing to their exposed position, etc., not infrequently occurs, and repeated attacks are very prone to cause the formation of adhesions.

Incarceration or obstruction is also by no means uncommon in the umbilical herniæ of adults, induced by the fact that the sac is the recipient of the large intestine, which, becoming loaded with fæces, leads to obstruction. Strangulation, moreover, is all too frequent, and when it occurs the prognosis is very grave.

Acquired umbilical herniæ of middle life are seldom, if ever, spontaneously cured. Sometimes, partly due to the pressure of an ill-fitting truss, and partly because of friction of the overlying clothing, the skin of the protrusion becomes excoriated and later even ulcerated. In certain cases this has led to perforation of the sac and consequent septic peritonitis.

Treatment. — An umbilical protrusion must always be looked upon as a somewhat serious condition, and its treatment should not be delayed. As in other forms of hernia, the treatment may be (1) palliative, (2) operative or radical.

The Palliative Treatment of Reducible Acquired Umbilical Hernia in Adults. — Seeing that an umbilical hernia is so commonly the outcome of obesity, the first step in its treatment should be to endeavour to lessen the amount of adipose tissue by careful dieting and other recognised means. At the same time attention must be paid to any other causes which may lead to increased intra-abdominal pressure. The application of a suitable truss is most desirable, for it is important to procure an upward and backward pressure over the swelling, in order to prevent the descent of fresh

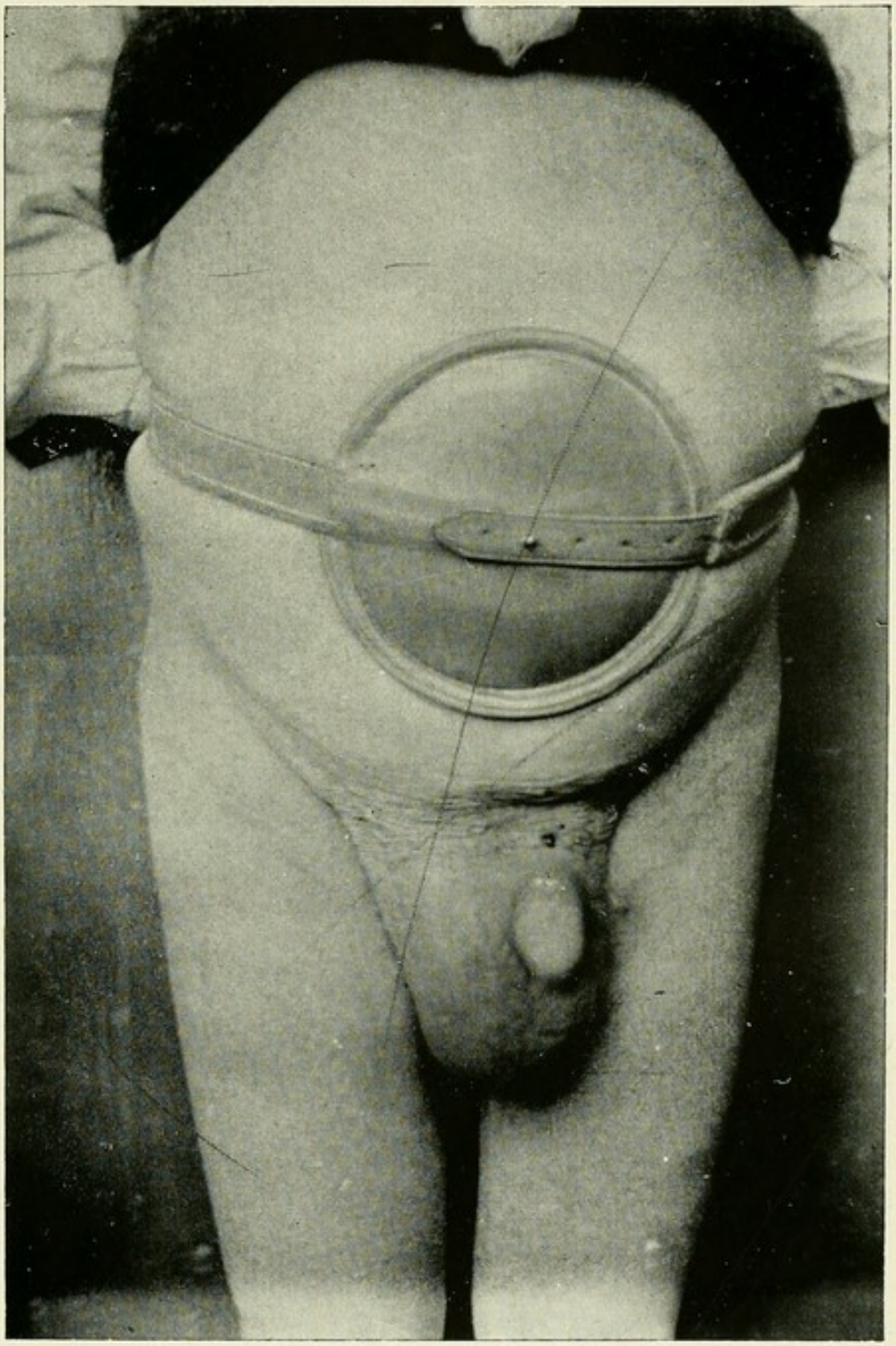

FIG. 91.—AN UMBILICAL TRUSS ADJUSTED.

To face p. 182.

viscera, and to keep reduced those that have been in the habit of protruding.

Such a truss in the majority of cases consists of (1) a slightly concave and circular pad made of metal, and of a size considerably greater than that of the hernial swelling; (2) a steel spring, usually immovable, fixed to one side of the pad, and passing round the trunk for at least three-quarters of its circumference. The whole truss is to be covered with leather of the ordinary kind on the aspect away from the surface of the body, and of chamois leather on that which is in contact with the skin. From the end of the spring the leather is prolonged as a strap, which is to fasten to a stud on the anterior surface of the pad at its centre.

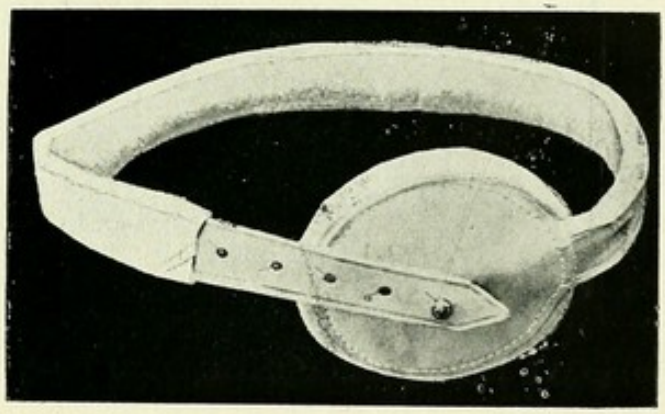

FIG. 90.—AN UMBILICAL TRUSS FOR AN ADULT.

In order to obtain the correct size of the truss, it is requisite to measure with a tape laid horizontally around the abdomen, and drawn decidedly taut at the level of the middle of the swelling or a little below it.

In adjusting this form of truss, it is well to place it in such a position that the upper edge of the instrument corresponds with the upper margin of the hernial protrusion, and this is particularly necessary in the corpulent who have very prominent abdomens. In this way the sufferer, when assuming the erect posture, will find that the truss exercises a beneficial pressure in a direction upward and backward, seeing that the abdominal walls will fall forward or bulge. If the patient is excessively stout, then two broad pads are to be attached to the sides of the spring, so that this some-

what narrow portion of the truss may not cut into the flanks of the wearer.

Another form of umbilical truss suitable for reducible herniæ in those subjects who are not obese, and particularly for men, is that known as the Salmon and Ody. This has a semicircular spring, with two pads of unequal size, fixed by movable joints to each end of the spring. The smaller pad is that which is to rest over the spine near the middle line behind, while the larger comes over the hernial swelling in front, and the two are connected round the opposite side of the abdomen by means of a flexible strap, fastening to two studs on the face of the anterior pad.

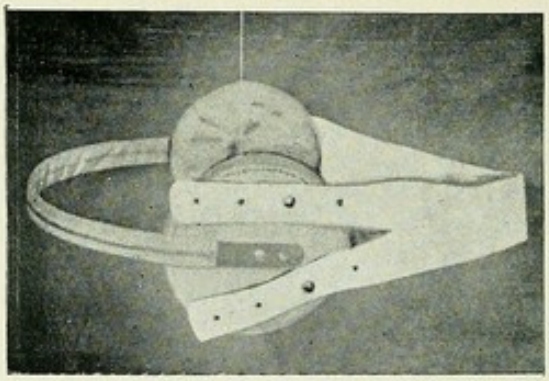

FIG. 92.—A SALMON AND ODY UMBILICAL TRUSS.

Occasionally when the abdominal walls are very lax, it is desirable to adjust a well-fitting abdominal belt, and then in front of this to place a large-sized ordinary umbilical truss. By this arrangement more support and pressure will be obtained without inconvenience to the patient.

The Palliative Treatment of Irreducible Acquired Umbilical Hernia. — Unfortunately, as has already been indicated, umbilical herniæ readily tend to become irreducible, and then their palliative treatment is a matter of some difficulty and uncertainty. In some cases where the protrusion is but small a similar truss to that used for a small reducible umbilical hernia will answer all purposes, and may lead to the reduction of the contents of the sac. But when the hernia has reached large dimensions, it will require a rim-plate truss. This consists of a truss like that which has been above described, but the pad of which is composed of

a ring of metal, circular or oval in shape, with the open space covered in by means of chamois leather, so as to form a shallow bag. The size of the rim must be accurately adapted so that it extends somewhat beyond the limits of the circumference of the protrusion. Further, in this truss, in order to insure steadiness, and because there is no place for a stud on the anterior surface of the pad, the strap passing from the end of the spring is divided into three portions, which are fastened to buckles attached to a leather facing.

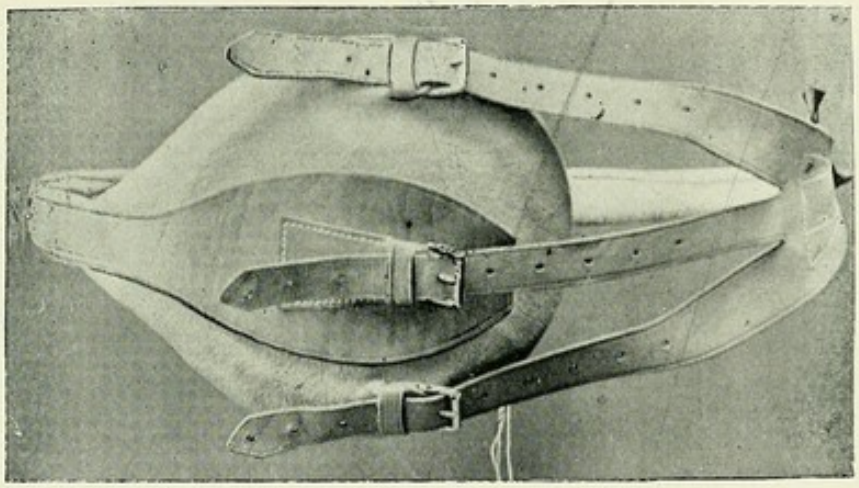

FIG. 93.—A RIM-PLATE UMBILICAL TRUSS.

Such an appliance not only tends to support the protruded viscera, but helps to prevent the descent of other portions of the abdominal organs, and may even bring about reduction of the contents of the sac.

An abdominal belt alone is of little or no use in the treatment of umbilical herniæ, but should be supplemented by an ordinary umbilical truss, worn external to it. Careful dieting, and the consequent diminution of the amount of superfluous adipose tissue, may lead to the reduction of certain herniæ which were previously irreducible, and thus to their being capable of treatment, as before indicated.

