A Combination of the Non-rotation of Midgut Loop and the Open-left Supracolic Peritoneal Recess

By

Hiroshi Hosokawa

Department of Anatomy, University of Tokyo School of Medicine
Hongo, Tokyo

The non-rotation of the midgut loop is not of very rare occurrence. According to Dott ('34) 26 authors have recorded 39 cases of this anomaly, and Estrada ('58) wrote in his comprehensive book titled "Anomalies of intestinal rotation and fixation" that this abnormality which was first described by Gruber in 1862, had been observed in 0.2% (4/2,071) of persons examined radiologically (Kantor, '34) and in 0.5% (5/1,050) of anatomically studied specimens (Smith, '11).

Of course it is possible for persons with this anomaly to live their whole life without any symptom attributable to this anomalous condition of the intestine. From time to time, however, these people are said to show acute or chronic symptoms such as appendicitis, intestinal obstruction as well as other organic lesions, and may be subjected to surgical operation (McIntosh & Donovan, '39; Snyder & Chaffin, '54; Salzberg & Martin, '61; Schulz et al., '61; Ishida et al., '63, etc.).

In the autumn of 1963, one case of the non-rotation of midgut loop was encountered in the gross anatomy dissection for medical freshman. Furthermore, it was revealed noteworthy that this anomaly was associated peculiarly with other abnormalities such as supracolic peritoneal recess and poor development of the omental bursa.

The cadaver was a 88-year-old male, Mr. T.I., who died in February 1963 because of the hepatitis.¹ No remarkable intestinal

¹) Mr. T.I. was a member of Shiragiku-kai, an association of volunteers who leave the will to donate their cadavers for the medical education. On this opportunity I should like to express our cordial gratitude to the members of this association for their respectable spirit for serving and helping the development of medical science.
disorders are said to have been complained of in his life. Some data of this cadaver, No. 2292, are as follows: Body length 149 cm; body weight 41.5 kg; brain 1450 g; heart 335 g; lung r. 620 g, l. 565 g; liver 970 g; spleen 122 g; pancreas 122 g; kidney r. 116 g, l. 117 g; adrenal gland r. 7.0 g, l. 7.0 g; stomach 170 g; small intestine 432 g, 265 cm; large intestine 260 g, 91 cm.

**Observations**

When the anterior abdominal wall is cut open, the liver and stomach are seen to occupy respectively the right and left upper part of the abdominal cavity (Fig. 1). The stomach is deviated a

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**Fig. 1.** Anterior view of abdominal viscera (1).
The ascending colon is strangely situated in the middle of the abdomen. Ca—colon ascendens, G—stomach, It—small intestine, H—liver, Oma—omentum majus, Omi—omentum minus, Vf—gall bladder, Vu—urinary bladder.
little mediad from the usual position and its greater curvature shows round contour, while the lesser curvature is shaped so to say like an incision. The greater omentum which arises from the greater curvature is hanging down and somewhat to the left and, after covering and adhering to the colic loop in the transverse colon, is fused to the parietal peritoneum of the left abdominal wall. The omentum is considerably rich in fatty tissue.

When the greater omentum is lifted and turned upwards, first of all it is noted that the ascending colon lies nearly on the median line of the abdominal cavity and is dislocated to the right as it runs upward (Figs. 2, 8). Thus the ascending colon divides the abdominal cavity into two halves, of which the right smaller one is filled with loops of small intestine, while the left, somewhat larger one lodges the transverse, descending as well as sigmoid colons which are disposed in a peculiar fashion.

The small intestine arises nearly on the median line and forms the duodenal arc concave to the left. The duodenum is only 14 cm in length and continues to the jejunum at the duodenojejunal flexure which is located on the right side of the median line (Figs. 3, 10). The jejunum and ileum are furnished with mesenterium, and the radix mesenterii courses from the lower extremity of medial border of the right kidney mediad and downwards nearly on the median line of the vertebral column (Figs. 4, 10). The lower extremity of the mesenteric root is just above the promontorium. The mesenterium is everywhere smooth-surfaced, showing no trace of adhesions and other pathological changes. Smaller part of the ileum lies in the pelvic cavity.

