

Single-Incision Laparoscopic Ladd's Procedure for Intestinal Malrotation

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ABSTRACT

Introduction: The potential of single-incision laparoscopic surgery (SILS) as a less invasive and more cosmetically appealing technique has prompted the expansion of its adoption. SILS has been shown to be a safe and feasible alternative to traditional multiport cholecystectomy, appendectomy, colectomy, and many other laparoscopic procedures. The objective of this study is to provide an initial report of the feasibility of correcting intestinal malrotation via a single-incision laparoscopic transumbilical approach.

Case Description: A 29-year-old woman presented with symptomatic congenital intestinal malrotation. She elected to undergo a Ladd's procedure using a single-incision laparoscopic approach with a SILS port and standard laparoscopic instruments. The procedure was accomplished without additional ports or conversion to laparotomy, and no intraoperative or postoperative complications were noted. Total operative time was 106 minutes. The patient had minimal postoperative pain and was satisfied with the cosmetic outcome.

Conclusion: When performed by a surgeon experienced in the SILS technique, single-incision laparoscopic Ladd's procedure for symptomatic intestinal malrotation in an adult is feasible and safe, with minimal postoperative pain and favorable cosmetic outcome.

Key Words: Minimally invasive surgical procedures, Laparoscopy, Intestinal volvulus, Digestive system surgical procedures

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INTRODUCTION

The well-established advantages of multiport laparoscopy over open laparotomy have prompted surgeons to pursue more minimally invasive surgical techniques. Single-incision laparoscopic surgery (SILS) has gained prominence in the field of surgery because of the anticipated beneficial outcomes that one single umbilical incision may have in improving postoperative pain, recovery time, and rates of incisional hernia and trocar injury.¹ Randomized controlled trials and case-matched comparisons conducted to date have shown improved patient satisfaction relative to cosmesis after SILS cholecystectomy and a better postoperative pain profile after SILS colectomy when compared with traditional laparoscopy.²⁻⁵ Given the potential advantage over multiport laparoscopy, a surgeon with significant experience in the SILS technique elected to proceed with a single-incision laparoscopic Ladd's procedure on a 29-year-old patient who presented with symptomatic congenital intestinal malrotation.

Intestinal malrotation is a consequence of impaired embryologic development and results in the formation of adhesive bands that can potentially obstruct the small bowel, causing complications such as volvulus and ischemia of the midgut. The procedure to correct this congenital anomaly was first described by William Ladd in 1936 and involves lysis of the peritoneal or Ladd's bands that cross the abdomen, functional positioning of the intestine, prophylactic appendectomy, and correction of any present volvulus.⁶ Although traditionally performed via open laparotomy, the laparoscopic approach has more recently become the standard of care for infants, children, and symptomatic adults.⁷⁻⁹ Adult presentation of malrotation ranges from asymptomatic to postprandial abdominal pain, emesis, nausea, and possible volvulus.¹⁰ The elective performance of a laparoscopic Ladd's procedure in adults can provide symptomatic relief while preventing the occurrence of future complications. Although the performance of a traditional multiport laparoscopic Ladd's procedure is a technically difficult case, we hypothesized that a surgeon experienced with the single-port laparoscopic technique could successfully perform this operation.

CASE REPORT

A 29-year-old woman with a body mass index of 44.54 was referred to the general surgery clinic for evaluation of chronic abdominal pain, nausea, and changes in bowel habits. The patient had previously been seen by a gastroenterologist, who ordered a computed tomography scan of her abdomen and pelvis, which revealed intestinal malrotation that had not been diagnosed previously (**Figure 1, Figure 2**). Her surgical history included a prior multiport cholecystectomy. The risks and benefits of a variety of treatment options were discussed, and the patient ultimately elected to undergo a Ladd's procedure. We discussed the open approach versus multiport laparoscopy, as well as SILS. She elected to proceed with an attempted single-port approach.

