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THE DEVELOPMENT OF THE GREAT OMENTUM AND TRANSVERSE MESOCOLON.

By C. B. Lockwood, F.R.C.S. Lond.

Before the development of the intestines and peritoneum was seriously studied, the relation of the great omentum to the transverse colon was fairly easy to understand. It was usually acknowledged that the following account was true.[1] Beginning as the greater curvature of the stomach two layers of peritoneum are seen descending; one layer passes from the front of the stomach, the other from the back, and they meet below to form the great omentum. Continuing downwards towards the lower

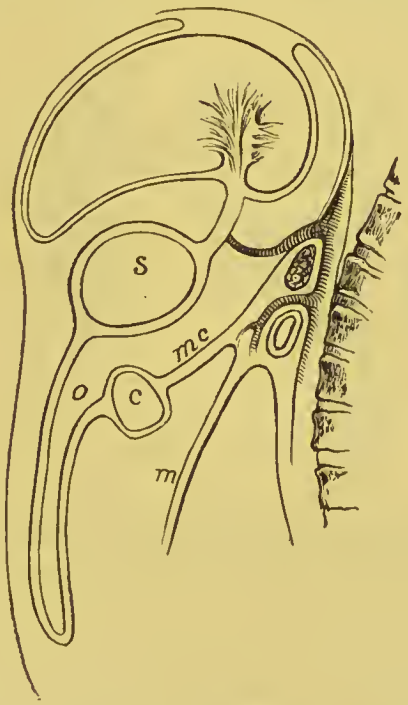

Fig. 1.—*s*, stomach; *o*, omentum; *c*, colon; *mc*, mesocolon; *m*, mesentery.

part of the abdomen, at last the two layers loop upwards to run towards the spine. Before the spine is reached the two layers separate to embrace the transverse colon. It therefore follows that the colon is fastened to the back of the abdomen by two layers of peritoneum, which are called the mesocolon. A glance at the diagram will at once make clear the description (fig. 1).

[1] Quain's *Anatomy*, 9th edition, vol. ii. p. 729 *et seq.*, is taken as the basis of this account.

Owing to the researches of Haller into the development of the intestines, it has been thought necessary to modify the old tracings in the following way :—As far as concerns the arrangement of the two layers of peritoneum which extend from the great curve of the stomach to the transverse colon no change is made. The transverse mesocolon is quite different: it is said to consist of four layers instead of two (fig. 2).

A short statement of the mode of formation of the great omentum and of the development of the transverse colon will show the reason for this new departure. The origin of the omentum may be first considered. At an early stage of development the stomach is attached to the back of the abdomen by two layers

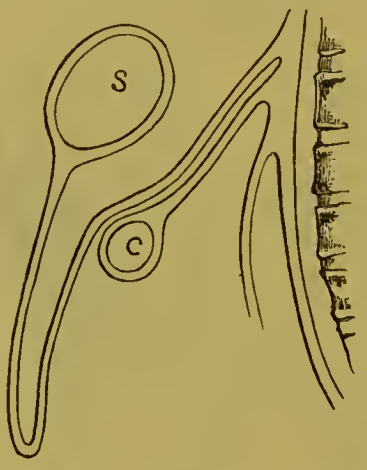

FIG. 2.—*s*, stomach ; *c*, colon.

Note.—For the sake of clearness the layers of peritoneum forming the transverse mesocolon are drawn some distance apart. They are really supposed to be adherent.

of peritoneum ; these layers form a mesentery for the organ, and are therefore called the mesogastrium (fig. 3). The mesogastrium extends from the spine to the greater curvature of the stomach, and, continuing to grow in a disproportionate manner, it forms a fold. This fold of the mesogastrium consists of two layers of peritoneum; it loops downwards from the stomach towards the lower part of the abdomen ; it then ascends to the spine. In fact, the mesogastrium has become the great omentum (fig. 4). It only requires that the transverse colon be placed between the layers of peritoneum which ascend towards the spine, entirely to reproduce the old description of the omentum

and mesocolon. If the development of the transverse colon be next examined it will be seen that this appears almost impossible to occur.

Stated briefly, it may be said that at first the colon is straight. The lower end of the gut is fixed in the pelvis, the upper ends at the cæcum, which is placed almost in the centre of the abdomen. In common with all the rest of the alimentary canal, it has an extensive mesentery. As the colon grows in length, the position of the cæcum alters. It passes round the upper part of the abdomen, so that to begin with it is beneath the stomach, thence

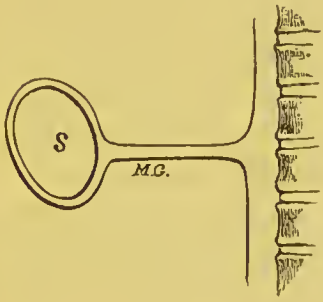

Fig. 3.—From Cruvelhier, *Traité d'Anatomie Descriptive*, vol. ii. p. 550. *s*, stomach ; *mg*, meso-gastrium.

