

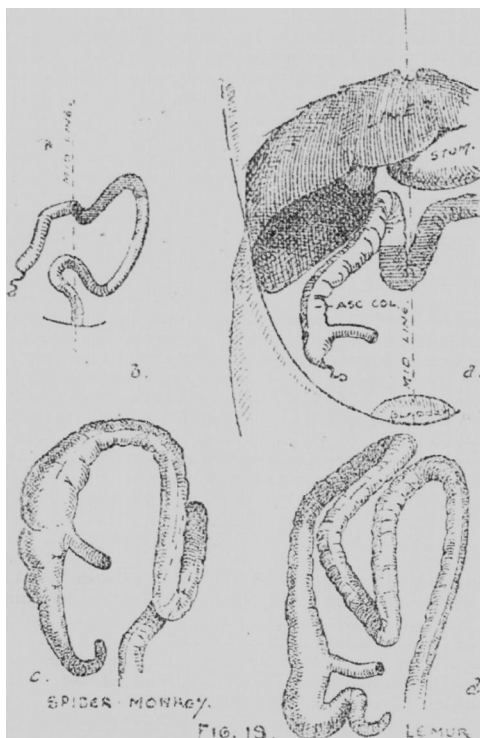
LECTURES ON THE ANATOMY OF THE INTESTINAL CANAL AND PERITONEUM IN MAN.

Delivered at the Royal College of Surgeons of England.

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LECTURE III.

The Ascending and Descending Colon.—In the adult, the ascending and the descending parts of the colon are placed vertically, while the direction of the transverse colon is practically horizontal. It is not quite horizontal, because the splenic flexure is on a higher level than the hepatic flexure, as well as posterior to it. This mutual relation between the three chief parts of the large intestine is not to be observed until some little time after the commencement of extra-uterine life. If the colon of a foetus from four to five inches in length be examined *in situ*, it will be seen that the descending segment is vertical, and that the splenic flexure is well marked, and is the highest point of the colic arch (Fig. 18 b). The ascending colon, however, is by no means vertical, and the hepatic flexure can hardly be said to exist. In fact, the bowel between the splenic flexure and the caecum follows an oblique line from above downwards, and to the right. This line



may be taken to represent the course of the caecum as it passes from left to right in the process of development. The particular position assumed by the segment of the colon to the right of the middle line is rendered necessary by the large size of the liver, along the under surface of which the bowel runs. This disposition of the large intestine is still marked in the foetus at full term, and may even be noticed sometimes in young subjects up to the age of two or three years.

Thus the specimen from which Fig. 18A was drawn was from the body of a female child aged 2 years. It is not until the liver has regained its normal proportions with reference to the other abdominal viscera that the hepatic flexure becomes well marked, and the right segment of the colon acquires the position that is familiar in the adult.

The period at which the caecum reaches its final resting place in the right iliac fossa is evidently liable to considerable variation. Thus, in foetuses measuring respectively $4\frac{1}{2}$ and $5\frac{1}{2}$ inches, I have found the caecum on a level with the lower end of the right kidney, while, in several foetuses at full term, the caput coli has still occupied a position immediately under the liver, and there has been no large intestine in the place of the ascending colon.

It is well known that the caecum may remain undescended throughout the whole period of existence. I have met with two examples of this condition in the hundred bodies examined. Both subjects were males; one was 41 years of age, and the other was 74. The disposition of the caecum was identical in the two cases. No large intestine occupied the position of the ascending colon. The caecum was placed on the right side, immediately under the liver, and just to the right of the gall-bladder. It was quite horizontal, continued the long axis of the transverse colon, and was included between the layers of the transverse mesocolon. The appendix came off from the posterior aspect of the caecum. It was normal, as were also its folds. Its mesentery joined the upper layer of the transverse mesocolon. From the extremity of the caecum, a horizontal fold of peritoneum was continued to the parietes, and upon it the edge of the liver rested. In one of these instances, the segment of colon from the tip of the caecum to the splenic flexure measured 38 inches, and it was only to the left half of this portion that the great omentum was attached. In this instance, also, the descending colon was unduly long, measuring 15 inches. In the other example, the bowel, from the tip of the caput to the splenic flexure, measured 27 inches; the great omentum commenced 5 inches from the first named point. The descending colon was of normal length. In both cases, the remaining viscera were normal, and there were no evidences of intra-uterine peritonitis.

