The first case report of reduced port surgery for preoperatively diagnosed intestinal malrotation in an adult

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A 31-year-old Japanese man with chronic abdominal pain underwent laparoscopic surgery using both a single port and 2.4-mm needle forceps for a preoperatively diagnosed intestinal malrotation. Abdominal findings revealed a twisted mesenteric pedicle; it also revealed that the right-side colon was not fused to the retroperitoneum and that both the transverse colon and the mesocolon were adhered to the second portion of the duodenum. After a Ladd procedure following resolution of the volvulus, the second portion of the duodenum was fixed to the retroperitoneum with four absorbable sutures in order to prevent recurrence. The operation was completed laparoscopically without additional ports. Reduced port surgery was recently developed in order to establish not only minimally invasive surgery but also better cosmetic results. Intestinal malrotation in adults is a rare disease and this is the first case report of reduced port surgery for the management of preoperatively diagnosed intestinal malrotation.

Key words: intestinal malrotation, reduced port surgery, adult

Introduction

Intestinal malrotation is generally diagnosed very early in life. Most cases are discovered in the first month of life, with 90% of all cases presenting within the first year.1 The incidences in adults are rare, estimated to be approximately 0.2% to 1.0% of the population, but a lack of autopsy studies in this area makes the estimation of the adulthood prevalence difficult.1-3 In the present report, we describe a case of adult intestinal malrotation with chronic abdominal pain completely treated with reduced port surgery (RPS), in which fewer ports are used than in conventional laparoscopic procedures and in which needle instruments are also adopted.4 RPS was developed in order to establish not only minimally invasive surgery but also better cosmetic results and has been applied broadly in various surgical fields.5,6 To our knowledge, this is the first report of RPS adopting both a single port and needle forceps for the management of preoperatively diagnosed intestinal malrotation.

Case report

A 31-year-old Japanese man with an unremarkable medical history consulted a doctor at a nearby medical clinic with a complaint of chronic abdominal pain. He was referred to our department for further evaluation of intestinal malrotation detected on abdominal computed tomography (CT). The CT in our department revealed a twisted mesenteric pedicle and dilatation of the distal superior mesenteric vein (Figure 1). Moreover, an upper gastrointestinal barium series showed a corkscrew sign, which was considered a typical image of intestinal malrotation.
malrotation involved with midgut volvulus (Figure 2). The patient initially chose to forego surgical intervention because his pain had decreased and because of time constraints, and remained under observation at the outpatient clinic with appropriate informed consent. However, over a period of 4 years, his abdominal pain gradually increased, which made him decide to undergo an operation.

The operation was performed with the SILS port (Covidien, Mansfield, USA) in the umbilicus and a 2.4-mm Endo Relief needle forceps (Hope Denshi, Chiba) placed just above the pubic bone. Abdominal findings revealed an incomplete-rotation type of intestinal malrotation involved with the midgut volvulus, that the right-side colon was not fused to the retroperitoneum, and that both the transverse colon and the mesocolon

![Figure 2. Counterclockwise rotation of the mesenteric pedicle (●: the corkscrew sign)](image)

![Figure 3. Dilatation of the distal superior mesenteric vein (○) and the small intestine (★) due to a twisted mesenteric pedicle were observed. The right side of the colon was not attached to the retroperitoneum.](image)

![Figure 4. After the Ladd procedure, the second portion of the duodenum was fixed to the retroperitoneum with four absorbable sutures (▲) in order to prevent recurrence.](image)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Embryonic stage (week)</th>
<th>Event</th>
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<tr>
<td>I</td>
<td>5—10</td>
<td>• 90° counterclockwise rotation of the midgut&lt;br&gt;• The midgut replacment into the abdominal cavity&lt;br&gt;• 180° counterclockwise rotation of the midgut inside the abdominal cavity</td>
<td>Omphalocele&lt;br&gt;Malrotation (rotation)&lt;br&gt;Non-rotation (&lt;90°)&lt;br&gt;Incomplete rotation (90°—180°)&lt;br&gt;Reverse-rotation</td>
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<td>II</td>
<td>11</td>
<td>• The duodenal C loop and the small bowel become attached to the posterior abdomen&lt;br&gt;• Establishment of the normal anatomy of the colon&lt;br&gt;• The cecum descends</td>
<td>Mobile cecum, etc.</td>
</tr>
<tr>
<td>III</td>
<td>11—</td>
<td>• Both the ascending and descending colon attach to the posterior abdomen</td>
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were adhered to the second portion of the duodenum (Figure 3). A twisted mesenteric pedicle was resolved manually by pulling the small intestine distally from the ileocecal to the proximal side using laparoscopic surgical forceps. After the Ladd procedure (in which appendectomy was not performed), the second portion of the duodenum was fixed to the retroperitoneum with four absorbable sutures (Figure 4). The operation was completed laparoscopically without additional ports.

