Lecture N. 23

Position Anomalies of the Intestine - the “Mesenterium Commune”

One day a surgeon in my group was about to perform an appendectomy on a young woman. He began with a Stropani - McBurney mini-laparotomy since he was not yet skilled in the video-assisted laparoscopic approach. Soon, however, he called for me because he was faced with a problem: the appendix and the cecum were undetectable, and - given the patient’s young age - he refrained from extending the laparotomy so as to prevent an unwanted cosmetic outcome. We thus decided to close the laparotomy and to proceed laparoscopically. This decision proved to be to our advantage, since identifying the cecum and the appendix positioned to the left in correspondence to the left hypochondrium would have been much more challenging via a traditional approach from the right.

Such anomalies in the position of the colon presented on numerous other occasions, often discovered due to appendix-related diseases as in the case above. Some of the more peculiar situations we found were: the cecum and the appendix at times in a sub-hepatic position, sometimes in the left hypochondrium, other times even in the left iliac fossa. Indeed, in this last instance it was truly striking to see on radiographic images the entire colon collected on the left, the cecum in the left iliac fossa, the ascending colon moving upwards and to the left of the midline up to the level of the greater curvature of the stomach, and then continue in the descending colon via a narrow U-shaped loop that formed, so to speak, the “transverse colon”.

Since, as we said, the anomaly once identified is in most cases related to appendicular diseases, the problems it posed had to do exclusively with the surgical tactics to adopt. Other situations, however, expressions of mostly serious complications, were much more challenging, such as the observation of a volvulus that developed some hours after laparoscopic cholecystectomy for lithiasis, which, on the other hand, had gone swiftly and smoothly.

Anomalies in the position of the intestine constitute a topic that, although frequently tackled by many authors, still elicit an immediate practical interest. Indeed, such disorders do not present only a morphological or doctrinal importance, but - from a clinical standpoint - from time to time pose diagnostic and therapeutic challenges. And, as mentioned above, it is for this reason that in our clinical experience we somewhat frequently encountered problematic and often dangerous situations. It must also be borne in mind that this disease affects pediatric and neonatal aged patients - perhaps more so than adult subjects - with consequent, not always simple, problems for the pediatric surgeon. The topical nature of this disorder is attested to by its constant presence in the literature. On the other hand, it seems today that the subject is somewhat neglected in the curriculum of medical students’ and, particularly of surgeons in residency, not to mention in textbooks of surgical pathology. As such, we believe it useful to revisit this subject, also in light of recent technological advances.
Our understanding of position anomalies of the intestine necessarily entails the study of the embryogenetic phenomena that lead to the definitive arrangement of the intestine itself. The anomalies on which we will focus in this lesson consist of the absence or an error of rotation. We are dealing with phenomena that evolve during stages between the sixth and tenth weeks of embryonic life.

Initially, the digestive tube is constituted by a rectilinear formation arranged longitudinally on a sagittal plane and is endowed with a common sagittal mesentery. The medial portion of the primitive intestine, corresponding to the so-called midgut, that is the duodenum-transverse colon tract, forms a slight curve with an anterior convexity whose radius is constituted by the superior mesenteric artery. The focus of our attention is precisely this segment making up the umbilical loop, called so because up until the tenth week of intrauterine life it protrudes through the umbilical opening into the umbilical cord due to fact that the gastroenteric tube grows at a faster rate than does the coelomatic cavity. During development, this loop undergoes a complex counter-clockwise rotation around the superior mesenteric artery, which constitutes the rotation axis. From the primitive position in the sagittal plane (Fig. 1a) the intestinal loop bends around the superior mesenteric artery, achieving a counterclockwise 270° arch in order to reach its definitive arrangement. To exemplify this process, Snyder and Chaffin created the diagram shown in Fig. 1b, which straightforwardly reproduces what happens in a much more complex fashion in the embryo.

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**Fig. 1**

a) l’ansa intestinale nella posizione primitiva sul piano sagittale; b) schema esemplificativo della rotazione completa dell’ansa intestinale (270°) secondo Snyder e Chaffin.
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We will now attempt to illustrate the various stages of this rotation: each of these is important, since the anomalies that interest us are precisely the outcome of arrested rotation arising during one or another.