In two other adult bodies, the caecum lay in the right iliac region, but both it and the whole of the ascending colon were entirely free from any peritoneal connections with the posterior parietes. The gut, from the tip of the caecum to the hepatic flexure, was entirely invested by peritoneum continuous with the mesentery. In fact, this part of the colon was covered in the same manner and by the same fold as the small intestine; and a condition was produced identical with that met with in many animals. The portion of large bowel thus free measured eight inches in both instances. The mesentery lacked its usual attachment to the posterior abdominal wall, and its root was represented by the interval between the duodenum and the transverse colon. The membrane had, indeed, no other than its original primary attachment, and the small intestine and ascending colon formed together a loop that practically represented the condition of the great primary intestinal loop.

It is evident that, if a right lumbar colotomy had been attempted in any one of the four subjects last described, the large intestine would not have been found. In connection with these and like malformations of the colon, reference must be made to the very valuable monograph of Mr. Lockwood (BRITISH MEDICAL JOURNAL, vol. ii, 1882, page 574). The importance to the practical surgeon of Mr. Lockwood's work cannot be too strongly spoken of.

The average length in the adult of the ascending colon (as measured from the tip of the caecum to the hepatic flexure) is eight inches, and of the descending colon (as measured from the splenic bend to the commencement of the sigmoid loop) eight inches and a half. The descending colon is the part of the large bowel that is least liable to variation. It is the only part of the gut, except the duodenum, that retains its original position as a portion of the great primary vertical loop. This segment of the intestine may sometimes be convoluted, and the longest descending colon that I have met with measured fifteen inches.

Considerable importance attaches, from a surgical point of view, to the frequency with which a mesocolon may be anticipated in connection with the vertical parts of the large intestine. With this anatomical circumstance, the operation of lumbar colotomy is very intimately concerned. The usual statement made in surgical text-books upon this subject, is to the effect that a mesocolon is more often found upon the right side of the body than upon the left; and this statement is used as one argument in support of left lumbar colotomy. I made a careful examination of the peritoneal investments of these parts of the colon in the 100 subjects dissected, with the following result. In 52 bodies (that is, in about one-half), there was neither an ascending nor a descending mesocolon. In 22, there was a descend-

ing mesocolon, but no trace of a corresponding fold on the other side. In 14 subjects, there was a mesocolon to both the ascending and the descending segments of the bowel; while, in the remaining 12 bodies, there was an ascending meso-colon, but no corresponding fold on the left side. It follows, therefore, that, in performing lumbar colotomy, a mesocolon may be expected upon the left side in 36 per cent. of all cases, and on the right side in 26 per cent. From the standpoint of development and comparative anatomy, it would certainly be expected that a descending mesocolon would be much more frequently met with than an ascending mesocolon. In the lower animals, the former membrane is always extensive and conspicuous. It is well marked in all species of monkey, and even in the anthropoid apes. It is the remains of the primary vertical fold of peritoneum, whereas the ascending mesocolon is a secondary production, a fold acquired by a certain phase in the development of the bowel. The line of attachment of the left meso-colon is usually along the outer border of the kidney, and is vertical. The attachment, therefore, has been moved some distance from the middle line, along which it would have originally extended. The line of attachment of the ascending mesocolon is, as a rule, less vertical, and is found crossing the lower end of the kidney from right to left, and then ascending along the inner margin of the gland. In like manner, when these folds are entirely absent, the left colon will be found to be adherent to the parietes along the outer border of the kidney, while the right will be fixed a little obliquely to the anterior surface of the lower end of the corresponding gland, and then along its inner margin. The ascending mesocolon will vary in breadth from one inch to two inches, while the fold on the left side will vary between one and three inches.

