LAPAROSCOPIC LADD’S PROCEDURE FOR INTESTINAL MALROTATION: REPORT OF THREE CASES

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Abstract: Ladd’s procedure for laparoscopic repair of malrotation has many advantages over conventional surgical techniques, such as earlier feeding and discharge. However, this procedure is still not commonly used in Taiwan. This report describes the results of treatment of intestinal malrotation in three patients using laparoscopic Ladd’s procedure. The patients, aged 8 days, 17 days, and 3 years, underwent laparoscopic Ladd’s procedure between July 1999 and September 2000. All three patients had symptoms of intermittent vomiting and were shown to have intestinal malrotation by upper gastrointestinal series study. The procedure was performed using three trocars of 5 mm diameter placed at the infraumbilical ring and the right and left lower quadrants. All procedures were completed laparoscopically. The operative times were 4.8, 3.6, and 3.5 hours, respectively. Feeding was started on postoperative Day 2 to 5, and the hospital stay was 6 to 11 days. Our results suggest that laparoscopic Ladd’s procedure can be performed safely in pediatric patients. In addition, patients are expected to benefit from the smaller incision, earlier feeding, shorter hospital stay, and fewer complications compared with traditional Ladd’s procedure.

Patients and Methods

From the tenth to twelfth gestational week, the 270° counterclockwise rotation and fixation of the bowel to the posterior abdominal wall of the midgut help to keep the bowel in a normal position with the duodenojejunal junction in the left upper abdomen and ileocecal junction in the right lower abdomen [1]. Intestinal malrotation occurs when this normal rotation or fixation fails and easily results in a narrow mesenteric root and abnormal peritoneal bands, and usually causes midgut volvulus, internal herniation, or duodenal and colonic obstruction [2].

Patients with intestinal malrotation have traditionally been treated using open Ladd’s procedure, which includes inspection of the mesenteric root, counterclockwise derotation of a midgut volvulus, lysis of Ladd’s bands, placement of the cecum into the left lower quadrant, and appendectomy [3]. In 1995, Van der Zee and Bax reported the first case of laparoscopic repair of acute volvulus in a neonate with malrotation, a minimally invasive approach to Ladd’s procedure [4]. Subsequent reports have suggested that laparoscopic Ladd’s procedure has many advantages including a minimal surgical wound, less postoperative adhesions, and shorter refeeding time and hospital stay [5–10]. However, this procedure is still not widely used in Taiwan. Here, we describe the results of laparoscopic Ladd’s procedure in three pediatric patients with intestinal malrotation.

From July 1999 to September 2000, three patients with bilious or non-bilious vomiting and failure to thrive were found to have intestinal malrotation by upper gastrointestinal (UGI) contrast studies. All patients underwent emergency laparoscopic Ladd’s procedure after adequate hydration.
Operative technique

The procedure was performed under general anesthesia with the patient in the supine position. Only three 5-mm trocars were used, and were placed at the infraumbilical ring (camera port) and right and left lower abdomen (working ports), respectively. The mini-laparotomy method was used for the first port (infraumbilical port). The intra-abdominal pressure was set to 8 to 10 cm H₂O depending on the patient’s weight, using CO₂ pneumoperitoneum. The other two trocars were then placed under direct visual guidance from the camera. Diagnostic laparoscopy was performed first to evaluate the pathology of the intestinal malrotation. The identification of the rotational abnormality was the most difficult part of this procedure. When a volvulus was present, reduction of the intestine via counterclockwise rotation with grasps was undertaken. Ladd’s bands were then identified and divided using an ultrasonic dissector. The base of the mesentery was widened by incising the peritoneum, resulting in increased length between the vascular arcades of the superior mesenteric artery. Care was taken to avoid any vascular injury. The small bowel was then placed on the right of the abdomen and the colon placed on the left to prevent any future development of volvulus. In the final step, the appendix was pulled through the subumbilical trocar and appendectomy was performed extracorporeally.

Case Reports

Patient 1

A 2,100-g, full-term girl was born by spontaneous vaginal delivery. The Apgar score was 8 at 5 minutes and perinatal aspiration syndrome was suspected. She suffered from intermittent vomiting and poor feeding after birth. A UGI series demonstrated intestinal malrotation. Laparoscopic Ladd’s procedure was performed on July 7, 1999, when she was 17 days old. Laparoscopic exploration confirmed the malposition of the cecum and the ascending colon at the mid-abdomen and adherence of these structures to the right retroperitoneum by Ladd’s bands, resulting in compression of the duodenum. The Ladd’s bands were divided completely, and the duodenum and proximal colon separated, putting the small bowel in the right abdomen and the colon in the left. The operative time was 3 hours 40 minutes. The patient had transient CO₂ retention on the first postoperative day. Oral intake was started on the second postoperative day and he was discharged on the sixth postoperative day. Subumbilical port infection was found during follow-up at the outpatient clinic 1 week after discharge and resolved after frequent dressing change. Feeding and growth were normal at 7 months’ follow-up.

Patient 2

A 2,900-g, male baby was born by cesarean section at term. He suffered from intermittent vomiting from birth. Orogastric tube decompression revealed bile content. A UGI series showed malrotation with possible volvulus. Laparoscopic Ladd’s procedure was performed on September 8, 2000, when he was 8 days old. The cecum, ascending colon, and associated Ladd’s bands were found to have a 360° clockwise rotation around the duodenum. The entire small bowel had mild ischemic change. After counterclockwise derotation, Ladd’s procedure was performed. The operative time was 4 hours 50 minutes. The perfusion of the entire intestine became normal after the operation. Feeding was restarted on the fifth postoperative day and he was discharged on the eleventh postoperative day. Subumbilical port infection was found during follow-up at the outpatient clinic 1 week after discharge and resolved after frequent dressing change. Feeding and growth were normal at 6 months postoperatively.

