

Laparoscopic treatment of intestinal malrotation in children

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Abstract

Background: Laparoscopic treatment of intestinal malrotation in children is difficult, and most of our pediatric surgeon colleagues active in the field of laparoscopic surgery tell us that more often than not they must convert to an open procedure. Initially, we experienced much difficulty too, but after modification we were able to master the technique, and now we feel confident. We here describe the actual technique we use.

Methods: Our experience encompasses nine children treated during the past 18 months. Five of the children presented in the newborn period and four later. During laparoscopic surgery, it is of paramount importance to concentrate not on the loops of bowel, but on the duodenum. By starting to identify the duodenum, mobilizing it, and carrying on the mobilization of the small bowel down until the whole small bowel has been seen, the pathologic anatomy is easily unraveled. Moreover, an existing volvulus is automatically reduced and the bowel automatically put in a nonrotation position in the abdomen.

Results: All patients have done well, and no complications have been noted. Operative time has been reduced to about 1 hour.

Conclusions: Laparoscopic treatment of intestinal malrotation in children is not so difficult provided certain rules, as described, are followed.

Key words: Malrotation — Laparoscopy — Child

Laparoscopic treatment of intestinal malrotation in children is difficult. Most of our pediatric surgeon colleagues active in the field of laparoscopic surgery tell us that more often than not they must convert to an open procedure. In the past 18 months we have treated nine children with intestinal malrotation laparoscopically. Initially, we also experienced much difficulty with the laparoscopic approach, but slowly

we mastered the technique and now feel much more confident. We here describe our actual experience.

Material and methods

Material

During the past 18 months, nine children have been treated laparoscopically for intestinal malrotation. Five of these children presented in the neonatal period with symptoms of high intestinal obstruction since birth. The diagnosis of malrotation in these children was made between 7 and 32 days after birth. Two of the children had a volvulus without strangulation (Fig. 1).

Four children were referred at the ages of 5½, 11, 18, and 28 months, respectively, for a feeding gastrostomy because of feeding problems in relation to mental retardation. Intestinal malrotation was diagnosed during the preoperative workup of these patients, which included a pH study and endoscopy of the esophagus as well as an upper gastrointestinal (GI) tract barium meal. One of these patients also had pathologic gastroesophageal reflux, and another had associated duodenal stenosis.

Method of laparoscopic treatment

The following technique evolved during our experience. The child is placed in a prone and slightly anti-Trendelenburg position on a short operating table. The hips are in exorotation and abduction, the knees in flexion, and the feet with the soles against each other. To prevent slipping of the patient from the table, the legs are enveloped with the lower end of the sheet covering the table. The tower with monitor, camera-unit, video, and insufflator stands to the right of the upper end of the table. The surgeon stands at the bottom end of the table, with the surgical assistant to his left and the scrub nurse to his right.

Three 5-mm lightweight trocars are inserted: the first in an open manner through the inferior umbilical fold for a 5-mm scope and the two others pararectally at the level of the umbilicus, the right one for a forceps (surgeon's left hand) and the left one for a pair of scissors (surgeon's right hand). CO₂ is insufflated at an initial flow of 0.5 l/min and a maintenance flow of 2 l/min. Pressure is limited to 5 mm Hg. It may help if the trocar holding the 5-mm endoscope is lifted by the assistant to allow maximal visibility within the small abdominal space.

It is not difficult to confirm the diagnosis of intestinal malrotation laparoscopically: Cecum and appendix are in a high and rather medial position below the liver, to which they are fixed by peritoneal bands. The second part of the duodenum looks long and tortuous. In the case of a volvulus, which is always in a clockwise direction, the typical picture is easily identified (see Fig. 1).

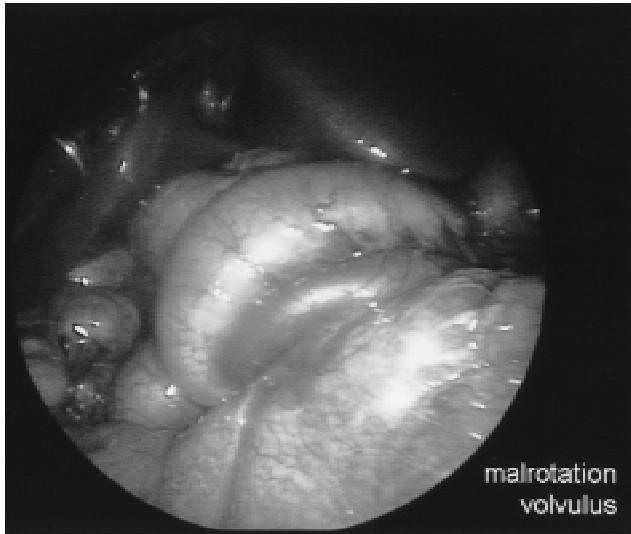


Fig. 1. Endoscopic view of a volvulus of the bowel in the context of intestinal malrotation. Above the volvulus the liver is seen with gallbladder. Between the volvulated loops of bowel, a large dilated vein is visible.