We already mentioned that, when the embryo is four weeks old and 5 mm long, the entire intestinal tract, including the umbilical loop, is situated in the median part and is arranged in a sagittal plane. An imaginary clock, positioned such that the origin of the superior mesenteric artery corresponds to the hub of the spheres, would indicate twelve o’clock at this stage, corresponding to the position of 0° (Fig. 2b). The duodenojejunal tract is arranged anteriorly and above the superior mesenteric artery, while the portion corresponding to the terminal ileum, the cecum and the colon is located below the artery. When at five weeks the embryo reaches a length of 10 mm, the duodenojejunal segment is pushed downwards by the development of the liver and of the left umbilical vein, and the entire umbilical loop has rotated 90° around the superior mesenteric artery, thereby passing in a counterclockwise fashion from the sagittal to the horizontal plane. The cecocolonic segment is thus moved from its primitive subarterial position to the left of the same artery (Fig. 2a).

Fig. 2  a) 90° counterclockwise rotation of the umbilical loop from the sagittal to the horizontal plane; b) primitive position of the duodenojejunal loop in the sagittal plane; c) movement of the duodenojejunal loop towards the left; d) position of the duodenojejunal segment when the umbilical loop, with a 180° rotation, is once again arranged in the sagittal plane.
While the situation for this section of the intestine remains nearly unchanged until the embryo has reached 40 mm in length (10th week of life), the duodenojejunal loop continues to move leftwards, passing under the superior mesenteric artery, which it crosses when the embryo measures 25 mm in length. This process is complete when the embryo is 40 mm long and the umbilical loop has achieved a 180° arch (Fig. 2a, b, c, d).

In this stage, the 10th week of life when the embryo is 40 mm long, the coelomatic cavity grows rapidly; as a result, the midgut retracts into it from its temporary intraumbilical position, simultaneously rotating, as already mentioned, 180°. At this point the cecum and the right colon, which in the preceding stage lay to the left of the superior mesenteric artery, rotating above the same artery in an anterosuperior direction, surpass the midline and begin to descend into the right quadrant (Fig. 3a). At the same time, the duodenojejunal loop completes its movement towards the left below the superior mesenteric artery.

**Fig. 3** a) return of the umbilical loop in the sagittal 180° from the primitive position; to the horizontal plane; b) position of the duodenojejunal segment when the umbilical loop has completed its 270° rotation; c) the umbilical loop has completed its rotation; d) sketch of the “mesenterium commune”
An additional 90° rotation completes the entire 270° cycle of the umbilical loop, thus giving the intestinal tract is definitive configuration. The jejunal loop has moved completely to the left (Fig. 3b), the cecocolonic loop downwards entirely to the right of the artery, and the cecum has nearly reached its definitive location in the right inferior quadrant (Fig. 3c).

The insertion of the mesentery into the posterior wall of the abdomen occurs simultaneously to after these phenomena: thus, the midgut, which was originally hanging from a peduncle formed essentially by the superior mesenteric artery, is now fixed, as far as the small intestine is concerned, to a broad oblique insertion with the base of the implant stretching from the upper left to the lower right quadrant; the duodenum, right and descending colon load on to the parietal peritoneum to which they are attached. The coalescence of these segments and the normal insertion of the mesenteries into the posterior wall of the abdomen are, as mentioned above, obviously conditioned by the precise rotation of the intestinal loop.

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From what we have discussed above it becomes clear that if the rotation of the umbilical loop does not come about or is interrupted during one of the stages described, the consequence will be an anomalous placement of the midgut or of a section thereof. Bearing in mind the embryogenetic development, what follows are the main malformations, among which we find the so-called «mesenterium commune» (Fig. 3d).

1) Complete absence of rotation, primitive sagittal mesentery

According to L. Quénu, this anomaly is more theoretical than real as it seems to be rather implausible. Indeed, according to Hecker, Grunwald and Kuhlmann, a perfect alignment of the various parts of the gastroenteric tract does not seem possible.