The patient was discharged on the seventh postoperative day without any complications. No abdominal discomfort has been reported in the 2 years since surgical intervention.

Discussion

An understanding of intestinal development is essential to the surgical management of intestinal malrotation, because the symptoms are often deceptive, the findings at operation are confusing, and various types may be encountered. Healthy embryonic intestinal rotation of the midgut involves three stages. Stage I occurs between the fifth and tenth gestational weeks. It is a 90° counterclockwise rotation of the midgut and its replacement into the abdominal cavity. Stage II occurs at the eleventh gestational week and involves a 180° counterclockwise rotation inside the abdominal cavity, so that the duodenal C loop and the small bowel become attached to the posterior abdominal wall via its mesentery, following the establishment of the normal anatomy of the colon. In stage III, the cecum descends, and both the ascending and descending colon attach to the posterior abdomen.7,9 Interruption of any stage results in various types of intestinal malrotation. Stage I anomalies include omphalocoele caused by failure of the gut to return to the abdomen. Stage II anomalies include non-rotation, incomplete rotation, and the reversed-rotation type of intestinal malrotation. Stage III anomalies include an unattached duodenum, a mobile cecum, and an unattached small bowel mesentery (Table 1).8

Typical symptoms in neonates with intestinal malrotation are abdominal distension and bilious vomiting, whereas in adults, symptoms are mostly one of three types: acute obstructive symptoms and signs of impending abdominal catastrophe, chronic abdominal complaints that include both pain and intermittent obstruction, and atypical symptoms of common abdominal diseases.17,10 Therefore, both the definitive preoperative diagnosis of intestinal malrotation and the decision to operate in adult patients pose challenges due to the variety of symptoms.

The widely accepted treatment for intestinal malrotation involved with midgut volvulus is the Ladd procedure, which includes lysis of all abdominal bands and adhesions, straightening of the duodenum such that it descends directly into the right lower quadrant, widening of the small bowel mesentery by tearing its serosal leaves, and appendectomy after replacement of the volvulus.11 In addition, in order to prevent later recurrence, additional procedures, such as fixation of the intestine to the peritoneal wall, are performed in some cases.17,12-14

For surgeons with significant experience in minimally invasive surgery, both diagnostic laparoscopy and definitive laparoscopic repair are viable options for the treatment of patients with chronic symptoms of intestinal malrotation.15,16 In addition, RPS, which was introduced as a mixed use of surgical techniques, such as single port surgery (SPS) and needlescopic surgery, has recently become popular in various surgical fields and adopted for various diseases.6,16,17 To date, there has been an insufficient number of RPS cases to support the safety of RPS, and neither RPS nor SPS is recommended as a safe and reliable option in the Japanese Society for Cancer of the Colon and Rectum guidelines.18 However, RPS was developed to establish not only minimally invasive surgery but also better cosmetic results, and surgical costs are also decreased because of the use of reusable needle forceps. Therefore, RPS may become the first surgical option for various diseases, including intestinal malrotation, if it is feasible.

On the other hand, RPS for intestinal malrotation has some disadvantages. First, resolution of the volvulus becomes more difficult, because RPS requires more sophisticated skills than standard laparoscopic surgery due to a limited working space and the smaller number of forceps. Second, less adhesion after RPS leads to recurrence more often than with conventional techniques, including standard laparoscopic surgery; however, to its advantage, it also leads to a smaller ratio of adhesive intestinal obstruction. Third, laparoscopic surgery, including RPS, is not feasible for urgent situations such as strangulated ileus.

In our experience, both the Ladd procedure and fixation of the duodenum to the retroperitoneum could be performed safely with RPS in an adult intestinal malrotation in which the clinical condition was not severe. The twisted mesenteric pedicle was resolved naturally by the laparoscopic method previously described (Shohei T, et al. first introduced this technique at the 44th annual meeting of the Japanese Society of Pediatric Surgeons in Tokyo), in which the volvulus was resolved manually by
pulling the small intestine distally from the distal side of the intestine with laparoscopic forceps such that rotation of the midgut volvulus was more than 360°. In addition, for the purpose of preventing recurrence, the second portion of the duodenum could be fixed to the retroperitoneum with four absorbable sutures. To our knowledge, this is the first report adopting both a single port and needle forceps for the management of intestinal malrotation. RPS for the management of intestinal malrotation in adults is a safe and reliable procedure if it can be performed under good visualization and if surgeons have definite understanding of its unique characteristics. More RPS cases are warranted to demonstrate its safety, good cosmetics, and minimal invasiveness, in order for it to be established as a radical surgery.

References