Regarding therapy, it is very important to concentrate on the stalk of the anomaly and not on the loops of bowel. Even when there is a volvulus without strangulation, it is far better to leave the volvulus for the time being and concentrate on the second part of the duodenum. First, the peritoneal bands fixing the cecum to the liver are severed, and the cecum is pushed to the left. Next, the second part of the duodenum is mobilized. It is very important to stick to the duodenum and to mobilize the distal duodenum further and further while pulling on the more proximal part. During this mobilization, a peritoneal band in the shape of a ring encircling the duodenum becomes apparent and should be transected anteriorly. This band represents the end of the retroperitoneal part of the duodenum. The proximal jejunum now comes into view. By pulling further and further on the jejunum, the whole jejunum is positioned on the right below the liver. By using this technique, an existing volvulus is reduced and the bowel put in a nonrotation position.

The stalk of the anomaly, however, is still narrow, and the second part of the duodenum and cecum are still lying side by side. By transecting the anterior peritoneal band between both structures and pushing the cecum to the left, the mesenteric stalk is broadened. The appendix is now grasped and exteriorized by removing the left trocar. The appendicular vessels are severed, and the appendix is ligated at its base and removed. The right-sided trocar is removed as well. After checking the trocar sides for eventual bleeding, the scope is removed, and the trocar holes are closed.

Results

The five newborn babies were treated for malrotation only. Of the remaining four children, two also received a gastrostomy, one underwent a gastrostomy and antireflux procedure according to Thal, and the last patient had laparoscopic treatment of the malrotation followed by a duodenoduodenostomy through a minilaparotomy. As the duodenum had been completely mobilized laparoscopically, only a very small laparotomy was needed to do this.

No perioperative complications occurred. Postoperatively, in one of the two children who also received a gastrostomy, the catheter dislodged and acquired an intraperitoneal position. This was recognized before feedings were given, and the catheter was removed. Despite treatment of the malrotation, the child continued to vomit, and a repeat

pH study demonstrated pathologic reflux. A barium meal showed good passage through the duodenum and proximal jejunum. In a second laparoscopic operation, the child received a gastrostomy as well as an antireflux procedure according to Thal. During that laparoscopic operation, no adhesions could be noted between the bowel and anterior abdominal wall. All the other children did well and left the hospital in 4 to 11 days. The laparoscopic approach of the malrotation proved to be difficult in the first few cases, lasting up to 3 hours. Presently, less than 1 hour is required.

Discussion

Laparoscopic procedures in small children are difficult because of the small peritoneal cavity and limited working space. Moreover, the pneumoperitoneum, especially at larger pressures, is harmful, the more so when the procedure lasts longer. However, with optimal muscle relaxation, a pneumoperitoneum pressure of 5 mmHg creates enough room for the laparoscopic treatment of intestinal malrotation. The same principles of treatment are followed as in open surgery:

- Transection of the bands of Ladd between the liver and cecum
- Broadening of the stalk of bowel by incising the anterior mesenteric sheet and separating the duodenum and cecum to prevent volvulus
- Appendectomy to prevent missed appendicitis
- Placement of the bowel in a nonrotation position in the abdomen.

Most of these principles were originally described by Ladd [2, 3]. Appendectomy, however, was not advocated, and broadening of the stalk by incising the anterior mesentery, although not clearly described, must have been part of the procedure. Ladd [3] wrote that if the surgeon attempts to evaluate the findings without delivering all the intestines outside the abdomen, he will become hopelessly confused, waste valuable time, and usually not find out that with which he is dealing. The same will happen during laparoscopic treatment of malrotation when the surgeon does not concentrate on the duodenum. Turning the loops of bowel around during the operation does not make the pathologic anatomy simpler. Even when a volvulus is present but no strangulation, it is better to leave the volvulus because access to the proximal duodenum is far better than after derotation. This is at variance with the classic open approach in which a volvulus is immediately reduced. By concentrating on the duodenum and mobilizing the duodenum, then later on the small bowel further and further, a volvulus will be reduced automatically and a nonrotation position obtained.

It is advocated that in all cases of malrotation, an intrinsic obstruction should be ruled out by passing a tube of adequate size through the duodenum into the jejunum [1, 4]. We have not adopted this policy as a routine because we think that in the event of a partial obstruction due to a membrane secondary change (e.g., bowel wall thickening),

a difference in caliber will be seen laparoscopically. This was obvious in the patient in which we treated the malrotation laparoscopically, but who had associated duodenal stenosis. Laparoscopic treatment of the malrotation greatly facilitated the duodenoduodenostomy because the duodenum had been completely mobilized. As a result, only a minilaparotomy was necessary.

Previously, we reported on the feasibility of the laparoscopic approach to intestinal malrotation in small children [5]. The technique has evolved and now is more standardized, reducing operative time and therefore the consequences of the pneumoperitoneum. The benefit for the child is obvious: less postoperative pain, less scarring, and apparently fewer adhesions.

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