2) Reverse rotation

This is a rare event, first observed by Strehl. McIntosh and Donovan have collected 16 cases from the literature, to which they added one of their own. Quénu reported one case. According to Gardner, this condition entails a 180° clockwise - and not counterclockwise - rotation of the umbilical loop, the reason for which the transverse colon comes to pass under and the duodenum above the superior mesenteric artery. If the mesenteric root is inserted into the right iliac fossa as is usual, the transverse colon, given its anomalous position, will pass through the parietal insertion of the mesentery and will remain incarcerated. If coalescence of the cecum and the ascending colon is absent or incomplete, as can happen under such circumstances, this segment of the colon, since it is mobile, can undergo torsion with occlusion of the transverse colon in the tract that passes through the mesenteric root.

3) Mesenterium commune

This is the term commonly assigned to the anomaly that arises when the rotation of the umbilical loop stops at 90° (Fig. 2a). It was coined apparently by W. Gruber,
who used it to describe 15 cases of intestinal positional anomalies between 1855 and 1870. In truth, the term “mesenterium commune” should not be used to denote only this condition, because it could well be assigned to other malformations owing to rotation defects. This is the reason why many authors, above all English-speaking ones, do not accept this terminology and have proposed a different nomenclature. If, however, we bear in mind that this is among the most frequent and most characteristic conditions, and that the term “mesenterium commune” truly conveys the idea of the malformation, it is understandable why the name is still commonly used.

As we already mentioned above, the mesenterium commune results from arrested intestinal rotation at 90°, the reason for which the duodenum does not cross the midline and descends to the left of the superior mesenteric artery, continuing with the tenue that is gathered entirely to the right. The cecum is located in the left inferior quadrant and the terminal ileum enters the cecum from the right passing through the midline. The colon lies completely to the left: the ascending segment moves upwards and to the left of the midline until it corresponds with the greater curvature of the stomach. From here it continues in the descending colon through a restricted U-shaped loop that constitutes the transverse colon. As shown in Fig. 4, the ileum and the colon receive all of the vascularization in a large mesenteric fan. And hence the name.

![Fig. 4](image)

According to some authors there may be two types of mesenterium commune, a “pure” form and another “complicated” by partial phenomena or by attachment anomalies: theories on the attachment of the peritoneal membrane still require a clear interpretive approach. From the theory of “sliding” advocated by Treitz to the theory of “welding” espoused by Toldt, the mechanism that guides the coalescence of normally adherent intestinal segments is still not entirely clear.
At the same time, it is likewise difficult to interpret those velamentous or bridle-like formations, which, especially in pediatric conditions, arise almost exclusively in a prepancreatic-duodenal location and which often complicate a malrotation.

These anomalous formations, made up of velamentous fringe and bands, are held by some authors to be of omental origin, i.e., derived from the posterior mesogastrium. Instead, other authors note that during the 14th week of life the duodenum attaches to the posterior parietal peritoneum and that the right colon, which from the 10th week onwards develops anteriorly to the duodenum, attaches precisely in front of this organ. At this point, if rotation is stopped, it is likely that the process of coalescence will also be interrupted, and that the observed pre-duodenal bands and veils prelude a pre-duodenal colonic attachment. This, according to McIntosh and Donovan, would be in agreement with the observation of a frequent concomitance between malformations and pre-duodenal bands, bearing in mind, as well, the fact that attachment of the right colon in front of the duodenum progresses gradually from above downwards as the cecum descends. All of this explains, albeit in part, why the cecum or the ascending colon in the mesenterium commune sometimes contract adhesions with the duodenum or with the pre-duodenal-pancreatic region, often provoking duodenal occlusion. It also partially accounts for why the cecum, not completely rotated, intersects and closely attaches to the descending portion of the duodenum, thus compressing it against the posterior wall and causing as such stenosis and occlusion.

In the newborn, anomalies due to arrested rotation at 90° may be complicated by failure of the intestine to return from the umbilical cord into the abdominal cavity, thereby leading to the condition known as omphalocele.

4) Anomalies, incompleteness of rotation and of fixation in the latter stages of intestinal development

These malformations are represented by internal, paraduodenal and retroperitoneal hernias, and above all by incomplete rotation of the colon with positioning of the cecum and the appendix anywhere from the left hypochondrium (as in the case described at the beginning of this lecture) to a (more frequently) subhepatic localization. These latter alterations are well-known in surgical practice.