The Operative Treatment of Reducible and Irreducible Acquired Umbilical Herniæ.—In persons who are not obese an umbilical hernia is infrequently the source of much trouble or danger, and is usually easily controlled by a suitable truss.

But this class of subjects undoubtedly form the most favourable for a radical operation on their hernial protrusion, and in them the probability of cure is considerable. It is, however, in the corpulent, in those who are often the subjects of disordered renal organs and of fatty hearts, that the greatest danger from strangulation exists, and, unfortunately, such patients are the most unfavourable for any operative procedures.

If the hernia, moreover, is irreducible, a further difficulty is added to its ready treatment by operation. These irreducible herniæ are liable to grow to an unwieldy size, and to give rise to much misery, so that patients would rather risk the effects of a severe operation than retain the burden they have. But they are often the site of internal adhesions, which may render the reduction of the contents, even after their exposure, a matter of no little difficulty, and in some cases one of impossibility.

Another fact militates against a radical operation in these large protrusions, namely, that when extruded the viscera may have their normal habitat within the abdomen filled up by the deposition of fat, so that, literally, there is no room left for the organs when an attempt is made to return them by operation.

It is, therefore, most necessary to carefully consider the case of a patient with a large irreducible umbilical hernia before advising that it should be treated by operation.

In the more favourable instances an operation may be undertaken if it is thought desirable, with a view to the return of the viscera, the extirpation of the sac, and obliteration of the aperture.

In the actual operation, the patient having been carefully prepared in every way, a vertical incision is made over the tumour, starting a short distance above its upper limit, and extending somewhat below its lower margin. While this is being done, considerable caution must be exercised, so as to avoid the wounding of any of the contents which may be adherent, for the superjacent tissues are often much thinned.

The sac having been reached and opened, it is necessary to search for any loculi that it may present. The omentum

that these contain is to be carefully unravelled, the adhesions, if any, separated, and the protruded portion ligatured and removed in the manner described under the account of the operation for inguinal hernia (p. 131). Many of these adhesions in old herniæ are so tough that it is well to leave them undivided, and to remove the adherent omentum with the sac-wall at the later stage of the proceedings. The intestine should be looked for lying behind the omentum, or within it, and if it is the small bowel, it is to be returned at the earliest possible moment, as it is but seldom adherent. The large gut, on the other hand, is very prone to form adhesions, and is, consequently, much more difficult to reduce; however, if the omentum is freely separated, then the colon is usually returned with comparative ease.

The stump of the ligatured omentum having been put back within the abdominal cavity, it remains, after removal of the sac, to close the umbilical aperture. The opening is temporarily closed with a sponge in the grip of a pair of pressure forceps; then the sac-wall is dissected up from the tissues of the abdominal parietes in which it is lying adherent. This will be a matter of some difficulty in certain cases, and it may be advisable to endeavour to reach the neck of the sac without actually separating the whole of the fundus. The protruded serous membrane is then to be cut away, so as to leave an opening in the anterior parietal peritoneum. The sponge is removed, all hæmorrhage arrested, and the aperture in the serous membrane closed by a continuous suture of fine silk. The obliteration of the umbilical aperture is not always an easy matter, especially when it has been considerably dilated. If it is of only moderate dimensions, then it is sufficient to freshen its edges, and to bring them together by a series of interrupted sutures of stronger silk than that used for the peritoneum.

If there is much separation of the recti, and the margins of the aperture are surrounded by thick edges, then it is preferable to divide these margins in such a manner that they will be separated into two layers, and the muscular tissue of the recti will be exposed in the whole length of the wound. The posterior layer thus formed is sutured by interrupted silk

stitches to its fellow on the opposite side. Then the exposed muscular fibres are brought together in a similar manner, and, lastly, the anterior layer is to be approximated. Above all these buried sutures, the subcutaneous tissue and skin are to be united by a row of silkworm-gut stitches, and in some instances a drainage-tube is to be inserted at the lowest angle of the wound for the first thirty-six hours.

The patient should be kept after the operation in the recumbent position as far as is consistent with the general condition, for at least a fortnight, and the abdominal wall is to be carefully supported by a suitable belt or truss immediately the patient arises from bed. This should in most cases be continued indefinitely, as the tendency to relapse is very great.

INCARCERATED UMBILICAL HERNIA.

From the facts stated above, it will be seen that umbilical herniæ are those in which incarceration or obstruction most frequently occurs, since they are so prone to contain the large intestine, within which fæces may so readily accumulate.

The signs and symptoms of incarceration have already been dealt with (p. 34). When such arise in a patient advanced in years the prognosis is very grave. The symptoms are not infrequently mistaken for those of strangulation, and, indeed, some cases may run on into that condition. The treatment to be adopted should consist of copious enemata, then taxis, or kneading the swelling, and the subsequent administration of a laxative.

If any doubt exist as to the true state of affairs, it is always safer to operate than to run any risk of allowing any portion of imprisoned bowel to become gangrenous.

STRANGULATED UMBILICAL HERNIA.

No class of herniæ when strangulated has a graver prognosis than that of strangulated umbilical herniæ in adults, especially if the sufferers are corpulent. The hernia was, previously to the strangulation, most probably irreducible, at

any rate, to a considerable extent, and this fact renders taxis very uncertain, for it is almost impossible to say whether the strangled bowel has or has not been satisfactorily returned. The strangulation is very liable to be extremely acute, particularly where the gut is imprisoned in a loculus, and the intestine may rapidly lose its vitality.

Probably most of these cases have the best chance of relief by immediate herniotomy, desperate as the procedure may appear. The operator must be prepared to meet with considerable, and, it may be, insuperable, difficulties. The plan of the operation is similar to that which has been described for non-strangulated herniæ ; but it must be always borne in mind that a small knuckle of bowel may lie hidden in a loculus, or among the omentum, and if not diligently searched for, may be overlooked.

An attempt should be made to perform a radical operation if the patient's general condition will allow of it.

An efficient truss should be always worn subsequent to the operation, provided the patient survive.

CHAPTER XV.

VENTRAL, OBTURATOR, AND LUMBAR HERNIÆ.

VENTRAL HERNIA.

Ventral Herniæ are those protrusions which pass through the anterior abdominal wall at spots other than the inguinal, femoral, and umbilical regions. They are always acquired, that is to say, they are formed after birth, though it is doubtless true that there may be a congenital weakness which may predispose to them. They may be developed either spontaneously or as the result of a wound of the abdominal parietes, the latter form constituting the so-called traumatic ventral hernia. The common sites through which the spontaneous protrusions take place are the linea alba, the lineæ semilunares, and more rarely the lineæ transversæ. The traumatic, on the other hand, may occur at any point.

Spontaneous Ventral Hernia.

Spontaneous Ventral Hernia in the Linea Alba.—The linea alba, as a definite fibrous interval between the recti abdominis muscles, only exists above the umbilicus, and it is here that it is most usual to find the spontaneous ventral herniæ. In women, however, and generally in those that have borne children, and are over thirty years of age, there is sometimes a considerable separation or divarication of the recti, extending for a part or the whole length between the ensiform appendix and the symphysis pubis, but most marked below the navel. A somewhat similar condition may occasionally be observed in children above the umbilicus, but not in so great a degree.

Rarely an abdominal tumour may produce a like separation in the male sex. Such disastasis is readily recognised by directing the patient while recumbent to raise the head and shoulders from the couch, when there will be seen a more or less prominent and vertical swelling in the middle line of the abdominal wall, and if the fingers be pressed in on either side of this the edges of the separated recti will be easily felt. This condition does not give rise to much inconvenience in the majority of instances, but should be

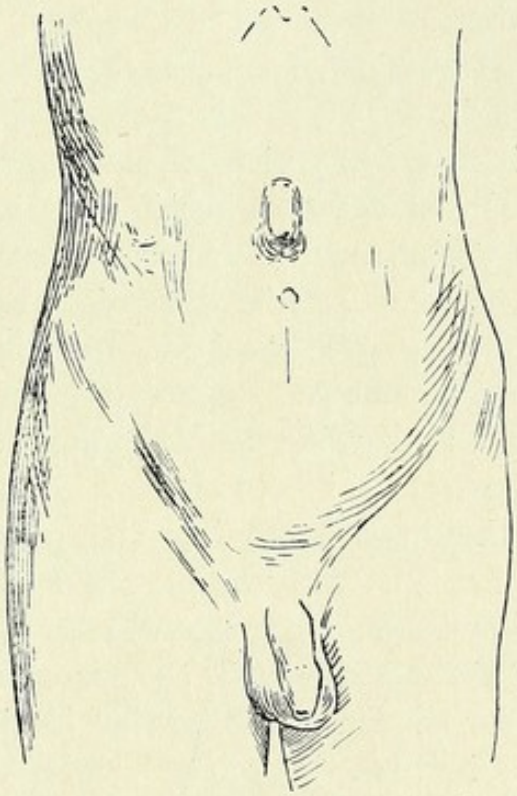

FIG. 94.—VENTRAL HERNIA IN THE LINEA ALBA ABOVE THE UMBILICUS.

treated by the application of a well-fitting abdominal belt, with the addition in some cases of a large umbilical truss adjusted over the belt.

If the tone of the abdominal muscles is good, over and above the separation of the recti, it may be advantageous to advise that a radical operation should be performed, on the same lines as those laid down for protrusions at the navel.

The other forms of hernial swellings in the linea alba, and the similar ones in the lateral lines mentioned above, are

commonly the outcome of a protrusion of extra-peritoneal fat through the fibrous material forming the lines themselves. There is usually in addition a congenital aperture, or an acquired opening between the interlacing fibres making up the linea alba.

Such herniæ are most frequently found above the umbilicus, and particularly so in the male sex. When they do occur below the navel, women are those usually affected. They are most prone to develop during middle life, but if they are dependent upon a congenital aperture in the fibres they may be seen in children.

The protruded portion of the extra-peritoneal tissue sooner or later tends to draw a finger-like process of peritoneum with it, and into this may slip a piece of omentum or other viscus. Gradually the size of the opening in the linea alba, and the amount of the peritoneal sac, increases, but it is uncommon to find these ventral herniæ assuming large proportions. Most generally they give rise, at any rate in their early stages, to a considerable degree of local pain, associated with various symptoms referable to the alimentary tract. The fatty part of the hernia is not usually reducible within the layer forming the linea alba, but the contents of the sac of peritoneum can generally be returned into the abdomen. Strangulation sometimes occurs, and may be very acute.

Treatment of Ventral Hernia in the Linea Alba.—The treatment of these forms of ventral herniæ is similar to that of small umbilical herniæ. For the herniæ which are found above the navel, in patients who are not stout, nothing is more satisfactory than a Salmon and Ody's umbilical truss, with a spring not too strong. For protrusions below the umbilicus, an ordinary umbilical truss will be found to be most suitable.

Operative procedures are almost always attended with great success in this class of case, and should therefore be urged, provided that there is no contra-indication, in all instances where there is much pain or other inconvenience. The details of the operation are like those given for the treatment of umbilical herniæ. In some cases when exposed the small tag of extra-peritoneal tissue will be found to

resemble a raspberry, having been converted, probably by slight continuous constriction, into a mass of dilated venous channels. It is not requisite to prescribe a truss after a radical operation on a spontaneous ventral hernia.

Spontaneous Ventral Herniæ occurring in the Lineæ Semilunares are not nearly so commonly met with as those in the middle line. Allusion has already been made to the fact that the so-called direct inguinal herniæ are many of them in reality of the nature of protrusions in the lineæ semilunares at their lowest part (p. 145).

