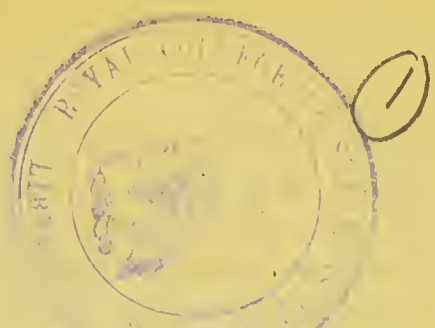

I.

ON ABNORMALITIES OF THE CÆCUM AND COLON WITH REFERENCE TO DEVELOPMENT.

Abnormalities of the cæcum and colon are of considerable rarity. They have been referred to by authors, but, as far as I am aware, no attempt has been made to collect and explain them. Only two abnormalities have come under my own observation. These will be briefly described and illustrated. Reference will afterwards be made to the cases which I have been able to collect.

The first case was that of a man, aged 57, who died of intestinal obstruction (the patient was under the care of Mr Willett, to whose kindness I am indebted for permission to make use of it). At the *post-mortem* examination, which was made under difficulties, the cæcum was found in the right hypochondriac region beneath the liver. The colon crossed from the cæcum to the splenic curve, and thence descended into the pelvis. Here a remarkable abnormality occurred. The descending colon was double; the two tubes were upon the same plane, the smaller one near the vertebral column. Each possessed appendices epiploicæ. The tube which was nearest the spine had a very small canal in its centre, which appeared to have a mucous lining. This canal opened above into the colon by means of a small aperture; below it was lost in a mass of malignant disease. It contained no fæces. Its walls were moderately thick. The malignant mass which received the end of the diverticulum also concealed the end of the outer tube, which was the colon proper (see fig. 1). Before attempting to explain the abnormal position of the cæcum, it will be as well to dismiss the double descending

colon. It is very hard to imagine how a tube which is at first single can afterwards become double. Without doubt such an occurrence is exceedingly rare. In the case of the colon, hardly any instances have been described by authors. No case of a double descending colon can be found. Meckel (*Tabulæ Anatomico-Pathologicæ*, tab. xiii. fig. iv., p. 13) has pictured the intestines of a fœtus in which there were two cæca (see fig. 2).

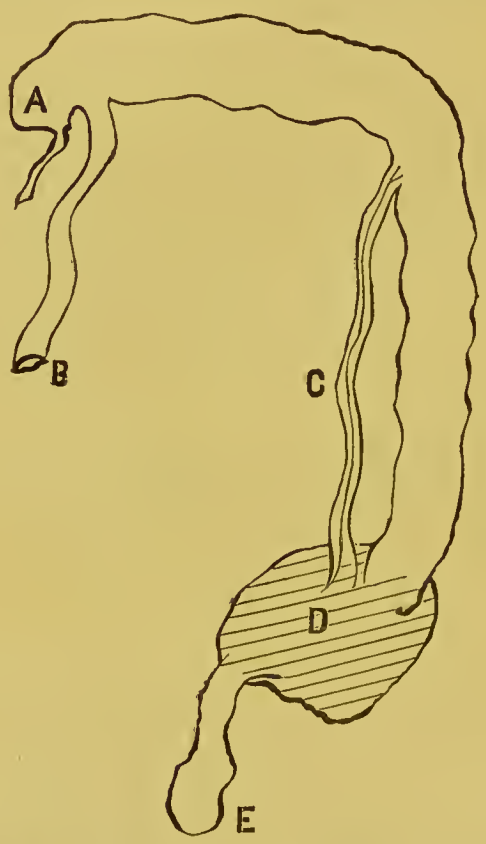

Fig. 1.—A, Cæcum ; B, ileum ; C, diverticulum (?) ; D, malignant mass : E, rectum.