The anomalies that the surgeon may more frequently encounter are thus the mesenterium commune and the left hypochondriac and subhepatic positioning of the cecum and appendix. Below we will endeavor to outline the most salient features of these conditions.

Any attempt to delineate the symptomotological picture of the mesenterium commune in its “pure” form is illusory and perhaps even meaningless. Indeed, when the condition is clearly not associated with alterations of fixation that induce phenomena of intestinal stenosis, it is nothing more than a morphological expression and, as such, its pathological significance is little or nothing. As a matter of fact, most
authors agree that this anomaly is more often than not asymptomatic. This detail, as we’ve said, makes it difficult - if not impossible - any study of its true frequency.

Some authors, moreover, hold that in carriers of *mesenterium commune* an alteration of the neuro-vegetative balance would exist in the splanchnic territory as an expression of a “*general vagotonic neurosis*” (Picard, Campi). These phenomena would be due in part to a modification in the tone of parasympatic fibers, perhaps as a consequence of lesions to visceral nerve branches caused by even temporary mesenteric torsions resulting from the abnormal mobility of intestinal loops. In any case, even if we were to admit this dystonic syndrome, the disturbances that it would be able to provoke would most often be negligible. At a practical level, therefore, it would seem to be more correct to admit that in the vast majority of cases *mesenterium commune* is - unless affected by some complication as we will see below - an absolutely latent malformation.

Other highly questionable and objectively unfounded hypotheses are those that speculate that *mesenterium commune* may represent a predisposing factor to intestinal tract diseases, such as, for example, appendicitis and duodenal ulcer. Campi describes a case of *mesenterium commune* associated with esophageal-gastroenteric megaly, and ponders whether there may be any connection between the two conditions.

The concomitance of partial or anomalous fixation leads to, rather, a symptomatologic picture that may ultimately develop into intestinal occlusions, which may, in turn, vary extremely in relation to the location and nature of the coalescence phenomena. The most frequent form is that caused by bands or pre-duodenal veils that attach the cecum or the right colon to the duodenum, which may remain compressed, thereby creating a duodenal occlusion or sub-occlusion. This event is rare in adults; in newborns, it occurs chiefly in the first few days after birth. In this case establishing the nature of the duodenal stenosis preoperatively is quite difficult: the differential diagnosis with other forms of stenosis or with phenomena of atresia most often comes about on the operating table.

Regardless of the above, *mesenterium commune* manifests itself - as we’ve said - only if it is complicated. The main complication is volvulus, which is facilitated by the abnormal mobility of the loop made up of the small intestine and the right colon around the axis corresponding to the superior mesenteric artery. Volvulus may involve the entire loop or part of the umbilical loop, depending on the degree of attachment of the mesentery to the peritoneal wall. It usually follows the direction of normal intestinal rotation. This serious complication generally occurs in newborns or children with the classic symptomatology of this form. In adults, volvulus may occur as frequently as intestinal intussusception.

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The diagnosis of *mesenterium commune*, if not made during surgery, is always radiological, unexpected and - more often than not unsuspected. The radiological picture is classic: absence of the third and fourth segments in their normal position, as well as of the duodenojejunal angle; the duodenum continues into the jejunum
without crossing the midline; the small intestine is entirely collected to the right (Fig. 5 - 6); the cecum and the right colon in a mesoceliac position or even situated to the left (Fig. 6 - 7) and the terminal ileum flows into the cecum from right to left.
As far as fixation defects are concerned, radiology may provide indirect signs of these as bizarre duodenal deformations, as stasis of the second segment of the duodenum or of the jejunum, and as points of duodenojejunal stenosis.

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From what has been described, it becomes obvious that surgical treatment is indicated only for complicated cases or those associated with other intestinal lesions. Numerous methods have been proposed to surgically correct mesenterium commune, but the approach which, according to the majority of authors, seems to achieve the best results is the fixing of the right to the left colon after having ligated the preduodenal bands (if present). In this way, the duodenum is liberated from possible stenosing factors and the cecum and the right colon are distanced from the duodenum, thereby enlarging the pedicle of the umbilical loop and diminishing the possibility of volvulus that becomes further unfeasible due to the attachment of the right to the left colon. If we bear in mind that the complications of mesenterium commune depend above all on fixation defects, it is understandable why most surgeons for go attaching the right colon in its normal position and moving the small intestine to the left by passing it under the superior mesenteric arteries.