There is sometimes found connected with the ascending colon a fold of peritoneum, to which I would suggest that the name of the sustentaculum hepatis may well be applied. It is comparable with the fold from the descending colon that is known as the sustentaculum lienis. The process in question is found extending from the right side of the ascending colon to the parietes at, or a little above, the

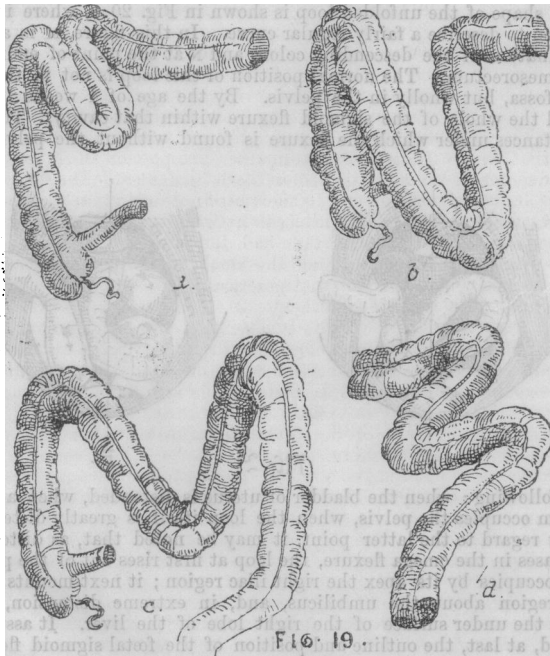


FIG. 19.

level of the highest part of the iliac crest. Its free border is concave, and looks directly forwards. Its width is about one inch and a half, and its depth (from before backwards) about two inches. It forms a shelf, upon which rests the extreme right margin of the liver. I have met with eighteen well marked examples of this fold in one hundred bodies.

It is needless to point out that the position of the liver is subject to some variation. In the fetus, at full term, its lowest point usually reaches the crest of the ilium; and this edge may retain the same relation to the bone for several months, and even for two or three years after birth. In the adult, also, it is not very unusual to find the lowest margin of the liver extending to within a short distance of the

iliac crest, and this, too, when the gland is perfectly normal in appearance. This relation is certainly more marked in women than in men, and may depend, to some extent, upon the use of stays. With three exceptions, the sustentaculum hepatis was associated with a liver that reached either the level of the iliac crest, or a point but a little way above it. It would appear as if the gland had pushed the fold of serous membrane before it, although, in each instance, the fold was a permanent one.

With regard to the exceptions, in two instances, the fold came off from the upper part of the colon, and reached the parietes at the level of the tip of the eleventh rib. In the remaining case, it came off from the hepatic flexure, and supported a liver that occupied a quite normal position. Of the eighteen individuals, eleven were females and seven males; twelve were under the age of three years, and the remainder were adults. In two instances, the fold formed, with another transverse fold that came off lower down from the upper part of the cæcum, a deep fossa, the mouth of which looked directly forwards.

The Transverse Colon.—This segment of the large intestine is liable to considerable variation in length, position, and arrangement. Its average length is 20 inches in the adult. The shortest measurements noted in this part in adults were respectively 12 and 13 inches, and the longest respectively 29, 30, and 33 inches.

It is obvious that the transverse portion of the intestine, when presenting the dimensions last named, cannot follow a straight, or evenly curved line, from the hepatic to the splenic flexure. In every adult body examined, I placed a thread transversely across the abdomen (after that cavity had been opened) at the level of the highest point on the iliac crest, and noted the relation that the transverse colon bore to it. In the majority of cases, the superficial part of the colic arch (that part that was exposed when the viscera were viewed *in situ*, before being disturbed) was either in whole, or in greater part, above this line. In the remaining instances, it was in whole, or in greater part, below it. The proportion of the two sets of cases to one another was as four to one.

