

Laparoscopic vs Open Surgical Management of Adhesive Bowel Obstruction in Children: A Retrospective Study Comparing the Outcomes at a Tertiary Care Center for Pediatric Surgery

Sunil Kumar¹, Amar AA Alnaqi², Yousuf A Khan³, Aisha Khan⁴, Vipul Gupta⁵, Suad Abul⁶, Abdulla Ali⁷, Esmaeel Taqi⁸, Ashraf Alkholy⁹

ABSTRACT

Background: Laparoscopic approach for management of adhesive bowel obstruction has become an established technique both in adults and children. There is an increased need of reporting of the outcome using this method of treatment in pediatric practice.

Aim: To compare the outcome of laparoscopic vs open surgery in children with adhesive bowel obstruction.

Materials and methods: Data were collected on children with adhesive bowel obstruction who were managed at a tertiary care level center for pediatric surgery from January 2007 to September 2017. Patients who were successfully managed by conservative management were excluded. Also the cases in which laparoscopic procedure was converted into an open surgery were excluded. Factors such as operative time, need for total parenteral nutrition, time to resume oral feeds, postoperative length of hospital stay, and complications during or after surgery were studied in laparoscopic and open group.

Results: Eighty children with adhesive intestinal obstruction were admitted. Eight were managed conservatively hence excluded. Forty-two were managed by open surgery and laparoscopic management was performed for 30. Four (10.3%) out of these were converted into open laparotomy. These were also excluded. Operative time was not significantly different between open (122 minutes) vs laparoscopic group (138 minutes). During dissection, complications like serosal tear were higher (20 vs 0) in the open group. Resection anastomosis (15 cases) and wound infections (6 cases) rate was also higher with open laparotomy. Mean time in days to start oral feeds (2.5 vs 5.9) and length of hospital stay (5.5 vs 11.3) was significantly shorter in laparoscopic group.

Conclusion: Laparoscopic management of adhesive bowel obstruction in children is safe and is associated with early postoperative recovery, shorter hospital stay and lower complication rate in comparison with open surgical management of these cases.

Keywords: Adhesive bowel obstruction, Laparoscopic management, Open laparotomy.

World Journal of Laparoscopic Surgery (2019): 10.5005/jp-journals-10033-1382

INTRODUCTION

Postoperative adhesions are an inevitable outcome of abdominal surgery in both adult and pediatric populations. Up to 90–95% of adult patients develop intra-abdominal adhesions following a laparotomy.^{1,2} Incidence of postoperative adhesive bowel obstruction in children has been reported in the range of 1–5% although it varies according to primary pathology and type of operation performed.^{3–6} Adhesive bowel obstruction can occur anytime from the early postoperative period after the index operation to many decades later. The management of adhesive bowel obstruction continues to evolve in both adult and pediatric patients. Open laparotomy is widely accepted as the standard approach for patients with adhesive bowel obstruction in whom conservative treatment fails. In recent times, laparoscopic approach has become a widely accepted treatment modality for adhesive small bowel obstruction in adults because of its advantages like less pain, fast recovery and reduced morbidity.⁷ Following its successful use in adult population, laparoscopic surgery has been increasingly used for the treatment of adhesive small bowel obstruction in children with good outcome.^{8–10}

Although advanced laparoscopic surgery is now commonly available in the majority of tertiary pediatric centers for the treatment

^{1–9}Department of Pediatric Surgery, Ibn Sina Hospital, Kuwait

Corresponding Author: Sunil Kumar, Department of Pediatric Surgery, Ibn Sina Hospital, Kuwait, Phone: +965 66018599, e-mail: sunilyadav90@hotmail.com

How to cite this article: Kumar S, Alnaqi AAA, Khan YA, *et al.* Laparoscopic vs Open Surgical Management of Adhesive Bowel Obstruction in Children: A Retrospective Study Comparing the Outcomes at a Tertiary Care Center for Pediatric Surgery. *World J Lap Surg* 2019;12(3):89–92.

Source of support: Nil

Conflict of interest: None

of both urgent and elective cases still data on the laparoscopic treatment of bowel obstruction due to adhesions are scarce. The purpose of this study was to report our institutional experience comparing outcomes in patients with adhesive bowel obstruction treated by laparoscopic adhesiolysis and open laparotomy.