The majority of these herniæ occur below the level of the umbilicus, and do not assume much magnitude. They are rather more common on the left side than on the right, appear usually after middle life, and in both sexes equally. They resemble very closely those found in the linea alba, both as regards causation and form. They are best treated with a small truss of the umbilical pattern, or, in some instances, with one with an interstitial plate; or, again, they may in suitable subjects be dealt with by means of operation of the same nature as that described for herniæ in the middle line.

Traumatic Ventral Hernia.

The protrusion of parietal peritoneum, with stretching of the cicatrix over it, may occur after any operation or other penetrating wound of the abdominal walls, except those of very small dimensions.

These herniæ are, however, most commonly found subsequent to laparotomy incisions in any part of the abdomen, and are frequent in those instances where muscular tissue has been divided and imperfectly sutured or united. They may also be brought about by suppuration in the abdominal wall, leading to a weak scar. Their position varies with the site of the cicatrix, but below the umbilicus is the region which is more prone to their formation than any other. Although they may appear at any age, yet they are more liable to form in the old than in the young.

Causation.—The occurrence of ventral hernia, after laparotomy and other wounds of the abdominal wall, demands

the closest investigation. Insufficient or imperfect suturing, drainage, sepsis, too early pressure upon the scar, or failure of adequate external support, are all factors which may lead to this distressing after-effect of section of the abdominal parietes. There is considerable difference of opinion as to the best methods whereby the severed tissues in laparotomy wounds should be brought into apposition, but it is becoming fairly universal now to recognise that it is good surgery to insert at least three layers of sutures in such incisions. The first is to be a continuous one of fine silk, to bring the cut edges of the parietal peritoneum together; the second of stronger silk, or of kangaroo-tail tendon or carefully prepared catgut, to approximate the fasciæ and muscles by an interrupted series of stitches; while the third is, again, a row

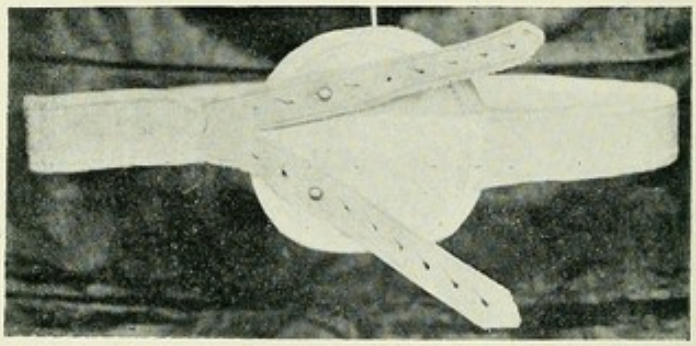

FIG. 95.—AN UMBILICAL TRUSS WITH THE LOWER EDGE CUT STRAIGHT.

of sutures of silkworm-gut, to close the skin and subcutaneous tissues. The first two tiers of stitches are therefore buried and remain permanently, while the superficial may be removed after ten days. There is also a difference of opinion as to whether support by the adjustment of an abdominal belt should be secured after a laparotomy. If the wound is in the lower half of the abdomen, or the patient is past middle life, or after convalescence is likely to have severe strain upon the cicatrix, then it is advisable to prescribe such an appliance. Such is the prophylaxis of ventral herniæ following traumatism.

Treatment of Traumatic Ventral Herniæ.—Should, unfortunately, a traumatic ventral hernia develop, in its early stages it is best treated by the pressure of a truss similar to that used for an umbilical hernia; and if the protrusion is close

above the symphysis pubis, it is well to have the lower edge of the pad cut straight, in place of the usual curved form.

In cases where the hernia is at the site of an incision made away from the middle line, as for the removal of the vermiform appendix, a truss with an interstitial plate will be requisite (p. 150).

By means of properly applied pressure, increase in the size of the protrusion will be prevented, and even actual diminution brought about. If there is a distinct history that the approximation of the edges of the wound was for some reason or other imperfectly accomplished, it will be advisable to undertake a secondary operation with a view to the closure of the aperture by careful suturing, but this is only likely to be of lasting benefit when the abdominal muscles are firm and the patient comparatively young.

In some cases the hernial protrusion assumes a very large size, and may be the site of serious complications, such as strangulation, incarceration, ulceration of the thinned skin covering, and even sloughing of the sac-wall, or intestinal obstruction the outcome of adhesions within the sac. Many of these more severe cases may be submitted to operation for the same reasons as the complicated umbilical herniæ. The utmost care must be exercised to avoid any danger of injuring the viscera lying within the sac when operating on these traumatic ventral herniæ.

OBTURATOR HERNIA.

An **obturator hernia** is one that protrudes through the obturator foramen in the os innominatum, and so into the upper part of the thigh. When the parietal peritoneum is forced through this opening, it carries in front of it the extra-peritoneal tissue and the pelvic fascia, and when it reaches the region of the thigh it passes upwards and forwards above the upper margin of the obturator externus muscle, so as to lie behind the pectineus. Occasionally it may force its way between the obturator externus and the obturator membrane. The obturator nerve is sometimes raised in front of the swelling, but is more usually found on the outer side, and at other

times behind the sac. The corresponding artery follows the same course as the nerve in its relation to the sac-wall.

Causation.—Obturator herniæ are much more frequent in elderly female subjects than in any other class of persons. Both sides seem to be equally liable to be affected, and occasional instances of the hernia being bilateral have been recorded. It is believed by some to occur more commonly in women who have been stout and then have rather rapidly

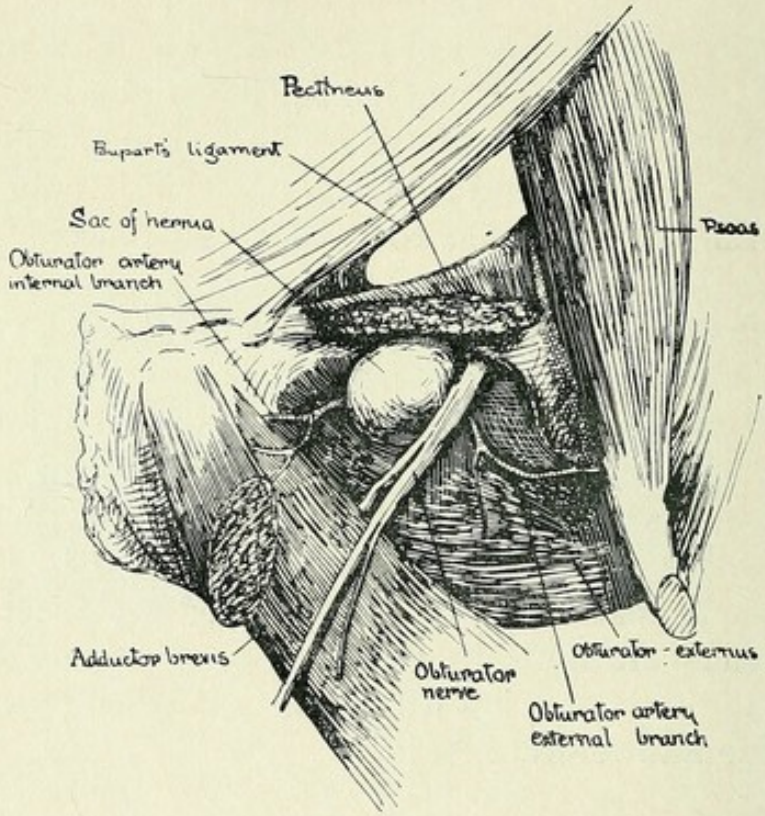

FIG. 96.—OBTURATOR HERNIA.

lost flesh, and in those who have borne children rather than in those who are nulliparous.

Signs and Symptoms.—Most usually this form of hernia is not recognised until strangulation is present, and even then the source of the intestinal obstruction may not be referred to the obturator region. Commonly there is little or no swelling in Scarpa's triangle, though in some cases a fulness may be found below the inner end of Poupart's ligament, somewhat resembling a femoral protrusion. It is from the internal aspect of the thigh that the tumour can be most readily palpated, just below and behind the origin of the

adductor longus muscle. Moreover, it is possible to explore the inner surface of the obturator aperture by the finger introduced into the vagina or rectum. Occasionally, moreover, pain may be referred over the area of the distribution of the obturator nerve.

Treatment.—If an obturator hernia is diagnosed in a non-strangulated condition, it is proper to advise that the swelling should be explored and treated radically, for the danger of strangulation is great, and no form of truss can be of much service. It has been estimated that 85 per cent. of these cases die when once the nipping of the contents of the sac occurs. When intestinal obstruction comes on in women well advanced in years, it is always right to bear in mind the possibility of a strangulated obturator hernia. If this should be suspected but not made sure of, then a laparotomy, either in the middle line or in the linea semilunaris of the same side, should be performed, and the imprisoned viscera released from the abdominal aspect of the obturator foramen. Here the constricting band can be easily divided, and the contents of the sac withdrawn, care being taken to avoid fouling the peritoneal cavity. The ring is to be incised in a direction downwards and somewhat inwards, so as to escape wounding the artery.

LUMBAR HERNIA.

Any protrusion occurring behind the lineæ semilunares, and between the last rib and the crest of the ilium, is spoken of as a **lumbar hernia.** They may be congenital or acquired, and the acquired form may be either spontaneous or traumatic. The congenital cases occur owing to a deficiency of the muscular tissue of the abdominal wall in the region specified, and such a condition is not infrequently bi-lateral. The acquired variety of the affection is usually due to imperfections of the abdominal wall, the result of operation or of suppuration, and are then termed traumatic. In other instances, again, a true spontaneous hernia may appear at one of the weak spots. These are known as the triangle of Petit and the upper lumbar triangle, which latter consists of a gap close below the last rib, where the aponeurosis of the

transversalis abdominis muscle has only the latissimus dorsi muscle lying superficial to it.

Such lumbar herniæ have to be diagnosed from: (1) lipomata; (2) abscesses; and (3) fibromata occurring in the region. The presence of an elastic swelling with a distinctly

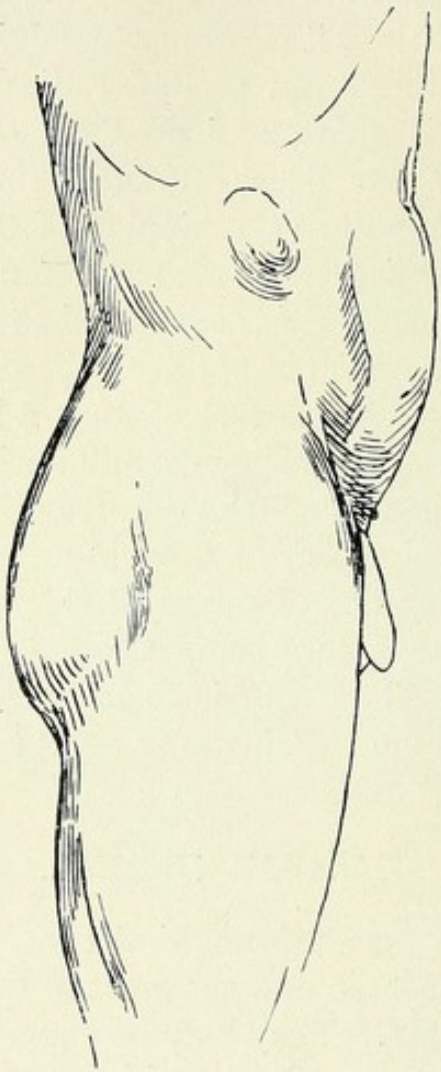

FIG. 97.—A RIGHT LUMBAR HERNIA.

expansile impulse on coughing or other straining effort, possibly an aperture in the abdominal wall that can be felt, and the ready reducibility of the contents of the sac, all clearly indicate the nature of the tumour as that of a hernial protrusion. A suitable truss, or perhaps in some cases a belt, is the best means of treating these rare herniæ.