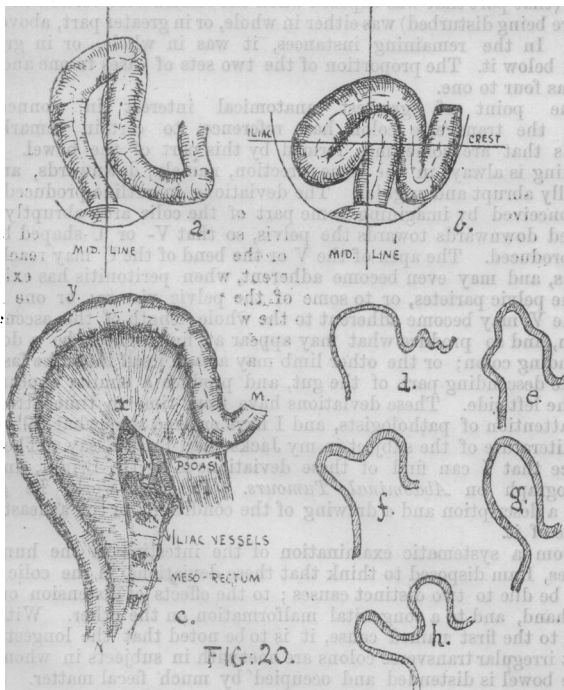
The point of greatest anatomical interest in connection with the transverse colon has reference to certain remarkable bends that are sometimes formed by this part of the bowel. The bending is always in the same direction, namely, downwards, and is usually abrupt and angular. The deviations in outline produced can be conceived by imagining some part of the colic arch abruptly displaced downwards towards the pelvis, so that V- or U-shaped bends are produced. The apex of the V or the bend of the U may reach the pubes, and may even become adherent, when peritonitis has existed, to the pelvic parietes, or to some of the pelvic viscera; or one limb of the V may become adherent to the whole length of the ascending colon, and so produce what may appear at first sight to be a double ascending colon; or the other limb may attach itself in a like fashion to the descending part of the gut, and produce a similar appearance on the left side. These deviations have from time to time attracted the attention of pathologists, and I have entered somewhat fully into the literature of the subject in my Jacksonian Prize Essay. The first notice that I can find of these deviations is by Dr. Bright, in his monograph on *Abdominal Tumours*. In that work, he gives both a description and a drawing of the condition, or of at least one phase of it.

From a systematic examination of the intestine in the hundred bodies, I am disposed to think that these deviations in the colic arch may be due to two distinct causes; to the effects of distension on the one hand, and to a congenital malformation on the other. With regard to the first named cause, it is to be noted that the longest and most irregular transverse colons are met with in subjects in whom the large bowel is distended and occupied by much fecal matter. Such individuals have probably been the subjects of chronic constipation, and have, more or less constantly, presented a distended state of the colon.

Now, if one of these long, loose, transverse colons be artificially distended with water, it will be observed that, when the distension has reached a certain degree, the centre of the colic arch begins to descend in the median line, so that a symmetrical V- or U-shaped bend is produced. In many bodies, especially in those where the bowel is loaded, slight degrees of this bending may be noticed, whereby the centre of the colic arch is brought below the umbilicus. Such a curve may probably be produced simply by the weight of the contained fecal matter. In marked instances, the apex of the bend may reach the pubes (Fig. 19 c), and of this condition I have met with four examples. If, when such an extreme bend exists, peritonitis be present, it is easy to understand that one limb of the bent arch may become adherent to the ascending or descending colon, and so produce the appearance of a double intestine.

The bends, on the other hand, that I have ventured to think may be congenital, are of a somewhat different character, and possibly represent a return to a distortion of the colon that is constant and pronounced in many animals.

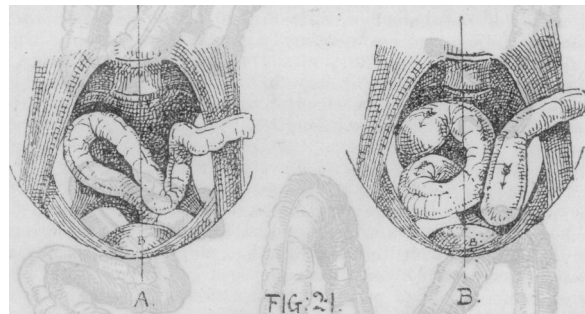
If the colon of a fetus, of about 5 inches in length, be examined *in situ*, a sharp but slight bend will often be noticed in the transverse section just to the left of the middle line (Fig. 18 B). In the large bowel of a foetus at full term, or even of a child of one or two years of age, a similar, but more pronounced, bend will be not unfrequently observed in the same portion of the gut (Fig. 18 A). In both these figures, the part of the bowel from which the great omentum arises is indicated by shading. In five instances, in adult bodies, I have found a bend in the right side of the colon of like description to that just named (Fig. 19 A); and, in one of the examples, the distortion was of such a degree that the apex of the bend reached the pubes (Fig. 19 B). In two of the cases, the malformation was rendered permanent by adhesions that were apparently non-pathological. In four adult bodies, moreover, I have met with a like bending in the left angle of the colon, the great omentum being attached to all the distorted part (Fig. 19 D); and here also, in two examples, the bend was secured by adhesions that did not appear to be normal. Although it may be expected that the effects of distension would tend to show themselves at the colic flexures, yet, in these nine examples, gross evidences of distension were lacking, and the bowel was not of undue length. In no instance was any other abnormality detected in the nine subjects. These distortions of the colon will be seen to bear some resemblance to those that are constant in many animals, of which examples are afforded by the large intestine of the Spider monkey (Fig. 18 c), and of a Lemur (Fig. 18 d).