Access was gained to the peritoneal cavity with a 2-cm incision within the umbilicus, as well as a 2-cm fascial incision. A 3-trochar SILS (Covidien, Mansfield, MA) port was placed through this defect and the abdomen insufflated. A 5-mm 30-degree bariatric scope with right angle adapter and standard 5-mm nonarticulating instruments was used for this operation. Initial diagnostic laparoscopy revealed multiple adhesions primarily between the cecum and the right upper quadrant, as well as adhesions connecting the cecum to the descending colon. This was in addition to intense scarring in the right upper quadrant, likely a result of the prior cholecystectomy. All adhesions were divided using either sharp dissection or a blunt-tip 5-mm Ligasure (Valleylab, Boulder, CO) device. Complete division of all adhesions, including those around the duodenum, allowed for complete and thorough evaluation of the entire small and large bowel starting at the pylorus. At this point, an appendectomy was performed using a standard stapled technique. This was accomplished by placement of a 12-mm trocar through the SILS port. Finally, the root of the mesentery was widened by scoring with the Ligasure and electrocautery device. The small bowel was then replaced on the patient's right side and the colon on left. The SILS port was removed and the fascial defect closed using 2 figure-eight 0-0 absorbable sutures. The deep tissues were closed with 3 interrupted 3-0 absorbable sutures, and a simple vacuum dressing was applied with instruction to remove it after 1 week. Total operative time was 106 minutes. The patient was discharged home the same day with a prescription for hydrocodone-acetaminophen 7.5 mg to 500 mg as needed for pain.

RESULTS

The patient underwent surgery through a 2-cm umbilical incision via SILS port. After undergoing a complete Ladd's

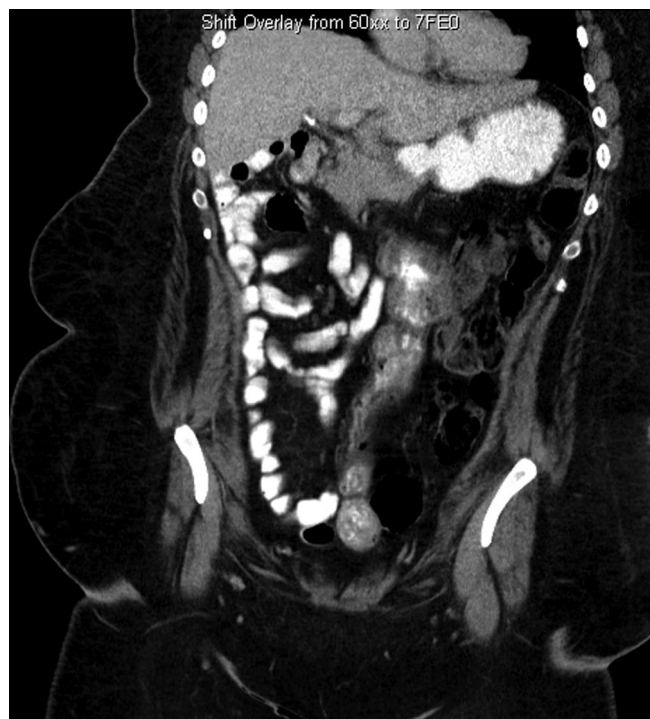


Figure 1. Coronal view of computed tomography scan showing intestinal malrotation.

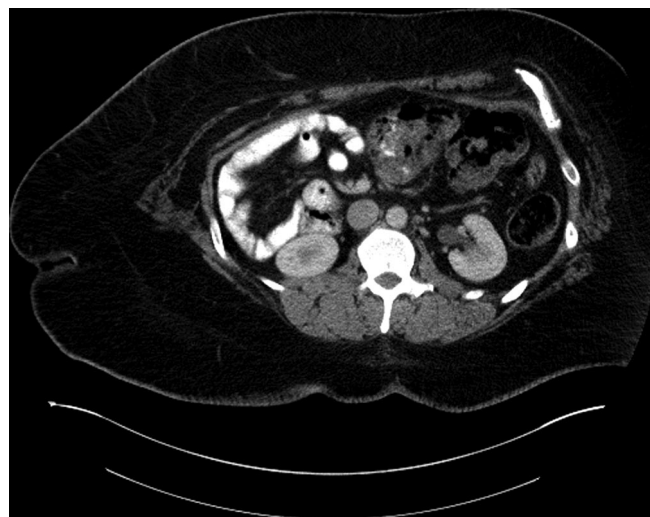


Figure 2. Axial view of computed tomography scan showing intestinal malrotation.

procedure, she was discharged without any complications. She reported a pain score of 0 on postoperative days 6 and 13 using a visual analog scale ranging from 0 to 10. The patient no longer required analgesia and had a full return of bowel function on postoperative day 6. She also expressed satisfaction with the cosmetic outcome. The postoperative

scar measured 2 cm and was hidden within the umbilical folds. The diffuse abdominal pain and severe constipation she experienced preoperatively had resolved.