CHAPTER XVI.

SCIATIC, PERINEAL, ISCHIO-RECTAL, VAGINAL AND DIAPHRAGMATIC HERNIÆ.

ALL these forms of hernia are very rare, and frequently their recognition does not take place until after the death of the patient, which death may have been the outcome of the hernia itself.

SCIATIC HERNIA.

Only a few examples of this variety of protrusion are on record. It occurs through the great sacro-sciatic foramen, and the swelling so formed constitutes one of the sub-gluteal tumours. It is, moreover, one that possesses an expansile impulse on cough, which fact in itself will serve to distinguish it from many of the other gluteal swellings.

Causation.—Nothing is really known concerning the causation of a hernia in the sciatic region, but seeing that a considerable proportion of the recorded cases were in infants, some authors have believed that there was a congenital factor at work in their production. Both sides appear to be equally affected, and both sexes may suffer from the condition.

Anatomy.—The peritoneal protrusion may escape either above or below the pyriformis muscle, but probably more generally in the latter position.

At first it lies deep to the gluteus maximus muscle, but as the protrusion enlarges it may pass from beneath the lower border of the muscle and reach the upper part of the thigh on its posterior aspect.

Signs and Symptoms.—It is obvious from its position that when the hernia is but small there is only slight, or even no,

evidence of an external swelling. Some pain may be elicited on deep pressure at a spot about the junction of the upper with the middle third of a line joining the posterior superior spine of the ilium with the summit of the great trochanter and possibly a fulness may be detected in this region.

A large hernia produces one of the distinct tumours of the gluteal region, and one with a marked impulse on cough, and one which may have its bulk reduced by direct pressure upon it, together with gurgling if intestine is present within it. The hernia may become the seat of strangulation.

Contents of the Sac.—It is an interesting fact that out of the comparatively few recorded cases of this rare form of hernia, besides intestine and omentum, the bladder and the ovary have been found on more than one occasion.

Diagnosis.—A sciatic protrusion has to be distinguished from the following conditions: Gluteal cyst, hæmatoma, abscess, lipoma, aneurism, and possibly a spina bifida.

Treatment.—Probably the best line of treatment to be adopted in the present day would be to submit the patient to operation, unless this for any reason was entirely contra-indicated. If truss pressure must be employed, the apparatus should take the form of a steel spring encircling the pelvis, and having a pad fixed to an arm at the postero-lateral part of the spring.

An operation with a view to a cure in a reducible protrusion may be undertaken either from the gluteal aspect, or by the performance of a laparotomy from the inner surface. If strangulation should be in evidence, it is best to deal with the hernia from its pelvic side by opening the abdomen in the middle line.

PERINEAL, ISCHIO-RECTAL, AND VAGINAL HERNIÆ.

Although it is very common to observe instances of prolapse of the pelvic viscera, yet it is extremely rare to meet with a protrusion of these organs through an aperture in the undescended pelvic floor.

Anatomy.—Perineal herniæ occur in men, and are usually formed by the protrusion of the recto-vesical pouch, and

tend to work their way downwards and forwards between the rectum behind and the bladder in front.

If an external swelling is produced it is generally seen on one or other side of the middle line; but occasionally it bulges the centre of the perineum.

In both sexes the protrusion may pass into the ischio-rectal fossa.

In the female it is probable that a true perineal hernia does not occur, owing to the close application of the rectum to the posterior surface of the vagina. If the lower part of Douglas's pouch happens to be pushed down, it is usual for the sac to work its way forwards into the vagina, or laterally into the ischio-rectal space or posterior part of the labium.

It is the rule for the peritoneal protrusion to pass through gaps between the different parts of the levator ani and coccygeus muscles.

Causation.—A congenital tendency in the form of want of proper development of the muscles constituting the floor of the pelvis would appear to be present in most cases. The female sex is a predisposing cause of true pelvic herniæ, which are five times more common in women than in men.

Signs and Symptoms.—Whenever protrusions of this nature exist they are characterized by the usual signs and symptoms of a hernia, and these sufficiently serve to distinguish the swellings from others that may occur in the same regions. They are accompanied, as a rule, by pain and discomfort.

Contents of the Sac.—One or two instances of enormous herniæ through the pelvic floor have been recorded, into which nearly the whole of the abdominal contents have prolapsed. Occasionally the bladder is one of the viscera protruded into the smaller herniæ, together with small intestine.

Treatment.—In order to completely reduce the contents of the sac it is generally sufficient to apply external pressure upon it, but it may be necessary to introduce two or more fingers into the vagina or rectum, and to exercise pressure on the sac between them and the lateral pelvic wall.

It is a question whether, if it is feasible, all cases of pelvic herniæ should not be submitted to operation with a view to

cure, a support in the form of a pessary, or perineal truss being worn after the sac has been removed and the hernial aperture closed.

In women a vaginal pessary not infrequently answers satisfactorily in maintaining the viscera within the abdomen.

If strangulation occurs, it is not usually difficult to reduce the contents without, or with, operative measures.

DIAPHRAGMATIC HERNIA.

As has been pointed out previously, this form of the escape of abdominal viscera is not, strictly speaking, a hernia that can be said to have any external evidence, seeing that the organs are protruded into the cavity of the thorax, and are therefore hidden from view. Yet it is a true hernia, and should command notice.

Anatomy and Causation.—There may be, from a congenital defect, a greater gap between the different portions of the origin of the muscular fibres of the diaphragm than is usual, and these apertures may act as a predisposing cause of the congenital form of this hernia. The arrangement of the blood-supply of the diaphragm may have some influence in the production of these weak spots, and the pressure exercised upon the abdomen of the child during the process of birth may possibly assist in the actual protrusion of the viscera through them. In the congenital cases a sac may or may not be present. If a peritoneal covering is in existence then it is customary to term the hernia a true one, but if the sac-wall is wanting, then a false one.

The acquired forms are again classified under these two headings, that where there is a definite sac-wall being rare, while that in which a sac is wanting is generally due to traumatism. These traumatic diaphragmatic herniæ are found most commonly on the left side, while the ordinary acquired are protrusions through congenital weak spots in the musculature of the diaphragm.

Signs and Symptoms.—As a rule these herniæ are not diagnosed until strangulation is in existence, or until after the death of the patient.

If, however, an infant is seen with the heart displaced to the right, and with want of proper breath sounds over the left side of the thorax, it may be conjectured that there is present a left congenital diaphragmatic hernia.

In acquired traumatic cases, the history of the injury and the occurrence of signs of intestinal obstruction with dulness on the left side of the chest point to the possibility of the viscera having escaped into the cavity of the thorax.

Treatment.—In most instances treatment has not been adopted until it is too late to be of any service. Where there has been a large passage of viscera into the thorax in congenital cases, it is often impossible to return the organs, owing to the fact that there is not room in the abdominal cavity to receive them. In acquired traumatic cases, probably abdominal section offers the best, though a very slender, chance of success.

CHAPTER XVII.

HERNIA OF THE BLADDER, VERMIFORM APPENDIX, AND OVARY.

HERNIA OF THE BLADDER.

THAT the **bladder** may be protruded from the abdominal cavity is coming to be recognised as not a very rare condition; in fact, it is probably to be found associated with nearly 1 per cent. of inguinal herniæ.

Varieties.—The amount of the viscus that is protruded varies much. The whole bladder and even the prostate has been found outside the muscular tissue forming the abdominal wall. The presence of the bladder in this abnormal position may be connected with a true hernial sac, or the bladder wall may have slipped down without a complete covering of peritoneum. The bladder is most frequently discovered in relation to the sac of an inguinal hernia, though it has passed into that of a femoral sac on several occasions. It is chiefly protruded on the right side of the body.

When the bladder descends with a peritoneal covering it is, as a rule, within the sac of a large inguinal hernia, and its extrusion occurs through a greatly dilated deep abdominal ring. This form is decidedly rare. In other cases the inner wall of the sac of a direct or an indirect inguinal hernia is partly represented by the peritoneum covering the postero-lateral aspect of the bladder. This is undoubtedly the commonest variety of hernia of the bladder, and it will be seen that the viscus itself does not in reality form a part of the contents of the sac, being, in truth, external to, though at the side of, the sac. A third variety, and a rare one, is that in

which the bladder descends without any peritoneal covering whatever.

Causation.—As to the causation of hernia of the bladder, there is some amount of uncertainty; but it would seem that a considerable proportion of the cases have occurred either in men the subjects of some obstruction to the outflow of urine, or in children and young persons with no such lesion.

When the bladder is distended on account of the presence of a stricture or an enlarged prostate, there is usually not only a hypertrophy of the muscular tissue in its wall, but also some more or less marked dilatation of its cavity. This latter effect may produce a certain degree of displacement of the organ, and that possibly in a lateral direction, so that its wall comes to lie at or near the inguinal ring. It is then that the straining efforts, which such patients usually have to make, will cause an extrusion of a portion of the bladder wall along with an inguinal hernia. In other instances part of the contents of an inguinal sac may have become adherent to the peritoneum-covered portion of the wall of the bladder, and may thus drag it down into the sac.

In younger subjects there may be a peculiar factor at work. The bladder is normally surrounded by fat, which in many cases not only lies external to its wall, but actually tends to infiltrate its muscular tissue. This peri-vesical fat is continuous with the adipose tissue that extends along the spermatic cord and that which passes up into the region of the kidney.

It would appear that in some examples of hernia of the bladder there has been a drag upon the bladder wall by this fat as it lies in the inguinal canal, and so there has come to be formed a hernia of the lateral wall of the viscus, in much the same way in which a ventral hernia is sometimes formed in the linea alba.

Signs and Symptoms.—As a rule a hernia of the bladder is not discovered until the viscus is exposed in its abnormal situation during an operation upon a hernia. A diagnosis of the presence of the bladder in connection with a hernial sac may be made supposing that several of the following signs

and symptoms are in evidence. A swelling is found in a hernial region, most usually that of the inguinal canal. This swelling is soft, smooth, has an expansile impulse on cough or crying, and generally fluctuates. As a rule, it can be partially reduced, first with the disappearance of the fluid portion, and then of some of the solid contents of the sac itself; but there will in most cases be left a part which is indefinite in outline, and which is doughy in consistence and dull on percussion.

Before reduction the fluid portion of the tumour will give a dull note, but resonance may be determined in that part which is the true sac and which may contain intestine. The swelling will have a characteristic tendency to undergo rapid alteration in size, and that spontaneously and without any straining effort. But by far the most distinctive sign, should it be present, is that the patient will be able to empty the tumour by the act of micturition, and that pressure upon the swelling may produce an uncontrollable desire to pass water. If such a condition is present the injection of a harmless fluid into the bladder will probably cause distension of the tumour in the groin, and it will thus be shown that there is a definite connection between the viscus and the swelling. Rectal examination may also reveal the fact that the bladder does not distend so markedly towards the sacrum as it should do in a normal condition.

Diagnosis.—There are only two other lesions that may be mistaken for a hernia of the bladder, and it is usual for the bladder extrusion to be mistaken for one of them, rather than one of them to be diagnosed as a hernia of the bladder. These two conditions are (1) an ordinary vaginal hydrocele, and (2) a hydrocele of a hernial sac. Several cases of a protrusion of the bladder into the scrotum have been tapped under the supposition that they were hydroceles. Attention to the fact that there is nearly always opacity with these cysts due to the extruded bladder, and that pressure upon the swelling generally gives rise to some diminution of it, together with a desire to micturate, should not allow any mistake to occur.

