

## Laparoscopic evaluation and treatment of intestinal malrotation in infants

E. Gross, M. K. Chen, T. E. Lobe

Section of Pediatric Surgery, LeBonheur Children's Medical Center, University of Tennessee, Memphis, 777 Washington Avenue, Ste. p-210, Memphis, TN 38105, USA

Received: 20 November 1995/Accepted: 12 December 1995

**Abstract.** Infants with intestinal malrotation present with bilious emesis and the diagnosis is generally obtained by an upper gastrointestinal barium study. Malrotation is suspected if the ligament of Treitz is not positioned to the left of the vertebral body. Barium enema may also be used to detect malrotation by noting the abnormal position of the cecum from its usual placement in the right lower quadrant, but this study is not as reliable due to the mobility of the cecum. Some infants may not have classic radiographic findings for malrotation, yet the contrast studies are not entirely normal. We recently treated two infants with recurrent vomiting whose UGI studies suggested intestinal malrotation. Laparoscopic exploration confirmed the diagnosis of malrotation. Laparoscopic correction (Ladd's procedure) of malrotation was carried out in one infant. The second infant underwent a traditional Ladd's procedure. The technique of laparoscopic Ladd's procedure is described. Laparoscopy may be used for the diagnosis and treatment of infants with intestinal malrotation. It may be especially helpful to verify the diagnosis in patients who do not have classic radiographic findings. Whether laparoscopy should be used in patients with midgut volvulus is debatable. Laparoscopic derotation of the volvulus in a setting where the bowel is markedly distended may be difficult and dangerous.

**Key words:** Laparoscopy — Malrotation — Ladd's procedure

Complications of abnormal rotation and fixation of the intestine classically present with bilious vomiting in the newborn period. Radiologic evaluation may show a duodenal obstruction from Ladd's bands or a midgut volvulus with an abnormally positioned ligament of Treitz which is normally

to the left of L1 or L2 at the same level as the duodenal bulb. The diagnosis and the operative management are indisputable in this group of patients. However, in other patients, usually an older group, the clinical presentation may be vague or the radiologic evaluation equivocal. In the past, these patients underwent mandatory exploratory laparotomy to rule out a malrotation. Advancements in minimally invasive surgery enable us to assess the intestinal rotation and fixation using laparoscopy. In addition, laparoscopy may also be used to treat the anomaly. We present two infants with intestinal malrotation who were evaluated laparoscopically. Laparoscopic correction of the malrotation (Ladd's procedure) was performed in one patient.

### Materials and methods

#### Case 1

A 6-week-old male was admitted for evaluation of recurrent vomiting since birth. Prenatal evaluation and delivery were uneventful. Physical examination was unremarkable. The ligament of Treitz did not cross the midline and was one vertebral body lower than the duodenal bulb on an UGI study (Fig. 1). Barium enema and follow-up abdominal films showed a mobile and nonfixed cecum. These findings were consistent with but not conclusive for intestinal malrotation. In order to better assess his mesenteric fixation, the infant underwent laparoscopy, which documented a mobile cecum and a short mesentery between the right colon and the distal duodenum. Laparotomy was carried out, which confirmed the laparoscopic findings, and a traditional Ladd's procedure was performed. The postoperative course was uncomplicated. Diet was resumed on the 4th postoperative day, and the infant was discharged home the next day.

#### Case 2

A 4-month-old female presented with recurrent vomiting since birth. She was the product of a full-term pregnancy and normal delivery. Her mother reported that the child suffered from intermittent bilious and nonbilious vomiting. On physical examination the child appeared well nourished. The abdomen was soft with no evidence of organomegaly and there were no other palpable masses. UGI showed the duodenojejunal junction lying over



**Fig. 1.** UGI study showing an abnormal lower and medial location of the ligament of Treitz (*arrow head*).

the left pedicle of the spine. Delayed small-bowel follow-through films documented the cecum in the left midabdomen. These findings suggested a short mesenteric pedicle. At laparoscopy, intestinal malrotation was identified. The Ladd's bands were divided and an appendectomy was performed. The postoperative course was uncomplicated. Diet resumed on the 2nd postoperative day, and the infant was discharged home 2 days later. She has had no further vomiting on follow-up examination.