The ilium opened into the cæcum nearest the middle line, and from it the gut extended upwards towards the hepatic curve. Below this cæcum was another, from which a tube extended parallel to and outside the first, and also continuous with the transverse colon at the hepatic curve. Evidently these cases are in some way related to each other. The reason of this double condition seems especially worthy of discussion. Meckel

also figures a case in which the cæcum was bifid (*Ibid.*, tab. xiii. fig. 9), and it may be mentioned that a double cæcum is the normal condition in some animals—manatee, two-toed anteater, &c. (Mivart, *Elementary Anatomy*, p. 448). Possibly this may be considered a stage towards the more complicated condition. The abnormal position of the cæcum may best be explained by reference to the specimens which are before you.

The first is an embryo, about an inch and a half long, probably

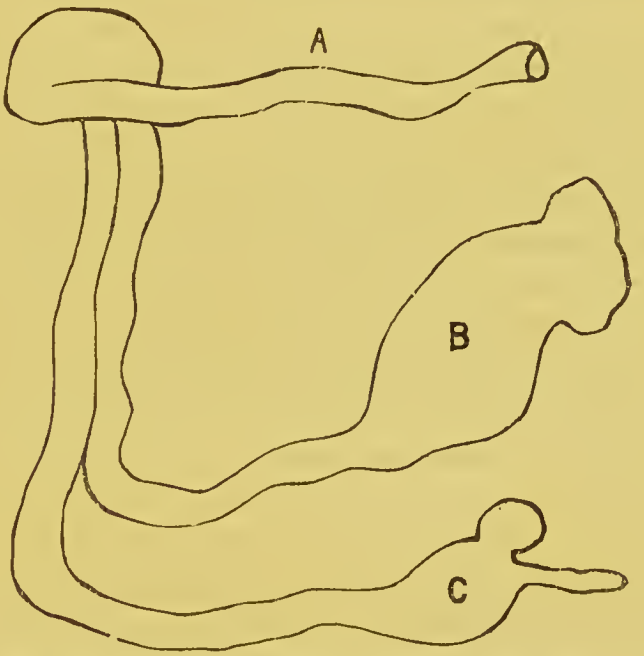

Fig. 2 (from Meckel).—A, Transverse colon ; B, caput coli ; C, caput coli.

about the tenth week of intra-uterine life. The umbilicus is widely open, and small intestines protrude within it. The cæcum lies close to the umbilicus. The alimentary canal descends straight from it into the pelvis. A common mesentery unites all the intestines to the spine. The gut above the cæcum represents the small intestines. These occupy all the right side of the abdomen. There is no difference between the calibre of the colon and that of the small intestines. The explanation of this arrangement appears to be as follows :—The intestinal canal in the youngest embryo is a simple tube, almost straight, and attached

to the spine by a mesentery. Changes take place in this tube which result in the formation of a stomach, large and small intestine, and cæcum. At present only the intestinal portion will be considered. It is most necessary to remember that this tube has a very great tendency to elongate. Its ends are fixed, the anterior near the developing diaphragm, the posterior in the pelvis. As the gut elongates, it therefore makes a loop which protrudes into the umbilicus. Not very far from the pelvic end of this loop a small protrusion occurs. This is the rudimentary cæcum and vermiform appendix. The gut, which passes straight from this into the pelvis, is large intestine; the gut above becomes small intestine. Growth continues; the umbilicus contracts, and necessarily the cæcum enters the abdomen. The small intestine elongates and fills the right side of the abdomen. The large intestine, which is quite straight, occupies the left side. The changes through which the large intestine afterwards passes are partially illustrated by the next specimen.

Specimen No. 2 is an embryo apparently between the third and fourth months of intra-uterine life. When the abdomen was opened the liver reached the pubes. It concealed all the other abdominal viscera. The cæcum was close to the umbilicus; but the colon was greatly elongated. It has formed a large curve, the convexity of which is near the cardiac end of the stomach. There is now an ascending colon, a splenic flexure, and transverse colon; all united by a long mesentery to the back of the abdomen. The right edge of this mesentery affords attachment to the small intestines. The left and the upper edge are united to the transverse and descending colon. The mesentery of the descending colon is still very abundant, and is attached, in the middle line, to the spine. All of this portion of gut is tortuous, but more especially below where the sigmoid flexure is beginning to form.