A hydrocele of a hernial sac is always irreducible, and

there are no symptoms pointing to a connection with the urinary apparatus.

A fatal error may be made if the presence of the bladder is not recognised when an operation is being performed upon a hernia for cure.

As a rule the bladder, as has been shown, will form part of the wall of the sac, as it were, and it is when the sac is being ligatured at its neck, after the contents have been reduced, that the accident of including the bladder wall occurs. Sometimes, however, when the sac has been twisted a portion of the bladder has been twisted up with it. The existence of the bladder may be surmised by a thickening of the sac at its upper and inner part, by the presence of unstriped muscular fibres, and often a deposit of fat in the same region and outside the cavity of the sac.

Prognosis.—The chief danger in hernia of the bladder lies in the fact of its being accidentally wounded. In addition to this there may become developed in that portion of the sac which is outside the abdominal wall some one or other of the lesions that are prone to affect the bladder. Thus inflammation, leading to a localized cystitis, deposit of urinary salts, producing a calculus, and even a urinary fistula, dependent upon a tapping, may occur.

Treatment.—As so many instances of hernia of the bladder are not made out until the wall of the viscus is actually exposed at the site of a hernia, it is well to consider what should be the line of treatment that is to be adopted when it is so discovered. Supposing that the bladder should have been accidentally included in a ligature, and the error should have been observed before the wound has been closed, then it is imperative that the ligature should be removed, and the wound in the bladder wall sutured with two layers of stitches, neither of which should involve the mucous membrane. If the injury is not discovered until some hours after the operation, usually by the discharge of a somewhat large amount of a thin urinous liquid, and often by the appearance of blood in the urine voided after the patient has returned to bed, then the wound should be immediately reopened, and the bladder wound sutured in a similar manner. It is not

well to resect the portion of the bladder that has been affected. Sometimes a fistula may result, but usually this will close of itself, provided that sepsis is rigidly excluded.

After the bladder wall has been sutured in either of the two supposed cases alluded to above, there still remains the necessity of dealing with the portion of the bladder that is found adherent to the sac-wall. This will need attention both when found thus accidentally, and in those cases in which the presence of the bladder has been surmised before an operation has been undertaken.

The peritoneum covering the wall of the bladder should be carefully incised so as to free it from that forming the rest of the sac-wall. In this manner the organ itself will be completely separated from the actual sac. The circular or oval aperture in the latter, that is in reality in the parietal peritoneum, can be dealt with as in a laparotomy aperture by a continuous suture or by a series of interrupted ones. The bladder itself may then be carefully loosened from the tissues in which it had come to lie, and pushed gently back within the abdominal wall. The remainder of the radical operation is conducted as for an ordinary form of inguinal hernia. A truss should always be adjusted when the patient convalesces.

HERNIA OF THE VERMIFORM APPENDIX.

Varieties.—The vermiform appendix may be found in the sac of a hernia either accompanied by other viscera, particularly the cæcum, or it may be the sole contents of the sac. The former condition is by no means an uncommon one, and constitutes an ordinary example of hernia, save for the fact that the appendix may be the site of inflammation whilst it lies among other viscera within the sac. When the latter condition is present, the appendix being the only occupant of the hernia, an interesting question arises as to how the appendix has come to enter the sac of a hernia.

Causation.—The normal appendix, some 4 to 5 inches long, with a complete meso-appendix, is free to move about in the abdominal cavity within a certain range around its attachment to the cæcum, but it cannot be brought down to, and

much less dragged through, either the right inguinal or femoral ring.

One of two conditions, then, is necessary for its descent. In the first place, it may itself be considerably in excess of its usual length. This can either be the outcome of a congenital elongation, or of a stretching the result of an adhesion. In the second place, the cæcum may be abnormally free from the presence of a long meso-cæcum, with the consequence that the appendix may approach dangerously near to the hernial rings. A further point needs consideration, and that is whether the appendix alone can be the primary and final contents of a hernial sac. It is undoubtedly possible for it to be extruded into the sac of a congenital inguinal hernia on the right side, but in this case there is a ready-formed sac into which it may prolapse. It is more difficult to understand how so small a part of the alimentary tract, one having so little surface area, would be able of itself to form a sac by pressure; but, on the other hand, it is probably not necessary that there should be the special and active distending force of a particular viscus in order that an acquired pouch of parietal peritoneum may be produced. It does not require any very resistant organ to share in the formation of a sac; in fact, it may be true that no pressure of any viscus is absolutely needful. Some sacs with narrow necks and of an acquired origin have but an extremely thin process of elongated omentum lying within them, and this would seem less able of its own accord to aid by pressure the protrusion of the serous membrane than even the appendix.

If, however, it is necessary to suppose that other of the abdominal contents besides the appendix have been the cause of the hernial sac, it is difficult to account for the very small pouches, and these with narrow necks, which not infrequently form the covering of the protruded appendices. Doubtless this argument is open to the rejoinder that it is quite possible for the original multiform contents of the sac to be reduced all but the appendix, which alone might have become adherent, and then for the mouth and neck of the sac to contract around the small structure passing through them.

Beyond this it is also feasible that constriction, or even strangulation, of the appendix may occur.

On the other hand, an appendix might slip into a sac which had not previously contained it, but had been occupied by some other viscera.

It may further be conjectured that, supposing the cæcum, together with the appendix, had passed into the sac of a hernia, and that the latter had acquired adhesion to the sac-wall, an elongation of the appendix might ensue, the cæcum thus become reducible, while the appendix remained alone in the sac.

It is, however, probable that the appendix of itself may form a sac and continue to be the sole occupant thereof.

It has thus been found in the sac of a right inguinal, a right femoral, and, in one case at least, in that of a left inguinal hernia. There is probably no instance in which it has descended alone into the sac of a left femoral, an umbilical or a ventral hernia.

Pathology of the Herniated Appendix.—The appendix when herniated is liable to a number of changes, some of which are peculiarly interesting, and others of the gravest import.

1. Elongation is almost invariably present. The normal or average length is given as 4 inches, but the appendix may vary from 1 to 9 inches. This lengthening may be the outcome of traction upon the tube, either from its being repeatedly nipped in the hernial ring, or from its being adherent within the sac.

Moreover, the appendix may be congenitally longer than usual, and this fact itself may predispose to its protrusion.

With this elongation there is sometimes an accompanying diminution in the calibre of the tube in its whole length, or only in that part which still lies within the abdomen.

2. Adhesions may form, and seem to be of comparatively common occurrence. Indeed, the appendix would appear to be more frequently adherent than other viscera found in hernial sacs. This adhesion is probably always the result of local inflammation, and it is a well-known fact that an abnormally-placed appendix is very liable to attacks of inflammation.

In these cases of adhesion the appendix may be found attached to the margins of the mouth of the sac, with the extremity free in the body of the sac, or the tip alone may be the part adherent, or its whole length may be attached.

This adherence, moreover, will bring about irreducibility, and may further lead, as above stated, to elongation and thinning of the appendix. Possibly, also, it sometimes has to do with the onset of inflammation by producing kinking of the organ. Lastly, the blocking of the mouth of the sac by the adherent appendix may be complete, and bring about the formation of a hydrocele of the body of the hernial sac.

3. A cystic dilatation of the protruded portion has been found in several cases. Within the abdomen such a condition may also be found, and would appear to be due to blockage of the lumen of the tube, either by contraction, constriction, or kinking.

Precisely the same may occur in a hernial sac. The mucous membrane of the tube contains glands which are habitually secreting, and if obstruction to the outflow of this secretion occurs, a cystic distension will result.

4. Inflammation of the appendix in a hernial sac is decidedly common, just as it is when the appendix retains its normal position. The causes of these inflammatory attacks are probably exactly similar to those of inflammation occurring in the appendix when within the peritoneal cavity. It has been suggested that a truss worn over an adherent appendix is very likely to produce injury, and thus cause inflammation, and possibly this may account for a small proportion of the cases.

As in the abdomen, so in the sac of a hernia, perforation of the appendix may be a termination of the inflammation, and this may lead to symptoms which are very like, if not identical with, those which are ordinarily said to be the outcome of strangulation of the appendix. In many of the recorded cases it has been stated that there was a sudden onset to the symptoms, and that there was local pain, vomiting, and in some constipation. These, of course, are symptoms which might well be put down to strangulation, and therefore intestinal obstruction; not so complete, cer-

tainly, as in cases where strangulation of a loop of intestine occurs, but similar in every detail to those which are in evidence when appendicitis is present within the abdomen. In this latter condition there is wanting any cause of strangulation of the appendix, though there is distinct inflammation of the tube.

5. Foreign bodies may be found within the lumen of the tube, and this quite as frequently as when the appendix is within the abdomen.

6. Strangulation of a true nature no doubt does occur sometimes when an appendix is protruded, though it is much less frequent than is usually thought to be the case. It may be brought about in at least two different ways. In some cases the contraction of inflammatory tissue outside the sac has seemed to be the real cause; but more frequently, it appears the appendix has been forced into a sac with a very narrow mouth, particularly that of a congenital inguinal hernia. Here the strangulation is the result of direct pressure of the tissues around the neck of the sac.

In whatever way produced, the symptoms which follow are, as has been stated, hardly those of true intestinal obstruction, but similar to those resulting from a partial enterocele, also from strangulation of Meckel's diverticulum, and occasionally from a strangulated ovary. The vermiform appendix, though somewhat poorly supplied with blood, seems to be well innervated, and it is probably as the outcome of reflex irritation that the symptoms which arise are present. Though there may be vomiting, it is not so urgent or persistent, nor does it become stercoraceous, as in acute obstruction, and the constipation present is rarely, if ever, absolute. Still, these cases are open to a considerable amount of uncertainty, and by far the wiser course is to explore the swelling.

Usually on opening the sac the appendix is readily recognised, but at times, owing to the presence of many adhesions, with, in fact, a matting together of the tissues, it is difficult to be certain as to the structure which is being dealt with. The appendix has been mistaken for the sac itself, for a second sac within an outer one, for the Fallopian tube, and

even for the urinary bladder. The elongated form, the presence of its extremity, and the smaller size as compared with other hollow viscera, all serve to differentiate the appendix.

Treatment of Hernia of the Appendix.—The methods of treating the organ vary according to the condition in which it is found. If a radical operation upon a non-strangulated reducible hernia is being undertaken, and the appendix is found in the sac, it may be returned into the abdomen, or it may be amputated in the usual way, and the stump replaced within the peritoneal cavity. If, however, the tube is found adherent, and specially if not of natural size, it is well to free it from its attachments and remove it. Furthermore, if, as in some cases of inflammation, and possibly also of strangulation, it is found perforated or gangrenous, it may be either removed after having been drawn down until healthy tissue is seen, or it may be left in the wound, which should remain unsutured.

Death occurs in a certain proportion of these cases from general peritonitis, as a consequence of an infection of the peritoneum from the hernial sac, and in other instances it is due to extravasation of the contents of an appendix which has been reduced into the abdomen. Recovery may be complete after operation, or it may be complicated with the presence of an intestinal fistula, as the outcome of perforation. Such a fistula, moreover, may occur spontaneously, as the result of an abscess, caused by inflammation and perforation, which has of itself opened through the skin or been incised by a surgeon. These fistulæ occasionally close without any operation, but most need to have the diseased appendix exposed and removed.

HERNIA OF THE OVARY.

Varieties.—The **ovary** may be protruded alone, together with its own Fallopian tube, or with other viscera. It may occur herniated either as a congenital or an acquired hernia.