The Sigmoid Flexure and Rectum.—The accepted account of this part of the bowel that is given in anatomical text-books, is as follows. The sigmoid flexure is said to be situated in the left iliac fossa, and to consist of a double bending of the bowel in the form of the letter S. It joins with the rectum at the pelvic brim, opposite the sacro-iliac synchondrosis; it is attached, by a distinct mesocolon, to the iliac fossa, is very movable, and falls into the pelvis when the bladder is empty. The rectum is divided into three parts; the first part commences at the sacro-iliac synchondrosis, and passes obliquely down from left to right, forming a gentle curve to the right, and ultimately gaining the middle line opposite the third piece of the sacrum; it is entirely invested by a fold of peritoneum called the meso-rectum. The second part extends along the concavity of the sacrum as far as the coccyx, at which point the third part begins, and inclines at once backwards to terminate at the anus. This account is very ancient, and has been handed down from book to book through

many generations. The descriptions given of the second and third parts of the rectum (the portions beyond the point of ending of the meso-rectum), I would fully endorse, both as regards the direction and position of the gut, and its relations to the serous membrane. But although I began to investigate these parts with a full belief in the ancient account, I must confess that, in the hundred bodies, I have never seen such a sigmoid flexure nor such a rectum. I would go so far as to state that the flexure does not occupy the iliac fossa, that its mesocolon does not arise wholly from that fossa, that its course is not that of either the letter S or the letter Σ , and that the first part of the rectum is not disposed in the manner familiarly described. The segments of gut termed the sigmoid flexure and the first part of the rectum form together a single simple loop that cannot be divided into parts. This loop begins where the descending colon ends, and ends at the commencement of the so-called second piece of the rectum; at the spot, in fact, where the meso-rectum ceases, opposite about the third piece of the sacrum. This loop, when unfolded, describes a figure that, if it must be compared to a letter, may well be compared to the capital Omega. If, at any time, new terms should be introduced, it might be well to call all that segment of the bowel between the ending of the descending colon and the ending of the meso-rectum the omega loop, and to limit the term "rectum" to the short piece of practically straight gut that is now described as the second and third parts of the rectum.

The length of this sigmoid or omega loop in the foetus has been already mentioned. Its average length in the adult is $17\frac{1}{2}$ inches. The longest loop met with (in a male aged 28) measured 27 inches, and the shortest (in a female aged 70) measured 6 inches only. This latter specimen was of a very exceptional character. In a small foetus about 5 inches in length, the coil forms a simple loop in the abdomen that is directed upwards and to the right, and that crosses the middle line (Fig. 18 B). In the foetus at full term, the coil may have practically the same outline and position, its apex reaching to the transverse part of the duodenum (Fig. 20 A), or it may have already begun to bend down towards the pelvis (Fig. 20 B). In the adult, the most usual shape of the unfolded loop is shown in Fig. 20 c, where it will be seen to describe a fairly regular curve. In this figure, M is at the termination of the descending colon, and N at the point of ending of the meso-rectum. The normal position of this loop is not in the left iliac fossa, but wholly in the pelvis. By the age of 4 weeks I have found the whole of the sigmoid flexure within that cavity. The circumstances under which the flexure is found without the pelvis are



the following: when the bladder or uterus is distended, when a large caecum occupies the pelvis, when the loop itself is greatly distended. With regard to the latter point, it may be noted that, as distension increases in the omega flexure, the loop at first rises out of the pelvis, and occupies by its apex the right iliac region; it next mounts up to the region about the umbilicus, and, in extreme distension, may reach the under surface of the right lobe of the liver. It assumes, indeed, at last, the outline and position of the fetal sigmoid flexure. I have more than once, in the adult, found the apex of a distended sigmoid or omega loop lying in contact with the transverse colon, or on a level with the transverse part of the duodenum. In one instance, the summit of the loop was fixed by morbid adhesions to the transverse duodenum. Taking the average in all the specimens examined, the most usual arrangement of the omega loop, when *in situ*, is the following. The descending colon ends just at the outer border of the psoas. The gut here suddenly changes its direction. It crosses the muscle at right angles, and about midway between the lumbo-sacral eminence and Poupart's ligament. It now descends vertically along the left pelvic wall, and may at once reach the pelvic floor. It then passes more or less horizontally and transversely across the pelvis from left to right, and commonly comes into contact with the right