In this specimen it is evident that the cæcum has ascended into the abdomen and turned towards the right side. The elongation of the intestines accounts for this change of position, but not for the direction which it takes. The liver, which is of immense size at this period, prevents it from ascending. It

must turn. The attachment of the small intestine to its right side determines that it shall pass round under the liver to the right hypochondriac region. This is the point it has attained in the specimen.

Evidently, there is a little difference between the arrangement of the large intestine of this fœtus and the abnormal case first described. Supposing the intestinal canal of the fœtus to undergo no further elongation, it would exactly represent the abnormal condition. In both there is a cæcum in the hypochondriac region, and no ascending colon. Merely to explain this abnormality by saying that development has been arrested at this point, means very little. As Professor Simpson has shown (*Edin. Med. Jour.*, vol. lii., 1839, p. 114), adhesions, due to intra-uterine inflammation of the peritoneum, are a frequent cause. Cases will shortly be quoted, clearly showing that it is no unfrequent cause of arrested development of the intestines. No old adhesions were observed in the case under consideration; but, owing to the circumstances under which the *post-mortem* examination was conducted, they might easily have been overlooked. This retention of the cæcum beneath the liver is possibly related in some way to the great changes in size which the liver undergoes. It has been seen that in one of the specimens upon the table the liver touched the pubes. Ascending from this point, it is ultimately lodged beneath the ribs. A retardation of its progress there seems not unlikely to influence the position of the intestines. Although referred to in general terms by authors,[1] I have not been able to discover many instances of this particular abnormality. A case is mentioned by Professor Turner (*Edin. Med. Jour.*, 1863, p. 110), in which the cæcum lay in the right hypochondriac region. The ileum possessed the same relation to the abdominal wall which the cæcum and ascending colon usually have. This malformation was evidently congenital; but no mention is made of any adhesions. A case very nearly related to this is mentioned

[1] Vater, *De Situ Intes. Coli.*, ed. 1737; Morgagni, *De Sedibus et Causis Morborum*, ep. ii., art. xvi.; Sömmering, *De Corporis Humani Fabrica*, p. 313: Meckel, *Anatomy*, French ed., Paris, 1825, &c.

by Dr Hilton Fagg (*Guy's Hospital Reports*, vol. xiv. 1869, p. 343, Case 55). The cæcum was not quite in the hypochondrium; but "when the abdomen was opened, the cæcum was seen to be immensely distended, occupying the centre and upper part of the abdominal cavity, and filling nearly half of it." (This distension was the result of disease.) "When the cæcum was lifted up, it was found to be quite free; but it could not be replaced in its position, which was occupied by other parts of the bowels. The cæcum passed into the ascending colon in the right hypochondrium. From this the transverse colon (which was much contracted) ran to the left hypochondrium, psssing beneath the cæcum in its course. The descending colon ran downwards for a few inches, and then passed across the spine to the right loin. Thus the sigmoid flexure lay in the ordinary position of the cæcum, and descended from the right to the rectum." The reference in this description to an ascending colon makes the case somewhat dubious; but evidently the malposition of the cæcum was congenital; and it is difficult to see how there could have been much of an ascending colon.

The second case which has come under observation occurred in the dissecting-room. The subject was a male, aged about 25; the colon had not completed its descent into the iliac fossa, and the cæcum was situated opposite the crest of the ilium. Both testicles were retained within the peritoneal cavity, close to the internal abdominal ring.