Causation.—But little is known as to the exact reasons why an ovary should be protruded beyond the abdominal wall. There is no doubt an analogy to be found in the descent of

the testis in the male, but there does not appear to be any structure in the female corresponding precisely to the gubernaculum testis of the male. That hernia of the ovary is most frequent in young infants is a well-recognised fact, and it would therefore seem that there is some congenital factor at work in the production of the protrusion. Malformations of the external or internal genital organs may be co-existent, but not so very commonly.

In congenital cases the ovary is usually accompanied by its Fallopian tube, and may be associated with the descent of other viscera, such as intestine, into the open pouch of peritoneum which invariably passes into the inguinal canal by the side of the organ, this process being the canal of Nuck. In the acquired variety, it is not uncommon for the ovary to be present as the sole occupant of the hernial sac.

The ovary is most usually met with in the inguinal region on the left side, though the right is only slightly less frequently the affected one, while sometimes the protrusion is double. Probably the ovary is never extruded into the sac of a femoral hernia. A few instances have occurred in which an ovary has been discovered in the region of Scarpa's triangle. It had in reality passed down the inguinal canal, through the superficial ring, and then over the outer pillar of the same into the triangle.

Signs and Symptoms.—1. **Before puberty.**—As a rule the body which is the herniated ovary is felt in early infancy in the inguinal region, generally in the inguinal canal itself, or just external to the superficial ring in the upper part of the labium, as an oval, firm, slightly sensitive structure. It is of about the same size as the testis of a male infant of the same age. It is freely movable, and if outside the canal, it can generally be easily pushed back again into it, and this without producing any puckering or invagination of the skin of the labium.

Occasionally the body may be surrounded by a layer of fluid. In other cases, again, it is accompanied by intestine, which is usually reducible, with its characteristic symptoms.

2. **After puberty.**—When the ovary is found herniated it as a rule enlarges proportionately with the growth of the

child, and when puberty is reached it may be the size of a normal ovary of this age. But in other instances there would seem to be a lack of development somewhat similar to that which occurs in the partially descended testes of boys.

When menstruation has commenced, there is a tendency for the tumour to become swollen, tender and painful at or just before the onset of the flow, the symptoms recurring with each monthly period. Unless there is considerable want of growth in the organ, it has after puberty more sensitiveness than it had at an earlier date. The herniated organ is not so readily reducible after puberty as it is before that stage is arrived at. It may possibly be found by rectal or vaginal examination that the uterus is drawn slightly to the side on which the ovary is protruded.

Prognosis.—If there is a protrusion of an ovary, the question may arise as to whether it is probable that there will be any untoward result from the abnormal position of the organ. Some want of growth may occur, but probably not so markedly as would appear to be general in the arrested testes of the opposite sex. As to whether this want of development can be prevented by the replacement of the ovary within the abdominal wall is a matter of dispute. It is also questionable whether these extruded ovaries are functional or not so far as the production of normal ova is concerned.

In some instances the ovary may become the seat of acute or chronic inflammation, with occasionally the formation of a pyo-salpinx, or cysts may form in its tissue of a similar nature to those which may affect the organ when it lies in the pelvis. In other cases a species of strangulation has ensued, or a torsion of the prolapsed tube has occurred. An encysted hydrocele of the canal of Nuck may form around the ovary.

Diagnosis.—There are three conditions which are liable to be confused with a hernia of the ovary in the inguinal region: (1) encysted hydrocele of the canal of Nuck; (2) a lipoma of the round ligament; and (3) a small piece of indurated omentum.

The first is distinguished by fluctuation and translucency being obtained in it, if it is of sufficient size to allow of these signs, and by the fact that it is more fixed, and that a grooved needle thrust into the swelling will reveal the presence of fluid in it, and cause it to promptly collapse.

A lipoma is softer, more fixed, and insensitive, while the tag of omentum is found to be attached to a neck at the upper part of the inguinal canal.

Treatment.—Many a herniated ovary can be reduced and kept within the abdomen by the application to the infant sufferer of a suitable inguinal truss. If there should be the protrusion of other viscera at the same time, this condition will also be benefited, if not entirely cured, by persistent truss pressure.

But if this method of treatment fail, it is advisable to recommend that a radical operation should be performed, with a view to the reduction of the ovary within the abdomen and the closure of the hernial apertures.

If the presence of an ovary outside the abdominal wall has been diagnosed previous to operation, or is exposed during a radical operation upon a hernia, the question will arise as to whether it should be returned if possible within the abdomen, or whether it should be removed together with its Fallopian tube if this is also herniated.

Should the ovary in a congenital hernia appear to be very shrivelled or the Fallopian tube obviously ill-developed, particularly if the opposite ovary is still in its normal habitat, then it would probably be the correct line of treatment to remove the whole of the extruded parts, and to entirely close the hernial apertures. On the other hand, if the patient has reached a later period of life, and the ovary appears to have developed proportionately with the growth of the rest of the body, then it is well to return the organ into the extra-peritoneal tissue at least, even if it cannot be put wholly into the abdominal cavity. It may be that the existence of the ovarian tissue, though not in its normal position, will yet have some effect upon the development of the woman, which would be lost if the organ was excised.

CHAPTER XVIII.

HERNIA IN ITS RELATION TO LIFE ASSURANCE, ACCIDENT INSURANCE, THE PUBLIC SERVICES, CLUBS, THE COLONIES.

THE last decade of the century has shown a considerable alteration of opinion with regard to the importance of a hernial protrusion in connection with life assurance, the entrance into the navy, the army, and the other public services. Even yet there would seem to be some lack of discrimination as to which varieties of hernia are the most likely to give rise to trouble, so as to bring in its train a risk to life, or offer a bar to efficient service.

HERNIA IN ITS RELATION TO LIFE ASSURANCE.

Broadly stated, a hernia which is easily reducible, and which can be readily controlled by a suitable truss, should not constitute a reason for extra rating. That herniæ do form a menace to life is abundantly proved by the Registrar-General's tables. For the period of twenty years reaching from 1878 to 1897 the average annual return of deaths directly from this cause is 43·5 per million living, the average actual deaths in each year being no less than 1,208. The fact of the increasing number of radical operations with a view to cure is also beginning to make itself felt in connection with life assurance.

Some offices pay very little attention to the question of hernia, regarding the risk as but slight, while others have more stringent rules concerning the same. It is obvious that to reject every proposer who happens to be the subject

of a protrusion is contrary to reason, and to include all would be risky in the extreme.

Each case, therefore, has to be taken on its own merits, but it is well that the medical examiner should have clear ideas as to the relative danger in the different cases that are placed before him.

The subject can be reviewed from two aspects, one the hernia itself, and the other the proposer who presents himself for assurance.

The Hernia Itself.

A male who is otherwise healthy presents himself with a reducible oblique inguinal hernia, which has never been strangulated, and is easily maintained in proper position by a suitable truss. Such a condition adds but little to the risk involved in accepting the life, and therefore requires no extra rating.

A partially reducible inguinal hernia, particularly if it has been the site of obstruction, should be classed as one necessitating a higher premium, if indeed it should not altogether negative the acceptance of the proposer. Single herniæ may be looked upon with less risk than double herniæ.

A femoral hernia, and especially those occurring in the males, in whom they are apt to be small and not easily noticed, should be treated with more suspicion than an inguinal protrusion, for the danger of strangulation is great.

Umbilical herniæ are so often associated with conditions which are adverse to longevity that it is very usual for the subjects of such to be rated higher or to be rejected.

The medical examiner, when examining a proposer with a hernia, should note its position, whether it is reducible or not, and whether the sufferer is wearing a properly-constructed and rightly-adjusted truss, and whether this instrument acts efficiently in retaining the protrusion in all positions of the patient.

In persons desirous of obtaining a life assurance policy, but who are subjects of inguinal herniæ, their occupation and habits should enter largely into the question of acceptance or refusal. Where a quiet life is led, with but little heavy exer-

tion that might lead to the descent and strangulation of bowel, the risk, as has been stated, is but slight. But when likely to be subjected to much strain, such as may occur in the hunting-field, then the protrusion will become a matter of considerable importance. Again, residence in certain regions abroad, where medical assistance is far to seek, or the renewal of a worn-out truss a matter of time, may debar the life from being accepted.

The presence of an irreducible inguinal hernia should condemn a life to non-acceptance, though if the condition has been remedied by a radical operation, there is no reason why the proposer may not be subsequently admitted.

Irreducible herniæ are always dangerous from the point of view of life assurance, because in them strangulation is always liable to occur from the bowel slipping down on slight exertion. Irreducibility, however, it must be remembered, is, as a rule, a transitory condition, and therefore the proposer may present himself when the contents of the sac, usually irreducible, happen to be within the abdomen, or, having submitted himself to examination with the contents down, he may return later with the whole completely reduced. Such a history is to be taken with serious import, and the case rejected, unless it is a suitable one to undergo a radical operation.

Radical Operation in Relation to Life Assurance.

There is no doubt that many inguinal herniæ, although perhaps not absolutely cured by operation, are so greatly benefited thereby, that they no longer offer any reason why a higher rate of premium should be enforced, particularly if the proposer is wearing a suitable truss. On the other hand, there are some cases in which, where a congenital inguinal hernia has been treated by operation, the proposer may be regarded, other things being equal, as a first-class life.

It may, therefore, be part of the duty of a medical examiner for life assurance to determine whether a case that presents itself is one that may be cured of hernia by operation, and if so, to recommend such a proceeding with a view to acceptance at the usual or slightly higher rates.

The Proposer who presents Himself for Assurance.

Peculiarities in the proposer himself are of almost equal importance, in deciding as to whether he shall be accepted, as the actual hernia from which he is suffering. Any of the following conditions associated with hernia would either necessitate rejection or extra rating: Obesity, lack of muscular tone, evidence of prolapse of the mesentery, and the triple bulging of the abdominal wall alluded to on p. 14, especially if it is present in young subjects.

The female sex, in addition, is a factor that may lead to the desirability of loading, or perhaps rejection.

HERNIA IN RELATION TO ACCIDENT INSURANCE.

Hernia plays a greater part in relation to accident insurance than it does in relation to life assurance. The same applies to sickness insurance, from which point of view it is dealt with under the question of hernia in relation to clubs.

There are two aspects in which hernia in relation to accident insurance may be considered. The one is where a proposer for an accident policy is found to have a protrusion, and the other is where one who has been insured at a time when he had no hernia afterwards claims on account of the appearance of such.

Proposer with Hernia.

Most accident insurance offices will not accept persons who are the subjects of hernia. As in life assurance, so here, some distinction ought to be made as to the form of hernia, the general condition, and the circumstances of the proposer. If he is suffering from a femoral protrusion, under no conditions would it be advisable to accept him; but if from a small, easily-retained inguinal hernia, then there would not be much risk in taking him, though perhaps with a 'rupture' clause, by which the company should be exempt from all claim arising from the hernia. Umbilical herniæ, again, constitute such a lesion as should preclude from the benefits of insurance.

The question of a radical operation with a view to cure may appropriately be mooted when the proposer has a hernia

that is likely to be so benefited. It would be well, however, that a period of at least twelve months should be allowed to elapse between the operation and the acceptance of the proposal.

Claim for Compensation on account of the appearance of a Hernia after Date of Insurance.

A person may bring a claim against an accident insurance office on account of his belief that a hernia which has developed is the outcome, more or less directly, of an accident of which he has been the subject. It then becomes the duty of the medical adviser of the office to determine whether or no the protrusion is in reality the result of the injury sustained, or whether it may not have been in existence prior to the accident.