The ileocecal junction lies just at the entrance of the pelvic cavity. The cecum, furnished with fairly well-developed mesentery, inclines to the left and the appendix vermiformis is attached to the right side of its anterior wall. The appendix, some 4 cm in length, extends upwards and curves to the right (Figs. 2, 11).

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Fig. 2. Anterior view of abdominal viscera (2).

The greater omentum is lifted and turned over upwards. The small intestine is on the right side of the ascending colon.

Ap appendix vermiformis, Bo posterior wall of bursa omentalis, Ca colon ascendens, Ce cecum, Cd colon descendens, Ct colon transversum, Cx, Cy descending and ascending limbs of colic loop, Fcs left colic flexure, G stomach, H liver, It small intestine, L spleen, Lgl lig. gastrolieneale, Oma omentum majus, P pancreas, Rs left kidney, S colon sigmoideum, Vf gall bladder, Vu urinary bladder, X right extremity of the supracolic peritoneal recess. The epiploic foramen lies deep behind this site.
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Fig. 3. Duodenum.
Duodenojejunal flexure (X) lies on the right side of the median line, which is shown by broken line.
D—duodenum, G—stomach, Gb—gall bladder, H—liver, Ms—arteria et vena mesenterica superior, P—pancreas.

Fig. 4. Attachment of the peritoneal garnitures to the posterior abdominal wall.
Bo—bursa omentalis, Scr—supracolic recess.
The **ascending colon**, approximately 20 cm in length, is peculiarly held by the mesenterium together with the small intestine. In other words the ascending colon is kept on the left side of the mesenterium near the attachment of radix mesenterii (Fig. 5-A). The upper and lower one-thirds of the ascending colon are attached to the mesenterium proper by a considerable mesocolon ascendens, while the middle part is so to say kept directly to the mesenterium.

The right colic flexure (hepatic flexure) is just in front of the duodenojejunal flexure, and the colon turns to the left and runs horizontally for some 13 cm. Then it forms a remarkable loop downwards, of which the descending and ascending limbs are respectively 9 cm and 14 cm in length. Since the terminal end of this loop continues to the descending colon at the left colic flexure (splenic flexure), this loop may be included in the **colon transversum**. The transverse part of the colon transversum is furnished with only short mesocolon, while the above mentioned colic loop is suspended by a broad mesentery. The lower extremity of this loop lies nearly at the level of the superior anterior iliac spine.

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**Fig. 5. Diagrammatic illustration of the peritoneum.**

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The colon descendens shows no marked deviation from the usual pattern, and turns upward in the left iliac fossa to form the sigmoid colon. The mesosigmoidium is well developed. The rectum courses downwards along the left side of the median line and, crossing behind the cecum, descends into the pelvic cavity.

Now, when the posterior surface of the greater omentum is traced upwards, it continues peculiarly to the posterior surface of the stomach, showing no usual adhesion to the colon transversum. Thus there is a large peritoneal space or recess which extends upwards and backwards between the stomach and colon transversum up to the level of the gastric fundus. Here it is bordered by the lig. gastrolienale (Figs. 2, 5-B). The contour of pancreas is seen on the posterior wall of this space (Fig. 2). Needless to say, this space is not the bursa omentalis, although it occupies the usual location of the latter. This supracolic peritoneal recess is originally derived from that part on the left side of the mesogastrium dorsale, which is just in opposite to the anlage of bursa omentalis.

Fig. 6. Arterial supply to the small and the large intestine. Abbreviations are to be seen in Fig. 7.
The proper *bursa omentalis* is found to be very small, occupying only a narrow area surrounded by the lesser curvature of the stomach (Fig. 9). The bursa measured only 7 cm in length and 5 cm in breadth. While it showed a slight superior recess, no traces of inferior or splenic recess were seen.