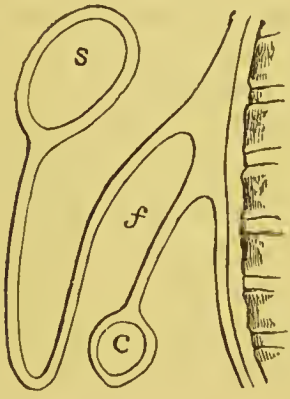

Fig. 4.—*s*, stomach ; *c*, colon ; *f*, fossa.

it passes across to the right side, and afterwards it descends into the right iliac region. From this it follows that at first only the left colon exists, afterwards the left and transverse colons, and at last a left, a transverse, and a right. Until quite a late stage of development the whole of the colon is attached to the back of the abdomen by a considerable mesentery. The transverse colon is the part more particularly in question. It is fastened to the spine by its mesentery just below the place where the meso-gastrium is attached (fig. 4). If the loop of the omentum were made longer, and if the mesocolon became fastened to the under surface of the omentum, the arrangement described in the new account (fig. 2) would be exactly reproduced. Indeed, this is what Haller and other observers believe to happen, and this is why the transverse mesocolon is said to be made of four layers

of peritoneum, two belonging to the omentum and two to the mesocolon.

Certain reasons can be found which tend to show that this theory, which in the remainder of this paper will be called Haller's theory, may not be true. Haller says that the upper surface of the mesocolon and the under surface of the omentum become adherent. It is an unusual thing for serous surfaces to become adherent even during the course of development.[1] It may reasonably be asked why the process of adhesion limits itself to this particular part of the peritoneum? A still more weighty reason for disbelief in Haller's theory would be, that the old account of the relation of the peritoneum to the transverse colon appears to be true (fig. 1). A number of bodies have been examined in the dissecting-rooms of St Bartholomew's Hospital: the peritoneum, which forms the under layer of the great omentum, always seemed to pass underneath the transverse colon to get to the spine. In other words, the colon was always between the two ascending layers of the great omentum.

It has been asserted that in the fœtus the two ascending layers of the omentum are capable of being stripped off the transverse colon and mesocolon (J. F. Meckel, J. Müller, Hansen, and Huschke). Evidently if this were done the original state of affairs (fig. 4) would be restored. The attempt has been made upon several fœtuses, and has never succeeded without laceration of the serous membrane, which, it may be remarked, is exceedingly thin and delicate. It is significant that, until Haller invented his theory, the old account of the mesocolon was thought to be true; it was only discovered to have four layers after the adhesion theory had been originated.

Starting on the assumption that the colon is in reality between the ascending layers of the great omentum, and that the transverse mesocolon consists of only two layers of peritoneum, a great many embryos (human) have been examined in order to endeavour to explain how the change occurs; the change being this, that the colon loses its mesentery (fig. 4) and gets between the layers of the omentum (fig. 1). In embryos an inch and a half long, and somewhere about the tenth week of intra-uterine life, it was found that the cæcum had passed round the abdomen

[1] See also Cleland, *Journ. of Anat. and Phys.*, 1868, p. 104.

as far as the right side. These embryos therefore possess a left and a transverse colon. Both of these portions of the gut have a considerable mesentery. The great omentum may be seen without difficulty close to the greater curvature of the stomach. Its posterior or ascending layers pass back direct to the spine. It seems unnecessary to say that at present they have no connection with the transverse colon. The under layer of the omentum, after reaching the spine, turns down again to become continuous with the upper layer of the transverse mesocolon (fig. 4). It has been remarked that at this period the mesocolon exactly resembles the mesentery of the small intestines. A deep peritoneal fossa therefore exists between the

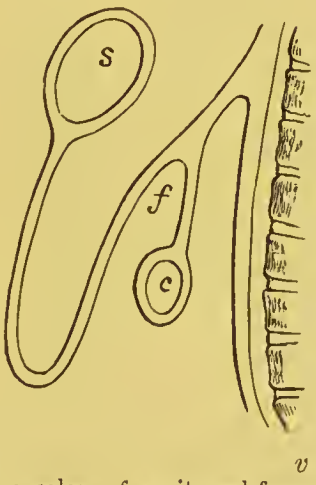

FIG. 5.—*s*, stomach ; *c*, colon ; *f*, peritoneal fossa ; *v*, vertebral column.

under surface of the omentum and upper surface of the transverse mesocolon. The importance of this fossa is very great, as it will be seen later on that most interesting changes occur in its walls; it is the point towards which attention should be especially directed.