In dealing with cases of this nature, it is important to remember that it is decidedly rare for a hernia to be formed suddenly, and the very fact that the applicant for compensation gives the history of a rapid development of his protrusion should in itself be a cause of suspicion. It cannot be denied that, in some infrequent cases, parts of the abdominal wall may be torn by some severe strain, as, for instance, in the effort to prevent the fall of a heavy piece of furniture; but in these persons there is a definite 'rupture,' in all probability, of the parietal peritoneum. This is followed by an escape of viscera into the extra-peritoneal tissue, or if the transversalis fascia and some of the superjacent muscular layers have also given way, the protrusion may pass into the subcutaneous tissues. Occasionally, if bowel has been so protruded, it has become at once strangulated, and an operation has been immediately called for. But this condition of affairs is very uncommon, and need hardly come into the category.

Further, it must be borne in mind that a person who has a patent processus vaginalis may, on account of a great effort, suffer the escape of viscera into the ready-formed sac, where it may become at once strangulated. In both the above conditions, provided that the medical examiner can satisfy himself that the strain was the direct precursor, and therefore probably the producer, of the hernia, he is justified

in allowing the claim, but it is necessary to repeat that such cases are rare.

On the other hand, a person may aver that he has developed a protrusion, not suddenly, but at a period which is remote from the date of the accident, believing it to have been caused by it. In such a case the position of the hernia should be of considerable service in arriving at a decision whether or not it has any connection with the accident. If it is in one of the usual positions for a protrusion, the inguinal, femoral, or umbilical regions, it is highly probable that the accident had little or no part in its causation, while, if it is in an unlikely spot, as, for instance, in the lineæ semilunares or alba, it is allowable to grant that the injury did participate in its production. Again, if the applicant has lax abdominal walls, or presents a hernia elsewhere than the one asserted to be the outcome of the strain, then his claim can hardly be upheld.

There is, however, yet another class of cases in which an actual perforating wound of the abdominal wall has resulted from an accident. Here there may be an immediate traumatic hernia, the prolapse of viscera, injured or uninjured, and this should certainly form a valid cause for compensation. A similar wound may heal, and then the scar may become the site of a secondary traumatic hernia, which, again, may be considered as worthy of compensation if it leads to incapacity.

HERNIA IN RELATION TO THE PUBLIC SERVICES.

The various public services require a certificate of good health before a candidate can be admitted to them. Some are more stringent than others, but in most a hernia will exclude from the employment which would otherwise be open to the applicant.

The Navy, the Army, and the Auxiliary Forces.

In these branches of the services but little distinction has hitherto been made in reference to the special form of hernia from which a would-be recruit may be suffering. As a rule a hernia of any form precludes him from acceptance. In some

countries where conscription is in force, the rejections on account of hernia, or a tendency to the same, are as much as 20 per cent. This may be well, but it would seem that the wholesale refusal to admit is a serious loss in the number who might prove to be efficient members of the Army.

In the **Royal Navy** no man will be received if he has a hernia of any form, even if it has been operated upon. As a rule, though there appear to be some exceptions, the development of a hernia, if found by the surgeon, necessitates retirement from the service, even although the sufferer is willing to undergo a radical operation with a view to cure.

In the **Army** hernial protrusions will, in the great majority of instances, debar an applicant from being enlisted. Men are not, however, invariably invalided from the Army on the development of a hernia, provided that a truss efficiently maintains the protrusion; but they may be thereby prevented from joining the Reserve, or, if they have been allowed to do so, the hernia will negative their acceptance for foreign service on recall.

It is an open question, however, whether it would not be right to advise a would-be recruit, if he was the subject of a congenital inguinal hernia, and otherwise a suitable candidate, to undergo a radical operation, and, if sound at the end of a year, to reapply for enlistment. Possibly, if a number of such cases presented themselves, there would be some relaxation in the stringency which now exists as to the refusal of the subjects of past hernia.

Cavalry service, with its frequent and severe strains, leads to the production of a large number of herniæ, and it is on this account that no one who has, or who seems to have the tendency to, a hernial protrusion, should be accepted for this portion of the service.

In the **Volunteer Forces** men who are slightly 'ruptured' may, if provided with a truss, be accepted for infantry, but in no case for artillery corps. Apparently here again no distinction is made as to the variety of hernia that is present, provided that it is not a severe one. A recruit would probably be accepted, if he was otherwise a suitable subject, after an operation with a view to cure. A private has to declare

the incidence of hernia after enrolment, but he would be allowed to remain in the force, provided that he wore an efficient truss, or he could undergo an operation for cure. It is difficult to determine the amount of inefficiency that results from hernia in these services, and it may be that hernia does not lead to such a degree of incapacity as is generally supposed.

The Civil Service.

Here once more hernia is a bar to entrance, and that even if it is present in the slightest forms, but the efficacy of operations in certain cases is so far beginning to be felt that in some of the branches—the Post Office, for instance—a candidate for a situation is required to undergo an operation with a view to cure prior to, and as a condition of, appointment.

In this branch, again, the development of hernia after appointment does not appear to have led to any large number of persons having to retire, and those that have had to do so have been chiefly males. Cases of strangulated hernia in this service have been rare.

HERNIA IN RELATION TO PROVIDENT CLUBS, SICKNESS AND ACCIDENT FUNDS.

Very few clubs will admit as members those who are the subjects of hernia, and many of the medical officers of such institutions are now advising the applicants, if they are sufferers from hernia, to undergo an operation with a view to cure, so that they may allow such to participate in the benefits of the club. It would seem that but little attention is paid as a rule to the form of hernia that is in existence. But as in other similar insurances, it is feasible that there might be a considerable allowance made with perfect safety in some of the less severe forms of hernia, provided that the sufferer was fitted with an efficient truss. Sickness funds generally grant their members relief if they are incapacitated by an operation upon a hernia that has developed subsequently to their entrance into the club. As in life and accident insurance, so in provident clubs, it would be wholly inadvisable to accept anyone who was the subject of an

irreducible inguinal hernia, or of a femoral, whether reducible or not, or of an umbilical, unless he could show that he had been greatly benefited by operation, and was wearing a suitable truss subsequent to it.

In connection with the Workmen's Compensation Act, it might occur that a man would put in a claim for damages on account either of the incidence of trouble with a hernia that was in existence prior to the accident, or for a hernia that he believes to have developed as the outcome of the injury that he has been subjected to. What has already been said on these points in relation to accident insurance would apply with equal force to the present conditions of this Act.

HERNIA IN RELATION TO THE COLONIES, AND TO TROPICAL CLIMATES.

In the increasing number who at the present time are proceeding to the different colonies, there are some who have to go to regions where they will be far removed from medical aid. It is questionable whether any who are the subjects of hernia should expose themselves to the evident risk that there is if their protrusions should become strangulated. It is for this and other reasons that nearly all the employés of the numerous railway and other companies that are coming into existence on all sides in the colonies and other parts are required to pass a medical examination. If hernia is found, then it remains with the medical referee to say whether or not he considers that the applicant must be rejected absolutely, or whether, provided that he undergoes an operation, it would be safe for him to go out.

With regard to actually tropical regions the difficulty becomes all the greater, seeing that it is almost impossible to wear a truss covered with leather under such conditions. Here it is particularly suitable that, should it be otherwise necessary or desirable for the person to proceed to the tropical quarter, an operation should be performed some months previous to the date of leaving. It is therefore by no means necessary that a hernial protrusion should prevent a person from being able to accept employment in a sphere distant from an opportunity of calling in medical aid.

INDEX

ABDOMEN, forms of, 13, 124
Abdominal belt, 184, 185, 188
ring, deep, 80, 130
superficial, 83
wall, 14
congenital defect of, 175, 197
Abnormal obturator artery, 156
Abscess, psoas, diagnosis from femoral hernia, 160
Accident insurance and hernia, 220
Accidents in taxis, 65
Acquired hernia, 17
Act, Workmen's Compensation, and hernia, 225
Adhesions in hernial sac, 9, 10, 30
Adipose tissue in relation to hernia, 17, 29, 32, 124, 161, 169, 180, 186, 196, 205
Adjustment of truss, importance of proper, 110
Advantages of herniotomy over taxis, 62
After-treatment of herniotomy, 75
of radical operation, 139
Age in relation to hernia, 13
Anæsthetic in herniotomy, general, 69
local, 69
in radical operation, 128
in taxis, 66, 68
Appendicitis in a hernial sac, 211
Appendix epiploica, 8, 10, 29
vermiformis, hernia of, 8, 48, 208
Arborescent vessels on sac-wall, 4, 70
Arching fibres of roof of inguinal canal, 82, 83, 136
Army, entrance into the, relation of hernia to, 223
Artery, abnormal obturator, 156
deep epigastric, 79, 146
Ascites and hernia, 17
Ascitic fluid, 9
Asepsis, importance of, 69, 121, 125
method of obtaining it, 69, 125
Assurance, life, and hernia, 217
Auscultation of a hernial swelling, 19, 45

Bacillus coli communis, 41, 56, 63
Bacteriology of fluid in hernial sacs, 56, 63, 65
Bag-truss, 119
Bakers, occurrence of hernia in, 16, 157
Bassini, radical operation of, 143
Bath, hot, in strangulation, 68
Bistoury, hernia, 70
Bladder, hernia of the, 205
Body of sac, 4
Bronchitis and hernia, 16, 32, 124
Bubonocele, 86, 111, 113

Cæcocele, congenital, 27, 133
Canal of Nuck, 88, 94, 97, 148, 214
Cases suitable for radical operation, 123, 124
unsuitable for radical operation, 124
Causes of failure after radical operation, 121
of hernia, exciting, 16
predisposing, 12
of irreducible hernia, 27
of strangulation, 37
Children, hernia in, 88, 99, 175, 178
Circumcision in hernia, 88, 103
Civil Service, hernia in relation to, 224

Claim for compensation on account of hernia, 221
Closure of femoral ring, 171
of inguinal canal, 135
Clubs and hernia, 224
Colic, severe, diagnosis from strangulation, 54
Colon bacillus, 41, 56, 63
Colonies and hernia, 124, 225
Compensation, claim for, on account of hernia, 221
Complete hernia, 86
Congenital hernia, 17, 27, 88, 133, 175
hydrocele, 90
Conjoined tendon, 82, 144, 146
Constipation, absolute, 42
as a cause of hernia, 17, 78
Constricting band in strangulation, treatment of, 72
Construction of a truss, 22
Contents of hernial sac, 7
Continuance of symptoms after apparent reduction by taxis, 65
Cooper's ligament, 172, 173
Cord, spermatic, 53, 85, 129, 136
Coverings of femoral hernia, 156
of direct inguinal hernia, 86, 146
of indirect inguinal hernia, 86
Cure, spontaneous, 25
Curve of spring of truss, 105
Cycling in hernia, 142
Cystic ovary in sac, 10, 215
Cysts in hernial sacs, 10, 211, 215

Dangers of taxis, 65
Definition of hernia, 1
of incarcerated hernia, 34
of inflamed hernia, 32
of irreducible hernia, 26
of obstructed hernia, 34
of strangulated hernia, 36
Development, muscular, 104, 142
want of, 141, 175, 197
Diagnosis of femoral hernia, 159
of inguinal hernia, 89
of inguinal hernia from femoral, 90, 96
of labial swellings, 95
of scrotal swellings, 91, 93
of swellings in Scarpa's triangle, 161
Diaphragmatic hernia, 202
Diet after herniotomy, 75
in relation to hernia, 105, 179 185
Dilation of hernial aperture in strangulation, 73
Direct inguinal hernia, 85, 144
operation for, 143
Directions for ordering a truss, 110
Disadvantages of herniotomy, 63
Divarication of the recti abdominis, 190
Division of constriction in strangulation, 72
Dressings after radical operation, 138, 140