pelvic wall. At this point it is bent upon itself, and, passing once more towards the left, reaches the middle line and descends to the anus (Fig. 21 A). It will lie, therefore, in more or less direct contact with the bladder and uterus, and may possibly touch the cæcum. It is in very close relation with the coils of small gut that occupy the pelvis, and by these coils the loop is usually hidden. Other, but much rarer, arrangements of the loop are shown in Figs. 21 B and 22; the diagram, in each case, having been made from a fresh specimen while the parts were *in situ*, and before the sigmoid loop had been in any way disturbed.

The line of attachment or ground-plan of the mesocolon that attaches the omega loop, is as follows (Fig. 20 c). It crosses the psoas at a right angle, and then takes a slight curve upwards, so as to pass over the iliac vessels at or about their bifurcation. The curve ends at the point *x*. This point is either situated just to the inner side of the psoas muscle, or between the psoas and the middle line, or, as is most frequently the case, just over the bifurcation of the vessels.

From this point, the line of attachment proceeds vertically down, taking, at first, a slight curve to the right, to terminate at *N*. Its course is to the left of the middle line, while its ending will be upon that line. It will be seen that, at the point *x*, the mesocolon is folded a little upon itself. From this point, also, arises that part of the membrane that goes to the summit of the loop (*y*). It is here, moreover, that the mesocolon attains its greatest length, and it is, lastly, at this spot the sigmoid artery enters. The average length of the mesocolon of the omega loop is as follows: over the psoas, 1½ inches; at the point *x*, 3¼ inches; on the sacrum, 1¾ inches. There is often no mesocolon over the psoas, the gut being adherent to that muscle. When a descending mesocolon exists, it joins that of the loop; and the line of attachment is then, as a rule, directed obliquely across the psoas and the lower end of the kidney, while beyond the pelvic brim the attachment is as above described. The distance between the points *M* and *N*—the extremities of the loop—is represented by the distance between the outer edge of the psoas and the third piece of the sacrum. The ends of the loop, however, just beyond their respective terminations, are usually brought nearer together by a slight contraction of the mesocolon, the distance between the parts being then, on an average, 3 inches. A line drawn transversely across the mesocolon, at its widest part, usually measures 4 inches. Morbid contractions and adhesions are singularly common in this mesocolon, especially in old subjects, and particularly it would appear in those liable to constipation. These contractions are most common over the psoas, and many bands are often seen passing from the left layer of the mesocolon to the peritoneum over the muscle. By such contraction, a loop of the shape figured in Fig. 20 n may be produced. By somewhat similar, and not necessarily morbid, contractions, loops of the shapes shown in Fig. 20 E, F, and H, may be brought about. In the species of loop shown in Fig. 20 G, the two ends of the bowel are brought close together, so close as to be sometimes in contact. In such instances, the greatest length of the mesocolon may reach 6, 8, or even 9 inches. This is the condition that especially favours volvulus of the sigmoid loop. I have met with six instances of this form, all the subjects being adults past middle life. In one remarkable specimen, the gut from the end of the descending colon to the third piece of the sacrum measured only 6 inches. It formed a perfectly simple bend over the psoas, and had no mesocolon of any kind. It was met with in the body of a male aged 70. From the left side of the mesocolon, folds of peritoneum are often found passing down to

depressions may be formed between these folds when more than one exists.