The explanation of this condition appears to be very simple. When there is an arrest of development, it is not unusual to find that it involves more than one organ. In this case the colon, as well as the testes, has failed in its descent. An examination of the fourth specimen, which is upon the table, shows that this explanation does not cover all the ground. This dissection of an eight months' fœtus shows that the cæcum has descended just below the iliac crest. The testes are within the peritoneal cavity, and close to the internal abdominal ring. The gubernaculum extends from them towards the pubes. A band of peritoneum passes from the right testis to the under

surface of the mesentery, close to where the ilium ends in the cæcum. If the testis be pulled down, the ileum and cæcum also descend. It is not presuming very much to say that, when the gubernaculum drags the testis down, it also alters the position of the cæcum. In the abnormality which has been described, the undescended condition of the cæcum and the undescended testis appear to have an intimate relation. There was no obvious reason why the testis did not descend in this man. The peritoneum in their neighbourhood appeared quite natural. In a similar case described by Simpson, he says there was a slight displacement upwards of the cæcum (*Edin. Med. Jour.*, vol. lii. p. 17 *et seq.*, Case xxx.). The testis was also adherent in the iliac fossa. In this case the reason of the non-descent of the testis is clear, and its effect upon the descent of the colon obvious. Since the above was written, this point has been found discussed by Serres, who is said by G. St Hilaire to have seen in several subjects an undescended colon associated with undescended testis (*Histoire des Anomalies de l'Organisation*, &c., vol. i. p. 378). A female fœtus which has been dissected shows that there is a similar relation between the descent of the ovary and the descent of the cæcum. In this child a band of peritoneum extends from the right ovary towards the cæcum, exactly resembling what is seen in the male fœtus.

Nothing remains to be said concerning the abnormalities which have come within my personal observation. It may be useful to bring together as many as possible of those described by other observers. They are scattered throughout a great amount of literature, and probably many have been overlooked. Cases which will be referred to as described by Mr Chiene (*Jour. of Anat. and Phys.*, 1868, p. 14, &c.), by Professor Turner (*Edin. Med. Jour.*, 1863, p. 110, &c.), and by Professor Cleland (*Jour. of Anat. and Phys.*, 1868, p. 204 *et seq.*), have been exceedingly well explained upon developmental grounds. Differences of opinion exist concerning some points in the development of the intestinal canal, but none exist as to the course which the cæcum pursues. It has been recognised since

the description of Haller. From the cases collected, it seems as if the cæcum may be arrested in any part of its progress. It will be better to glance first at the positions it occupies, and afterwards to mention the abnormalities. The positions are as follows:—

1. Outside the abdomen.

2. Within the abdomen close to the umbilicus. At this period, owing to the great size of the liver and the shortness of the colon, the cæcum is very low in the abdomen.

3. The cæcum ascends within the abdomen, and is in the left hypochondriac region close to the cardiac end of the stomach. At this period all the small intestines occupy the right side of the abdomen. The colon occupies the left side. It is almost straight, and is attached by a mesentery to the spine.

4. The cæcum passing round is beneath the liver in the right hypochondriae region.

5. The cæcum descends into the iliac fossa.

The whole colon, before it has attained its final stage, has an abundant mesentery. The small intestines as they elongate occupy the front and lower part of the abdominal cavity. This necessarily tends to raise the transverse and keep back the ascending and descending colons. As these latter attain their proper position and increase in size, they have no tendency to retain their mesentery, but separate its layers until at last they are uncovered behind.

The first place at which it would be expected to find the cæcum retained would be at the umbilicus. Specimen 249 in the Teratological Series of the Royal College of Surgeons is an instance of this condition. The most interesting is one recorded by Professor Simpson (*Edin. Med. Jour.*, vol. lii., 1839, p. 19). The cæcum and part of the small intestines were found in an umbilical hernia, held there by adhesions. This occurred in a newly-born child, and the adhesions were due to intra-uterine inflammation. This case is important, as it suggests a probable cause for many of these arrests of development. Merely to say there has been an arrest of development is but

half the truth. There must have been some cause for that arrest, and in most cases adhesions are probably present.