Ectopia of ovary, 213
viscerum, 177
Elastic strangulation, 38
Emphysema as a sign of gangrene, 60
Enteritis, 54, 56, 66
Enterocele, 8
partial, 8, 42, 47
Entero-epiplocele, 8
Epiplocele, 8, 51
Eructation, 44
Eventration, 177
Exciting causes of hernia, 16
Expansile impulse, 19, 34, 45
loss of, in strangulation, 45

Fæcal fistula, 76
occlusion, 39
vomiting, 42
Fæculent vomiting, 42
Falciform process, 171
Fallopian tube, hernia of, 213
Fascia iliaca, 155
lata, 155
transversalis, 83, 155, 156
Faulty curve of spring in truss, 105
Female sex, causes of hernia in, 16, 157, 180, 196, 213
Females, femoral hernia in, 3, 157
inguinal hernia in, 3
radical operation in, 124
umbilical hernia in, 180
Femoral canal, 154
hernia, anatomy, 153
causation, 157
diagnosis, 159
operation for, 168
signs and symptoms, 158
treatment, 162
ring, 152
Fenestrated sac, 6
Fistula, intestinal, after herniotomy, 76, 213
Flatulency as a cause of hernia, 105

Fluid in hernial sacs, 9, 45, 64
bacteriology of, 63
Foreign bodies in hernial sac, 10
Forked-tongue truss, 113
Forward impulse, 19, 45, 67
Frequency of hernia, 3
of femoral hernia in males, 3
of inguinal hernia in females, 3
Fundus of sac, 4

Gangrene, 57, 58, 61, 76
Gangrenous gut, treatment of, 76
Gardeners, prevalence of hernia in, 16, 157
Gimbernat's ligament, 153, 155
Glands, enlarged, diagnosis from hernia, 53, 97, 98, 161
Glénard's disease, 15
Gurgling in hernia, 19

Hæmatocele, diagnosis from hernia, 92
Hæmorrhage in herniotomy, 157
from omentum, 132
Halsted, radical operation of, 142
Heart disease and hernia, 186
Heredity in hernia, 12
Hernia, acquired, 17
causes of, 12
contents of, 7
definition of, 1
derivation of the word, 2
diaphragmatic, 202
femoral, 153
incarcerated, 34
inflamed, 32
inguinal, direct, 85
indirect, 85
interstitial, 88, 147
irreducible, 26
labial, 94, 95
lumbar, 197
obstructed, 34
obturator, 195
of bladder, 205
of Fallopian tube, 213
of Meckel's diverticulum, 10, 48
of ovary, 213
of vermiform appendix, 10, 48, 208
parts of, 4
perineal, 200
sciatic, 199
sac of, 4
strangulated, 36
traumatic, 1, 17, 193
vaginal, 200
Hernia, varieties of, 2
ventral, 190
umbilical, 174
Herniotomy, 69
advantages of opening the sac in, 71
after-treatment of, 75
instruments for, 70
preparation for, 69
treatment of intestine in, 73
of omentum in, 73
Herniotomy needles, 127
Hesselbach's triangle, 79, 80
Hey's ligament, 172
Hiccough, 44
Hinged-cup truss, 117
Hollow-pad truss, 119, 166
Hydatid cyst in sac, 10
Hydrocele and inguinal hernia, 92, 93, 94, 97
encysted, of cord, 92, 97
of canal of Nuck, 97
of hernial sac, 9, 92, 94, 95, 206

Impulse, expansile, 19, 34, 45
loss of, in strangulation, 19
forward, 19, 45, 67
thrill, 91
Incomplete reduction, 66
sac, 27, 133
Indigestion as a symptom of hernia, 20, 181
Indiarubber covered truss, 100, 103
Indirect inguinal hernia, 85
Infants, hernia in, 99, 175, 178
Inflamed hernia, 32
Inguinal canal, 80
fulness in femoral truss, 165
hernia, 78
causes of, 87
diagnosis of, 89
direct, 85, 143, 144
indirect, 85
interstitial, 147
irreducible, 92, 116
rarer forms of, 145
reducible, 90, 99
treatment of, 99, 121
truss, 105
Instruments for herniotomy, 70
for radical operation, 127
Internal hernia, 2
strangulation, 2
Interstitial inguinal hernia, 88, 147
plate, 151

Intestine in hernial sacs, 7, 19, 73, 133
gangrenous, 57, 58, 61, 77
suspected, 58, 74
Irreducible hernia, 26
causes of, 27
definition of, 26
diagnosis of, 31, 92, 161
prognosis in, 31
signs of, 30
treatment of, 31
femoral hernia, 161
inguinal hernia, 92
scrotal hernia, 93
umbilical hernia, 184
Ischio-rectal hernia, 200

Knife, hernia, 70
Kocher, radical operation of, 143

Labial abscess, 94
cyst, 94
hernia, 94
Lavater's hernia, 47 (note)
Lembert's suture, 77
Life assurance and hernia, 217
and radical operation, 219
Ligature material, 131
of omentum, 52, 131
Linea alba, hernia in, 190, 193
semilunaris, hernia in, 193
Lipoma, extra-peritoneal, 192
in the femoral region, 161
of the round ligament, 97, 215
of the spermatic cord, 97, 205
Littre's hernia, 10, 48
Loose bodies in hernial sacs, 10
Lumbar hernia, 197
Lymphatic glands, diagnosis of hernia from, 53, 97, 98, 161

Macewen, radical operation of, 143
Male sex as a cause of hernia, 13, 88
Males, femoral hernia in, 3
inguinal hernia in, 3
radical operation in, 123
Masked hernia, 47
Measurement for a femoral truss, 107, 163
for an inguinal truss, 101, 107
for an umbilical truss, 183
Meckel's diverticulum, hernia of, 8
strangulation of, 10, 48
Mesentery, changes in, when extruded, 9
length of, 15
prolapse of, 15
Meteorism, 44
Moc-main truss, 22, 23
Mouth of sac, 4
Muscular development, 104, 142

Navy, Royal, entrance into, relation of hernia to, 223
Neck of sac, 4
Needle, hernia, 127
Nuck, canal of, 88, 94, 97, 148, 214
Nurse, duties of, 69

Oblique inguinal hernia, 85
Obstructed hernia, 34
causes of, 34
diagnosis of, 35
prognosis in, 35
treatment of, 35
Obturator hernia, 195
Occupation as a cause of hernia, 16
Omental hernia, 8
sac, 8
Omentum, adhesions of, 30, 130
changes in structure of, 9
ligature of, 131
strangulation of, 51
Opening sac, mode of, in strangulated hernia, 71
Operation, after-treatment of, 75, 139
for irreducible hernia, 32
for reducible hernia, 125
for strangulated hernia, 69
Ovary, hernia of, 213

Pad of a truss, 24
Pain in hernia, 20, 39
Paralysis of intestine, 60, 77
Partial enterocele, 8, 42, 47
Pathological effects of strangulation, 54
Pathology of herniated appendix, 210
Percussion of a hernial swelling, 8, 19, 45
Perineal hernia, 200
Peritonitis, 54, 61
Phimosis in relation to hernia, 17, 88, 103, 178
Pneumococcus, 56
Pneumonia after herniotomy, 56
Post Office, hernia in relation to, 224
Predisposing causes of hernia, 12
Pregnancy and hernia, 16, 180
vomiting of, 66

Preparation of patient for herniotomy, 69
for radical operation, 125
Pressure upon irreducible contents, 117
Processus vaginalis, 5, 99, 148
Properitoneal hernia, 151
Prostration in strangulation, 43
Provident clubs, hernia in relation to, 224
Psoas abscess, 160
Purgatives after herniotomy, 76

'Radical cure,' inadvisability of the term, 122
Radical operation, after-treatment of, 139
in femoral hernia, 168
in inguinal hernia, 121
in relation to life assurance, 219
in umbilical hernia, 185
instruments for, 127, 128
preparation for, 125
principles of, 25, 123
use of truss after, 140, 144, 173
Rarer forms of inguinal hernia, 145
Rat-tail truss, 111
Recti abdominis muscles, divarication of, 190
Reducible hernia, 18
prognosis of, 20
signs of, 19
treatment of, 21
operative, 25
palliative, 21
'Reduction en masse,' 65, 66
Reduction of hernia, 19, 32, 64
Resection of intestine, 77
Resonant note over hernia, 19
Richter's hernia, 8, 42, 47
Ring, deep abdominal, 79
femoral, 153
superficial abdominal, 83
Rubber truss, 100, 103
Rupture, 1, 147, 221

Sac, 4
adhesions in, 29
bilocular, 6
contents of, 7
cysts in, 10
fenestrated, 6
fluid in, 9, 45, 64
formation of, 4
hour-glass, 7
Sac, hydrocele of, 9, 94, 95, 206
omental, 8
preformed, 5, 221
rupture of, 67
tubercle of, 9
varieties of, 6
Salmon and Ody inguinal truss, 23
umbilical truss, 184
Saphenous opening, 155
Sciatic hernia, 199
Scrotal hernia, 86, 91, 92
swellings, diagnosis of, 91, 93
truss, 111
Sepsis a cause of failure after radical operation, 121
Septic fluid in hernial sac, 56, 63, 65, 71
Septum crurale, 154
Sex in relation to hernia, 13, 88, 157, 180
Sickness funds, hernia in relation to, 224
Silk twist for ligatures, 131
for sutures, 137
Skein of wool truss, 100
Skin incisions in herniotomy, 70
in radical operations, 128, 169, 186
Spermatic cord, 53, 85, 129, 136
Spring of truss, 22, 105
Stokers, prevalence of hernia in, 16
Stomach, washing out of, 70
Strangulated hernia, 36
causes of, 37
definition of, 36
diagnosis of, 35
pathological changes in, 54
signs of, 39
symptoms of, 39
treatment of, 62
Strychnine, use of, in hernia, 75, 140
Sudden production of hernia, 5, 88
Suture material, 137
Swelling as a sign of hernia, 19, 30

Taxis, 21
aids to, 68
dangers of, 65
in irreducible hernia, 32
in reducible hernia, 21
in strangulated hernia, 64
when inadmissible, 65
Tendon, conjoined, 82, 144, 146
Tenseness of sac, a sign of strangulation, 44

Testis, 88
inflamed, diagnosis from irreducible inguinal hernia, 92
diagnosis from strangulation, 53
partially descended, in relation to hernia, 148
Thigh-belt, 164
Traumatic hernia, 17, 193
Tropical climates, hernia in relation to, 225
Truss, 21
femoral, 162
with inguinal, 115
inguinal, 105
umbilical, 180, 183
use of, after radical operation, 140, 144, 173, 188
ventral, 194
Types of femoral hernia, 158

Umbilical hernia, 174
adult, 180
causation of, 175, 178, 180
congenital, 175
incarcerated, 188
infantile, 178
operation upon, 185, 189
prognosis of, 179, 181
strangulated, 188
truss, 180, 183
Under-strap, 106, 112, 163
Under-strap, position of, in femoral truss, 163
in inguinal truss, 106
use of, 106
Use of truss after radical operation, 140, 144, 173, 188

Vaginal hernia, 200
Varicocele, 90, 91
Varicose saphena vein, 159
veins, labial, 92
Ventral hernia, 191
in linea alba, 191
in linea semilunaris, 193
traumatic, 193
Vermiform appendix, hernia of, 8, 48, 208
inflammation of, 211
pathology of herniated, 210
strangulation of, 212
treatment of hernia of, 213
Vessels, arborescent, on sac-wall, 4, [70
Volunteer forces, entrance into, relation of hernia to, 223
Vomiting, fæcal, 42
fæculent, 42
in hernia, 28, 181
in obstructed hernia, 34
in pregnancy, 66
in strangulated hernia, 40
stercoraceous, 42

Workmen's Compensation Act, 225

THE END

Baillière, Tindall and Cox, 20 and 21, King William Street, Strand