DISCUSSION

During weeks 7 through 10 of embryologic development, proximal and distal limbs of the midgut undergo a 270-degree counterclockwise rotation around the axis of the superior mesenteric artery, generating the final placement of the small intestine, ascending colon, and transverse colon. Intestinal malrotation results from either the incomplete or reversed rotation of the midgut limbs, leading to abnormal placement of the abdominal contents, which are held in place by Ladd's bands.¹⁰ The presence of Ladd's bands can lead to compression and partial obstruction of the duodenum or volvulus of the intestines, which may induce obstruction, ischemia, and necrosis of the entire midgut.⁹ Because of the severity of presentation, patients typically are diagnosed during childhood, with adult presentation of intestinal malrotation being uncommon.⁶ Symptomatic adults may present with acute abdominal pain, nausea, nonbilious vomiting, constipation, abdominal distention, or chronic abdominal pain; malrotation can also be diagnosed incidentally by imaging performed to investigate a separate complaint. A study by Moldrem et al. indicated that elective repair of symptomatic intestinal malrotation in the adult population is a safe procedure resulting in alleviation of symptoms and reduced potential for future volvulus.¹¹ Review of the literature indicates that the laparoscopic approach is preferred to the open approach for this procedure, as demonstrated by multiple case series and case reports documented in the literature. There is, however, a lack of publications concerning the correction of intestinal malrotation using SILS.⁶⁻⁹

The implementation of laparoscopic procedures in the 1990s ushered in a new era of surgery. Since the advent of traditional multiport laparoscopy, surgeons have endeavored to develop even less invasive procedures.⁸ Single-incision laparoscopy in particular has become increasingly popular, with potential benefits in cosmetic outcomes, pain, and trocar injury rates. Surgeons around the world have used the SILS approach for procedures such as appendectomy, cholecystectomy, adrenalectomy, laparoscopic total extraperitoneal inguinal hernia repair, left and right hemicolectomy, sigmoidectomy, sleeve gastrectomy, gastrojejunostomy, and nephrectomy.^{12,13} The successful performance of a single-incision laparoscopic Ladd's procedure has not yet been reported.

Because SILS is a relatively recent development in the field of surgery, most published studies concerning single-incision laparoscopy are case reports and series. Although a few small randomized controlled trials have been published concerning the outcomes of SILS, several larger trials are underway and should be completed within the next few years, which will provide more definitive understanding of the advantages and disadvantages of single-incision procedures.^{1,2,14,15} Potential benefits of SILS require further investigation but may include decreased pain, decreased recovery time, and fewer trocar-related complications, including trocar injuries, wound infections, and port-site hernias.^{1,2,16,17} To date, evidence suggests that SILS is a safe and feasible alternative to traditional laparoscopy in regard to cholecystectomy, appendectomy, and colectomy, with no overt additional risk to the patient when compared with traditional laparoscopy.^{2-4,13,18,19} Potential disadvantages of SILS include crowding of instruments and camera at the port site, decreased triangulation of instruments, longer operative times owing to the inherent learning curve, increased pain, and increased port-site hernias.¹ All of these potential disadvantages can be overcome with standardized training and meticulous application of technique.

Given the potential advantages to the patient, the surgeon elected to correct this patient's symptomatic congenital intestinal malrotation via SILS. The operating surgeon in this case has considerable experience, having performed more than 1000 SILS procedures for a variety of cases. Adequate visualization, mobilization, and lysis of adhesions and Ladd's bands were obtained through a 2-cm incision that was hidden well within the umbilicus. Although long-term follow-up data are not yet available, the patient demonstrated minimal postoperative pain and had no postoperative wound complications, adding to the collection of evidence supporting SILS as a reasonable alternative to traditional multiport laparoscopy, even for more advanced cases.

In the ever-expanding scope of minimally invasive surgery, this case report demonstrates yet another surgical presentation that can use the single-incision laparoscopic approach. Although there are legitimate concerns regarding the learning curve, operative times, or possibility of port-site hernias, there is also a growing body of evidence that highlights the benefits of the less invasive technique. Surgeons who are familiar and comfortable with more common single-incision laparoscopic procedures such as cholecystectomy and colectomy should be able to leverage their skills as advanced laparoscopic surgeons to perform such procedures as well. Larger randomized con-

trolled trials comparing multiport laparoscopic and single-incision laparoscopic cholecystectomy, appendectomy, inguinal herniorrhaphy, and colectomy are underway at our facility to provide a more definitive statement regarding the benefits and disadvantages of the SILS technique. From this case, we hope to illustrate that the single-incision laparoscopic correction of congenital intestinal malrotation via a Ladd's procedure can be successfully and safely performed by a surgeon experienced in the SILS technique.

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