The next position in which it might be anticipated that the cæcum would be found, is in the left side of the abdomen. Dr Wilks (*Medical Times and Gazette*, vol. i., 1882, p. 135) mentions such a case, but does not say whether the bowel was adherent there, or give other particulars. He mentions at the same time three cases in which the cæcum was free in the abdomen. These may have been merely cases in which the mesentery was retained. A case recorded by Dr Hilton Fagge is much less open to doubt. "The cæcum lay to the left of the umbilicus, upon the small intestines, which were placed beneath it. It was firmly fixed by old adhesions to the sigmoid flexure and the omentum, which was altogether on the same side, and was fixed to the same spot" (*Guy's Hospital Reports*, vol. xiv. p. 172). It is added, "that the question was much discussed at the *post-mortem* room, whether the position of the cæcum was due to a congenital displacement or a pathological act. The cæcum was entirely surrounded by peritoneum, and the iliac fossa was also lined by a smooth serous membrane. It is probable, therefore, that the cæcum had been entirely free and loose from birth." This latter conclusion of course depends upon the age of the adhesions. The case just quoted from Simpson, points to the importance of trying to discriminate between old intra-uterine adhesions and recent ones.

The third position—that in which the large intestines occupy the left side of the abdomen, and the small the right—is illustrated by the following cases:—In 1850 Mr Berry showed a case to the Pathological Society in which "the cæcum, with the ascending colon and the end of the ileum, was turned upside down, and lay in the left side, being kept there by the mesentery" (*Path. Soc. Trans.*, 1850, p. 222). The description in this case is not very copious; but it appears that, although the large intestine had elongated, it still occupied the left side of the abdomen. There is also a description of a case by Dr Jukes (Case of Carcinomatous Stricture of the Rectum, &c., 1842) which seems to illustrate the same condition. The most typical

cases are described by Reid. In the first, "all the large intestines were coiled up in the left lumbar region and left iliac fossa, and were firmly tied in their situation by the reflexions of the peritoneum. The small intestines consequently occupied the right side," &c. (*Edin. Med. Jour.*, vol. xlvi. p. 70). The abnormality in this case was, without doubt, congenital. The second case was exactly similar; but the cæcum was not so firmly fixed in the left lumbar region (*Ibid.*, p. 71). Reid was of opinion that the abnormalities were due to congenital defect. Dr Hilton Fagge (*Ibid.*, p. 345) describes a nearly similar case, in which all the large intestines were upon the left side of the abdomen. The cæcum was in the pelvis. "The right loin was empty, both the ascending and the descending colon being on the left side of the abdomen." This condition does not materially differ from the others, except in the fact that the cæcum was in the pelvis. It appears as if the usual growing and elongation of the colon had occurred; but, as there was no transverse colon, the cæcum necessarily travelled downwards.

In its ascent the cæcum gets very close to the cardiac end of the stomach. It may be retained in this position, as is shown by a case described by Seymour (*Revue des Sciences Méd.*, 1875, vol. vi.). He says—"The ileum, instead of ending in the right iliac fossa, went into the left, folding upon itself, mounted, covered the spleen, and terminated at the cardiac end of the stomach in a cæcum enormously distended and with very thin walls. The vermiform appendix rested on the spleen. The colon, as large in diameter as the cæcum, passed transversely into the right hypochondriac region, thence descended into the right iliac fossa, where it suddenly diminished in volume as to look like ileum. This portion of the intestine, making a few convolutions, crossed the vertebral column from below upwards towards the left kidney, when it descended again to the right iliac fossa, crossing again the vertebral column. Then it passed transversely to the left to open as usual." No mention is made of any adhesion of the cæcum in the left hypochondrium. The small size of the colon is interesting. It will be seen, by reference to the smallest specimens of embryos, that in them