### *Laparoscopic technique*

A 5-mm trocar was inserted using an open technique through an infraumbilical incision. Carbon dioxide was used to insufflate the abdomen after verifying the intraabdominal position of the trocar with a 4-mm laparoscope. The bowel was found to be malrotated with classic Ladd's bands attaching the duodenum to the colon, and there was no evidence of a volvulus. Under direct visualization three additional 5-mm ports were placed: in the right upper and lower quadrants, and in the left upper quadrant. Using sharp and blunt dissection with bipolar cautery, the bands connecting the duodenum to the colon were divided. Grasping forceps were used to follow the duodenum down to the jejunum and additional bands were divided to widen the mesenteric root. After completing the dissection, the small bowel was placed in the right side of the abdomen and the colon on the left side to maintain a wide mesenteric base. To complete the Ladd's procedure, an appendectomy was carried out using endoscopic loops and scissors. The trocars were removed under direct vision to ensure hemostasis and the fascial defects were closed with absorbable sutures. The operative time was 76 min.

### **Discussion**

Failure of normal rotation and fixation of the intestinal tract can present with various clinical problems. During the neonatal period, the classical presentation is usually that of bilious emesis due to duodenal obstruction, internal herniation, or midgut volvulus. Failure of mesenteric fixation allows the small bowel to rotate around the narrow mesenteric pedicle and may result in gangrenous bowel and death if it is not recognized and treated expediently. In patients older

than 2 months, as in one of our patients, a higher incidence of vague and nonspecific symptoms such as failure to thrive, intermittent bilious and nonbilious vomiting, diarrhea, and recurrent abdominal pain may occur [2].

The diagnosis of malrotation is made with radiographic studies. Barium enema may be normal or only suggestive of malrotation. The presence of a mobile and nonfixed cecum away from its usual position in the right lower quadrant may be indicative of an abnormally rotated intestine. This study is not as reliable as a UGI contrast study. In a review of 23 patients by Simpson and colleagues, UGI was 100% specific and 96% sensitive [1]. A UGI may show corkscrewlike deformity of the duodenum, abnormal fixation of the ligament of Treitz, or right upper quadrant placement of the duodenum and small bowel. Occasionally, the UGI findings are inconclusive and only suggestive of the true underlying pathology.

In the cases presented, laparoscopy was used to evaluate and verify the diagnosis of intestinal malrotation. Laparoscopy provides easy and rapid visualization of the position of the ligament of Treitz, small bowel, and cecum. The technique is especially useful for those patients who do not have conclusive radiographic findings for malrotation. Since 1932, Ladd's procedure has been the treatment of choice for malrotation [3]. This treatment is recommended by nearly all pediatric surgeons for every patient diagnosed with malrotation. Even without evidence of a volvulus, Ladd's procedure is carried out because the potential occurrence of this catastrophic complication is unpredictable. Ladd's operation can be done successfully using laparoscopic technique, as we demonstrated. Laparoscopy has the advantage of smaller incisions, less pain, earlier resumption of oral intake, and shorter hospitalization.

We conclude that laparoscopy provides a novel way to verify the diagnosis of malrotation in children with equivocal radiographic studies. In addition, treatment may also be successfully carried out without a laparotomy. The presence of a midgut volvulus with intestinal distension may be difficult to correct with laparoscopy. Currently, we do not recommend its use in such a setting. Further studies and long-term follow-up are needed to compare the results of this minimally invasive technique to those of the traditional and efficacious Ladd's procedure.

### **References**

1. Ladd WE (1932) Congenital obstruction of the duodenum in children. *N Engl J Med* 206: 277-283
2. Powell DM, Othersen HB, Smith CD (1989) Malrotation of the intestines in children: the effect of age on presentation and therapy. *J Pediatr Surg* 24: 777-780
3. Simpson AJ, Leonidas JC, Krasna IH, Becker JM, Schneider KM (1972) Roentgen diagnosis of midgut malrotation: value of upper gastrointestinal radiographic study. *J Pediatr Surg* 7: 243-252