Embryos of a larger size, 2½ inches long, and probably between the third and fourth months of intra-uterine life, were next examined. A considerable change has occurred in the relations of the great omentum and transverse mesocolon. The former is still seen hanging from the greater curvature of the stomach ; it has increased in length, but not very much. The posterior or ascending layer can no longer be traced back to the spine. It extends a short distance towards the posterior wall of the

abdomen, and then turns forwards to become continuous with the superior layer of the mesocolon. From this it follows that the superior layer of the mesocolon no longer reaches the spine (fig. 5).

The inferior layer of the transverse mesocolon presents no peculiarity, but merely passes from the under surface of the mesocolon back to the vertebral column. It is evident that the mesocolon has lost a part of its superior layer of peritoneum. In embryos nearly $3\frac{1}{2}$ inches long, and apparently between the fourth and fifth months of gestation, further changes have taken place. The great omentum has increased very little in length. It is still placed immediately beneath the curve of the stomach,

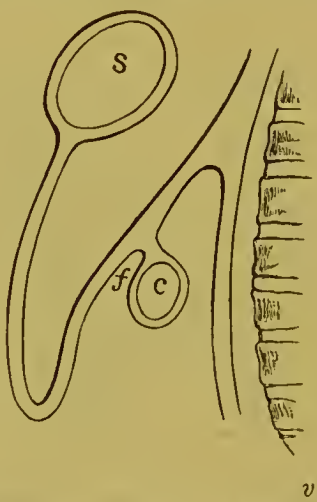

FIG. 6.—*s*, stomach ; *c*, colon ; *v*, vertebral column ; *f*, fossa.

and considerably above the transverse colon. There is no evidence that any process of adhesion is taking place. Indeed, the colon and omentum are quite apart. A very great change has nevertheless occurred. The ascending or posterior layer of the great omentum only extends a very short way towards the spine (fig. 6), and then turns downwards again over the colon. This brings about that the peritoneal fossa between the under surface of the omentum and upper surface of the transverse mesocolon has almost disappeared. It further happens that the colon is almost between the ascending layers of the great omentum and has lost its mesentery.

In larger embryos the small fossa, seen in fig. 6, quite disappears, and when this has occurred the peritoneum has the

arrangement formerly described, viz., that as the ascending layers of the great omentum ran back to the spine they formed the transverse mesocolon, which, therefore, consisted of only two layers. It may be remarked that the fossa within the omentum and mesocolon persists longest towards the left side. In embryos and fœtuses the stomach is much more vertical than in the adult. From this it follows that the colon is nearer the pyloric than the cardiac end of the organ. The omental fossa is therefore wider towards the cardiac end, and takes longer to become obliterated.

If these observations are correct, it seems quite possible for the transverse colon to become closely related to the omentum without the intervention of any process of adhesion. Merely the withdrawing of the fold of peritoneum between the under surface of the omentum and upper surface of the mesocolon is sufficient to bring this result to pass; and more, for it at once places the transverse colon between the layers of the omentum. It still remains to be discussed how the fossa becomes obliterated, how the peritoneum which forms it gets drawn out. It would be a simple explanation to say that the peritoneum forming the fossa has been pulled out by the growth of the great omentum—in fact, that the serous membrane forming the fossa has now to form part of the omentum. This may be partially true, but an examination of many embryos shows that, as a rule, the omentum does not grow very much before birth. Its increase in size does not seem large enough to remove all the serous membrane forming the fossa. The growth of the colon itself may be a factor. About the time the fossa is being removed the colon is increasing in size. In the youngest embryos there is no distinction between large and small gut as far as calibre is concerned. As growth progresses the colon becomes a receptacle for meconium, and its proportionate size is very great. It does not seem hard to believe that this increase may be one of the forces at work in the removal of the peritoneum forming the fossa.

It follows from the above account that,—

A. The old account of the mesocolon is true. That it contains two layers of serous membrane, not four.

B. That adhesion does not take place between the omentum and transverse mesocolon.

C. That the peritoneal fossa between the omentum and transverse mesocolon becomes obliterated by an unfolding of the serous membrane.

Specimens illustrating this account have been placed in the Museum of St Bartholomew's Hospital.