*Arterial supply.*

As shown in figures 6 and 7, the *superior mesenteric artery* supplies the whole loops of small intestine, colon ascendens, transverse part and descending limb of the colon transversum, while the *in-
*ferior mesenteric artery* supplies the colon descendens and sigmoideum. The ascending limb of the peculiar colic loop receives branches from the anastomosing portion between the superior and inferior mesenteric arteries, implying that this portion represents the transition area between the two territories.

**Discussion**

Two years ago the present author reported a peculiar peritoneal sac which enclosed the greater part of the small intestine (Hosokawa & Nakajima, '62). Although peritoneal encapsulation of the small intestine has not been so rare in the literature, our case was so unique that it was almost impossible to explain embryologically the morphogenesis of the sac in question.

On the contrary, the present case is so to say a rather common abnormality which can be explained and understood very easily, for it represents nothing but a non-rotation of the midgut loop in the early fetal life. It is noteworthy, however, that in the present case the non-rotation of midgut loop was associated with other peritoneal anomalies, the open-left supracolic recess and the poor development of bursa omentalis. So this case is characterised by a combination of peritoneal abnormalities arising early in the fetal life.

It is known that the non-rotation is caused by the disorder of return of intestinal loop from inside the umbilical cord into the abdomen in about the tenth fetal week. At about the same time the supracolic recess and bursa omentalis begin to develop and normally the former becomes reduced later, while the latter continues to grow more and more extensively behind the stomach up and downwards. In the present case, however, the opposite has happened. Namely the omental bursa was left rudimentary, while the supracolic recess was kept wide-open, thus compensating the poor development of the bursa.

Each abnormality combined in the present case is easy to explain embryologically. But the question is left open, whether nor not these abnormalities have been induced by a common disturbing factor in the fetal development. The exact date of adhesion between the omental bursa and transverse colon as well as mesocolon is obscure, while Kollmann (1898) stated that it occurs in the fourth fetal month.

It is possible that the open-left supracolic recess is associated
with, and probably due to, the poor development of the bursa omentalis, since these two spaces are so to say in a compensatory relationship to each other. Supposing that the clock-like rotation of the stomach and mesogastria does not take place enough, the omental bursa is obliged to remain small, thus keeping the supracolic space wide open.

Examining the case report of anatomists (Young, 1884; Reid, '08, etc.) as well as of surgeons (Delatour, '15; Rixford, '20, etc.) of the non-rotation of midgut loop, the author could not find the statement on the supracolic recess. Young (1884) just wrote that the bursa was obliterated by adhesion.

The mechanism of rotation of the intestinal loop has been discussed by many authors such as Frazer & Robbins ('15), Dott ('23), Baxter ('53) etc. Nobody has, however, payed attention to the relationship between the intestinal rotation and formation of omental bursa as well as disappearance of the supracolic peritoneal space. Is it impossible to assume that there exists some causal interrelationship between the rotation of mesogastria and that of the midgut loop in the fetal life?

Summary

In the laboratory dissection for medical freshman, a non-rotation of the midgut loop was found peculiarly in association with the open-left supracolic peritoneal recess and poorly developed bursa omentalis. Although the non-rotation itself is not of very rare occurrence, such a combination of three peritoneal abnormalities deserves attention, implying that some common factors may have induced these developmental anomalies of the intestine and peritoneal garnitures.

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Bibliography

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Explanation of Plate I

Fig. 8. Anterior view of abdominal viscera. The greater omentum and stomach are lifted and turned over upwards, so as to show the supracolic peritoneal recess extending upwards between the stomach (G) and transverse colon (Ct).

Fig. 9. Very small contour of the omental bursa (arrow) is seen inside the lesser curvature of the stomach.

Fig. 10. The right half of abdominal cavity. The radix mesenterii is seen to arise at the duodenojejunal flexure (indicated by an arrow) and to extend downwards along the median line.

Fig. 11. The ileocecal junction is shown by the arrow. The appendix vermiformis is directed to the right and upwards.
Plate I

H. Hosokawa