there is no difference in size between colon and ileum. In this case the small calibre of the colon has persisted. Presuming it is true that the cæcum was retained at the cardiac end of the stomach, the peculiar turns and twists which the colon made seem capable of explanation by remembering its tendency to elongate, and by observing that there is no descending colon. The opening of the sigmoid flexure into the rectum on the right side is not unusual. It existed in one of the cases already referred to. Curling dissected twenty newly-born children, and found this condition in two of them (*Med. Chir. Trans.*, vol. xliii. p. 311). It has been recognised by Giraldes and by Huguier. The specimens (*v. ante*) show that at first the rectum is quite in the middle, as is also that part of the gut which forms the sigmoid flexure. Here, again, as the large intestine elongates, it must form a loop. It seems probable that, under ordinary circumstances, the presence of the small intestines on the right side will determine to loop bending to the left. The traction exerted by the descent of the left ovary or testicle may also influence its descent into the iliac fossa. The retention of the cæcum in the right hypochondriac region has been already described. The completion of its progress into the iliac fossa has also been considered. Even yet the process of complete development has not been accomplished. If the larger fœtus be examined, it is easily seen that there is a fairly long ascending and descending mesocolon, and also a mesocæcum. This condition usually persists for a while after birth. Some "observers consider it to be the usual, if not the more common, arrangement" (Holme's *Surgical Dis. of Children*, London, 1868, p. 117). Sometimes there may be only a descending mesocolon. Morgagni (*De Sedibus et Causis Morborum*, lib. iii. epis. 34) mentions a case, in which the descending colon remained in the middle line, and was attached there by mesentery, exactly as it is at an early stage of development. A very interesting case, described by Mr Chiene (*Journal of Anatomy and Physiology*, 1868, p. 14), shows that the whole of the large intestine may retain its mesentery. In this case "the cæcum was not lodged in the right illac fossa, but lay loose in the cavity of the

abdomen. A mesocæcum, 5 inches broad, directly continuous with the mesentery, passed to the surface of the last lumbar vertebra. The colon twisted on itself, and not subdivided into an ascending and transverse portions, lay to the left of the middle line, and was continuous with the descending colon and sigmoid flexure, which occupied their normal positions. A well-marked mesocolon was connected to the posterior aspect of the entire colon. The great omentum was prolonged downwards from the lower border of the stomach; its posterior recurrent layers passed backwards to the spine." They had, therefore, no attachment whatever to the colon: a point which throws the greatest light and confirmation upon the views put forward concerning the development of the colon. Another very important feature in this case was this. There was a large cicatrix at the root of the mesocolon. As Mr Chiene points out, this may have had a very great effect upon the proper development of the intestines, and was almost certainly the cause of their great abnormality. In the sixteenth volume of the *St Bartholomew's Hospital Reports*, Mr Walsham describes a a case in which the ascending colon and cæcum remain attached to the right border of the mesentery, and have no attachment to the posterior wall of the abdomen, so that if the mesentery were raised, the cæcum and colon were lifted with it. This is exactly the condition which exists in the two largest fœtus which are before you, and which represent the usual state just before birth. In Mr Walsham's case, the sigmoid flexure crossed the spine at the fifth lumbar vertebra, to open into the rectum upon the right side. This abnormality of the sigmoid flexure has already been spoken of. It is one of the commonest and best recognised displacements.

A retardation of the process of development seems to have occurred in most of the cases already mentioned. Professor Turner (*Ibid.*, p. 115) has mentioned a case in which the cæcum was found in the pelvis. This he attributes to an excess of development. In one of Dr Hilton Fagge's cases, owing to the non-existence of a transverse colon, a similar result seems to have been brought about. It is necessary to bear in

mind that, as Esquirol (quoted by Copland, *Dictionary of Medicine*, vol. i. p. 386) has pointed out, such displaeements of the cæeum, transverse colon, and sigmoid flexure, are very frequent in melancholics. Of course, in these cases they are due to fæcal accumulation.

The cases of abnormality mentioned in this paper have many of them a clinical aspect, which has not been referred to. I hope in another place to show that very frequently indeed these abnormalities lead to fatal results, and that, owing to their existence, they have caused the gravest embarrassments to the operator. A knowledge of their occasional existenee may be of great service to the physieian.

Nov. 1884.—Sinee the publication of this paper in the *British Medical Journal*, I have had the opportunity to examine two more abnormalities of the eolon. One of these is of espeeial interest, because colotomy was attempted. Mr Thomas Smith, who has kindly permitted me to make use of the case, performed the operation, but was unable to find the colon. After the patient's death it was found that the bowel occupied the left side of the abdomen. The cæeum was situated about opposite the left sacro-iliae symphysis, and the gut ascended vertically from it towards the left hypochondrium. There was an abrupt bend near the eardiae end of the stomach, after which the tube deseended very mueh in the manner usual to the left eolon. From this it followed that the large intestines were represented by two portions of bowel lying parallel to one another like the limbs of an inverted U, and situated entirely towards the left. Firm and strong adhesions bound these two portions of intestine to each other. The position of the sigmoid flexure was not abnormal. The small intestines filled all the right side of the abdomen. Beside the abnormalities which have been described, a retro-peritoneal hernia was present, which has been alluded to by Mr Eve in his lectures at the Royal College of Surgeons, 1884. The specimen is in the Museum of St Bartholomew's Hospital.