It seems redundant to emphasize the difficulties faced by a surgeon when, if malrotation is ignored, he must intervene on a segment of the intestine. This is especially true for the cecum and the appendix, which in these conditions most usually cannot be approached via normal access routes. For all of these reasons mesenterium commune represents a malformation that is not only an anatomic curiosity, but a condition that from time to time raises problems of a practical, diagnostic, clinical and, above all, surgical nature.

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As far as anomalies due to incomplete rotation of the colon are concerned, reference should be made to the cases that are encountered not uncommonly in surgical practice. And these are situations that can prove to be authentic challenges for surgeons. Such events include above all localization of the cecum in the left hypochondrium and, perhaps more frequently - at least in our experience - when it localizes in subhepatically.

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The episode to which we referred at the opening of this lecture, that is, the difficulty in reaching the appendix via a classic laparotomy in the right iliac region and the subsequent resolution of the problem with a laparoscopic approach, aptly illustrates how this latter technique has revolutionized the surgical management of position anomalies of the intestines, especially the colon. Moreover, the problems created by these malformations are for the most part caused precisely by an appendix located other than where it should be.
In our experience, too, accrued at the Surgical Clinic of the University of Genoa, such episodes, be they the result of mesenterium commune or of incomplete rotation of the colon, were commonplace. The greatest difficulties, of course, arose under conditions of acute abdomen due to appendicular causes, even though in such instances careful consideration of previous or current symptoms of the acute event could in some cases induce the observation that the pain was atypical compared to the norm: indeed, even in the pre-acute stages, pain was often traced - not to the right iliac or at most epigastric region - but, rather, to the mesogastrium, not infrequently accompanied by irradiation to the left iliac region. Because these were emergency situations and morphological tests were not performed, laparotomy was often median, and less frequently right trans- or pararectal.

In an elective setting the position of the cecum/appendix was systematically revealed by radiography with contrast media: a small amount of barium swallow was normally enough to achieve our purpose, which was to limit the extent of the laparotomic incision. An anomalous position of the cecum/appendix, be it subhepatic or worst of all located to the left, would have required an even more invasive procedure.

Under other conditions of acute abdomen, in general cases involving volvulus of the colonic loop or compression phenomena or, still again, volvulus affecting duodenal-ileal elements, the problem was overcome in any event by carrying out a deliberately extended laparotomy.

For chronic pathological processes, as well, especially those of a neoplastic nature, since intestinal arrangement was always revealed by preoperative diagnostic tests and possible malrotations of the colon were detected in advance, such malformative situations rarely constituted a challenge for surgical treatment.

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Over the past 20 years, defined by the introduction of minimally invasive video-assisted laparoscopy, the problems deriving from mesenterium commune and other position anomalies during the surgical treatment, both elective and emergency, of appendicular disease have been greatly reduced. The need remains, nonetheless, to be aware of the possibility and to understand the difficulties that a surgeon may encounter at the operating table. The interest that this malformative disease continues to arouse in both general and pediatric surgeons is witnessed in the number contributions appearing in the references (see below). It was our intent join this list with the experience of our School, by dedicating this lecture above all to surgeons in training, students and residents.
References

2) Campi L. - Su un singolare caso di mesenterium commune associato ad esofago-gastro-enteromegalia. Minerva Med. 100, 2, 1953
4) Hecker, Grunwald, Kuhlmann - Les anomalies congénital de forme et de position du gros intestin et leur importance chirurgicale. Revue de chirurgie 64, 661, 1926
5) Ladd W.E. - Congenital duodenal obstruction. Surgery 1, 878, 1937
14) Quénu L. - A propos de 4 cas de “mesenterium commune”de l’adulte dont 2 associé a un ulcère duodénal. Journ. de Chirurgie 72, 778, 1956