Patient 3

A 3-year-old boy had suffered from intermittent vomiting and abdominal pain since birth, which had become aggravated in the past year. His body weight had decreased from 11 kg to 10 kg in the last month. A UGI series showed intestinal malrotation with evidence of volvulus. Laparoscopic Ladd’s procedure was performed on September 19, 2000. Midgut volvulus with 360° clockwise rotation and mildly ischemic bowel was noted. The operative time was 3 hours 30 minutes. Oral intake was started on the second postoperative day and he was discharged on the sixth postoperative day. There was no postoperative complication. Oral intake and weight gain was satisfactory at 6 months postoperatively.

Discussion

The traditional Ladd’s procedure requires much handling of the bowel, which easily results in adhesions and postoperative ileus. Returning to full feeding may take many days after the procedure, resulting in lengthy hospitalization. Although the adhesions resulting from the operation are thought to be beneficial, the development of adhesion ileus after Ladd’s procedure remains a potentially significant complication. In Lin et al’s series [11], four of 54 patients developed bowel obstruction secondary to adhesions after Ladd’s procedure. On the other hand, Bass et al reported excellent results with laparoscopic Ladd’s procedure, with feeding beginning within 24 hours after operation and early discharge averaging 2.2 days [5]. No adhesion ileus or symptom recurrence was noted at postoperative follow-up.

In our initial experience, three patients with intestinal malrotation, aged 17 days, 8 days, and 3 years, respectively, were treated using laparoscopic Ladd’s procedure. All three patients had the symptoms of
poor feeding, vomiting, and/or abdominal pain, and were shown to have intestinal malrotation by UGI series. All intraabdominal procedures were identical to those used in open Ladd’s operation and were completed successfully via laparoscopy; the symptoms completely resolved after surgery in all three patients. The mean operation time was 4.0 hours, feeding was started on average 3.3 days after surgery, and the mean hospital stay was 9.0 days. The first patient had transient CO₂ retention and chylous ascites, the second had subumbilical wound infection, while no complication was found in the third patient. Our results suggest that the laparoscopic procedure can be performed safely even in newborn patients with very low body weight (2,100 g), and in patients with malrotation with volvulus.

Compared to the findings of Bass et al [5], our patients had a longer hospital stay and more postoperative ileus, which was probably mainly due to the longer operative time in our patients (4.0 hr vs 58 min). The longer operative time may have been due to our limited experience with the procedure, the use of larger trocars (5 mm vs 3 mm) and the smaller body weights of our patients compared to the series of Bass et al. In addition, unlike in the series of Bass et al, two of our three patients had volvulus, which made the operation more difficult. Nevertheless, our results using the laparoscopic approach were still better than those obtained using our traditional laparotomy approach [unpublished data] in 12 patients with intestinal malrotation with midgut volvulus and ischemic bowel who had a mean operative time of 2.5 hours, refeeding time of 9 days, and a mean hospital stay of 14 days.

In the present series of three patients, the most difficult part of the laparoscopic approach was the identification of the abnormally positioned intestine and the determination of whether volvulus was present, after which the procedure could be completed in about 1 hour. For patients with volvulus, Bax and van der Zee suggested that, instead of turning the loops of bowel back during the operation, concentrating on and tracing down the duodenum would save time [12]. In our three patients, we found that tracing back from the transverse colon enabled much easier definition and reduction of the volvulus.

In conclusion, laparoscopic Ladd’s procedure allows excellent visualization of the duodenocolic and Ladd’s bands and accommodates appendectomy easily. Our results suggest that it can be performed safely in pediatric patients. Although our initial results showed the refeeding time and hospital stay remained long due to a longer operation time associated with a learning curve for the technique, use of larger trocars, and low patient body weight, the laparoscopic procedure still had the benefit of a smaller incision. With more experience, the operation time, refeeding time, hospital stay, and complications should be reduced. These findings suggest that laparoscopic Ladd’s procedure might replace the open technique for the treatment of patients with intestinal malrotation in the future.

Table. Clinical characteristics of the three cases of intestinal malrotation treated using laparoscopic Ladd’s procedure

<table>
<thead>
<tr>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>17 d</td>
<td>8 d</td>
</tr>
<tr>
<td>Sex</td>
<td>F</td>
<td>M</td>
</tr>
<tr>
<td>Weight</td>
<td>2,100 g</td>
<td>2,900 g</td>
</tr>
<tr>
<td>Symptoms</td>
<td>Bilious vomiting</td>
<td>Bilious vomiting</td>
</tr>
<tr>
<td>Volvulus</td>
<td>No</td>
<td>Yes (360°)</td>
</tr>
<tr>
<td>Operative time</td>
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<td>4.8 h</td>
</tr>
<tr>
<td>Feeding time (POD)</td>
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<td>5</td>
</tr>
<tr>
<td>Hospital stay (POD)</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Complications</td>
<td>CO₂ retention, chylous ascites</td>
<td>Wound infection</td>
</tr>
</tbody>
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POD = postoperative days.

References

Laparoscopic Ladd’s Procedure