It will be seen that this specimen resembles and forms part

of a class which was mentioned at page 9, *v. ante.* It seems necessary to call special attention to the fact that adhesions were present in this case. It is hard to say whether these were formed before or after birth, but they seem to have approximated so closely in appearance to the covering of the colon and other viscera, that the impression is left upon the mind that they must have existed a great many years. An abnormality very like the preceding has recently been described in the *Journal of Anatomy and Physiology,* by Dr Bruce Young (vol xix. p. 98).

The next abnormality was found in a subject brought to St Bartholomew's Hospital for dissection. Inasmuch as it does not exactly resemble any of those which have been mentioned, it seems appropriate to give a short account of it. The subject was a well-developed male. When the abdomen was opened it was seen that the great omentum was altogether on the left side, and lay crumpled up beneath the greater curvature of the stomach close to the hilum of the spleen to which it was adherent. The small intestines presented no peculiarity. The large intestines were decidedly abnormal. The cæcum occupied the upper part of the right iliac fossa, and a short ascending colon passed upwards from it towards the liver; this portion of the gut was of considerable size, and was attached to the posterior wall of the abdomen by a short but complete mesentery. Instead of lying near the outer edge of the quadratus lumborum, the ascending colon lay in front of the right psoas muscle. The right kidney and quadratus lumborum were hardly overlapped at all by the bowel in question. The transverse colon covered the abdomen at about the proper level to reach the splenic curve, which did not occupy its ordinary position. This flexure was situated almost in the middle line of the body, and the left colon descended from it in a very unusual way; for after leaving it the intestine ran downwards, almost in the middle line, and was quite behind the peritoneum, which simply stretched over its front surface. Curiously enough this portion of the gut had no appendices epiploicæ like the other parts of the large intestine, and, moreover, its calibre was hardly half that of the ascending and transverse colons. The sigmoid

flexure began in the middle line and lay towards the right instead of the left. Both testicles were descended. No adhesions of the peritoneum could be discovered. A large cyst (? hydatid) occupied the Spigelian lobe of the liver.

Reference to the cases which have been mentioned already shows that none of them exactly resemble the one under discussion. That described by Morgagni (*De Sedibus et causis Morborum*, lib. iii. epis. 34) affords the nearest resemblance. In that instance the left colon was in the middle line, but was fastened there by a mesentery. It seems as if, in this case, the bowel had retained its median position, but that, as far as its peritoneal covering was concerned, the usual course of development had proceeded. As regards the peritoneum this assertion perhaps needs slight modification, for it may be remembered that no appendices epiploicæ were present. These structures owe their presence to a comparatively late effort of development, and their absence in this case may be associated with the development of the gut, which was "half the size of the other parts of the large intestine." The fact that the sigmoid flexure was situated upon the right side instead of the left does not seem to call for further comment.

Although some pains have been taken, only two cases have been found in which it has been recorded that the operation of colotomy was unsuccessful owing to the fact that the colon was not in its normal position. Both of these have been referred to elsewhere (*St Bartholomew's Hospital Reports*, vol. xix., 1883, p. 225). In the comments made upon them, it is remarked (*Ibid.* p. 261) that the question of congenital abnormality of the colon bears the same relation to the operation of colotomy as the question of arterial abnormality does to ligature of arteries. With the possibility of the colon having been congenitally displaced clearly in view, it does not seem unreasonable to suggest that, in the case of an unsuccessful operation, the operator should take steps to see that he was not so unfortunate as to have to deal with such an occurrence.