The Intersigmoid Fossa.—The opening of this fossa is seen on the left wall of the mesocolon, when the loop is drawn forwards and upwards. The pouch is formed between the layers of the mesocolon, and is due to a turning in of a funnel-shaped process of the peritoneum. The opening is usually found in the mesocolon at the point *x* (Fig. 20 c), but more especially when this point lies over the bifurcation of the iliac vessels. The floor of the pouch is adherent to these vessels, and through the transparent floor the ureter can usually be seen crossing the artery. In other and less common instances, the fossa is removed from the root of the mesocolon, and is found some way up upon that membrane, it may be midway between the parietes and the gut, or found even nearer to the bowel than to the attachment of the serous fold. The long axis of the pouch is directed downwards and to the left. The orifice is round or oval, with a thin distinct sharp edge, that shows an absence of blood-vessels. The sigmoid artery lies above it, and to the right. It is by the last named vessel that the fossa is produced. This trunk is usually shorter than the mesocolon in which it runs; that membrane is therefore drawn upon, so as to present a funnel-like depression where the artery reaches it. A deepening of this depression constitutes the fossa. The fossa varies in depth from 1 to 1½ inches. It will usually lodge the forefinger up to the first joint. In one case it accommodated the entire thumb, and in a solitary instance (in a female aged 17) it was so large as to lodge conveniently three fingers up to the joints, between the first and second phalanges. When the fossa is in its usual place, at the brim of the pelvis, its direction corresponds to that of the sigmoid artery; when it is removed from the brim, it may take very varied directions. In a few specimens, the orifice of the fossa would only accommodate a No. 7, No. 10, or No. 12 catheter, although the depth of the pouch varied in these cases from an inch to half an inch. In three specimens the orifice was valvular. The true fossa is not met with in small foetuses. It is quite rare in the foetus at full term, although at that period it is very often represented by a funnel-shaped depression. In older subjects, it is frequently quite obliterated by the adhesions alluded to. The perfect fossa was met with in 52 per cent. of all the subjects. But if distinct funnel-shaped depressions be added to the examples of the true fossa, then the percentage reaches 65 per cent. The sigmoid artery, as it descends to the mesocolon, forms a very distinct fold in the upper layer of that membrane, that is placed at right angles to the long axis of the bowel. It would appear that it is usually about this fold—as about an axis—that volvulus takes place. From a point on the left layer of the mesocolon corresponding to this plica, another fold may arise and pass down to the pelvic brim or the broad ligament. In such a case, there will be no true sigmoid fossa. Two cases of strangulated hernia in the intersigmoid fossa have been recorded—one by Lawrence, and one by Mr. Eve, in the Erasmus Wilson lectures, delivered at the Royal College of Surgeons in 1884.

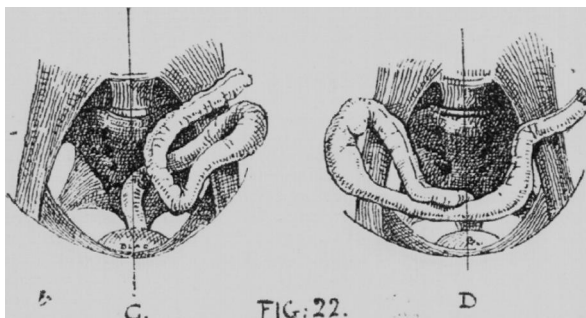


FIG. 22.

the brim of the pelvis, to the broad ligament, to the psoas muscle, and to the iliac fossa. They tend greatly to keep the flexure in position, but are not sufficiently constant to be classified. Large fossæ or

LONDON DENTAL HOSPITAL.—The twenty-seventh annual general meeting of the governors of this institution was held this week at the hospital in Leicester Square. Sir J. McGarel-Hogg, M.P., presided. The annual report set forth that the institution was daily becoming more largely resorted to by the necessitous poor. The number of cases treated during the past year was 38,304, being 2,672 in excess of that of the previous year. The general fund amounted to £1,662 0s. 10d.; donations of life-governors, £325 5s.; and the annual subscriptions, £673 11s. 6d.; the total receipts from all sources being £1,857 3s. 3d., while the expenditure amounted to £1,360 0s. 6d. The mortgage debt had been reduced by £1,500; but there was still a deficit of £3,471 3s. 11d. on the extension-account, and a special appeal was made for subscriptions to pay off this incumbrance, which pressed heavily upon the resources of the charity. The other business transacted was formal.

DONATIONS.—By the will of the late Major-General George Pope, C.B., who died in London on the 21st ultimo, the following legacies, payable on the death of his daughter, are given—namely, £5,000 to the Lord-Lieutenant of the County of Sutherland, for the construction of a harbour of refuge at Helmsdale; £3,000 for a free medical dispensary, and a further sum of £2,000 for a small hospital in connection with the dispensary, for the benefit of the needy residents in the county; £500 for the poor of that district; £1,000 to the Tain Academy, for the benefit of poor children to prosecute their studies there; £1,000 to the University of Aberdeen, for a like purpose; £2,000 to the Northern Infirmary, Inverness; £1,000 for the University of Bombay.