MATERIALS AND METHODS

This retrospective study was conducted in the Department of Pediatric Surgery at Ibn Sina Hospital of Kuwait. This is a Tertiary Care

Center for Pediatric Surgery dealing with all routine and emergency cases in pediatric surgery from newborn period till 12 years of age. In this study, charts of all the patients who were admitted with diagnosis of adhesive bowel obstruction from January 2007 to September 2017 were reviewed and analyzed. During first half of study period (January 2007–August 2012). All the patients who needed surgical intervention were managed by open laparotomy. In the second half of the study period (September 2012–September 2017), laparoscopic management was adopted and laparoscopic adhesiolysis was performed for these cases by the consultant pediatric surgeon who is well-versed with advanced laparoscopy. Adhesiolysis was performed by blunt and sharp dissection using bipolar diathermy in open laparotomy cases while in laparoscopic cases mostly sharp dissection was performed using laparoscopic scissors or laparoscopic energy device for thick bands. Children who were successfully managed with conservative treatment without any surgical intervention were excluded from this study. Also, the cases where the laparoscopic procedure was converted into an open laparotomy were excluded from the study. Demographic data of all the patients with diagnosis of adhesive intestinal obstruction were obtained. Details of primary pathology and surgical procedure, time between previous surgery and penetration, the duration of adhesiolysis surgery, intraoperative findings and techniques, need for total parenteral nutrition, duration of hospital stay, and complications were recorded for both the open and laparoscopic groups. After discharge from the hospital, all the patients were followed up for a minimum period of 1 year. Statistical analysis was carried out comparing open and laparoscopic group and significance was devised using paired *t*-test. $p < 0.05$ was considered statistically significant.

RESULTS

Seventytwo of 80 children with adhesive bowel obstruction needed surgical intervention. These children aged between 2 months and 132 months (mean = 53.88 ± 37.58). There were 43 men and 29 women. All of these 72 children had undergone at least one surgical procedure before they had presented with adhesive bowel obstruction. Previous surgical procedures done on these children are shown in Figure 1. They include colostomy or ileostomy closure after anorectal malformation (five), Hirschsprung's disease (three cases), necrotizing enterocolitis (five cases), meconium

ileus (three cases), appendectomy (six cases), Meckel's diverticulum (three cases), intussusception (four cases), Ladd's procedure for malrotation (four cases), congenital diaphragmatic hernia (four cases), Nissen fundoplication (three cases), and six cases of intra-abdominal benign or malignant masses (ganglioneuroma 1, hepatoblastoma 1, Wilms tumor 1, mesenteric cyst 1, ovarian cyst 1, and one retroperitoneal cyst). In the open laparotomy group, mean age in months (51.83 ± 38.92) and weight in kilograms (19.58 ± 13.24) was not significantly different from laparoscopic group where mean age in months and weight in kilograms was 56.19 ± 35.79 and 17.50 ± 8.49 , respectively. Mean duration since previous surgery in open laparotomy group was 20 months while in laparoscopic group it was 28 months. Average operative time was 138 minutes in laparotomy group and 122 minutes in laparoscopic group. Intraoperative findings were similar in both the groups. Transitional zone due to adhesive band or bands between proximal dilated and distal collapsed small intestine was observed in all patients in both open and laparoscopy group. In open laparotomy group, three patients (7.1%) had single obstructing band while multiple obstructing bands between the bowel loops and abdominal scar were seen in 39 (92.8%). Four patients (16.4%) in the laparoscopic group had a single thick obstructing band (Fig. 2) while in 22 (84.6%) of the laparoscopic group patients had multiple adhesive bands with scar and bowel loops (Fig. 3). During adhesiolysis in open surgery, serosal tears were reported in 20 patients and two of them needed intraoperative blood transfusion. None in laparoscopic group had this complication. In 35% (15) of laparoscopic cases, it was required to resect a segment of small intestine because it was of doubtful viability. No bowel resection and anastomosis was needed in laparoscopic group. In one case which was managed by open laparotomy left dome of diaphragm was injured while separating dense adhesions with diaphragmatic dome. It was repaired with interrupted nonabsorbable stitches. One case in each open and laparoscopic group developed postoperative pneumonia, which was managed chest physiotherapy and antibiotics. Wound complications like seroma and infection occurred in six cases in open laparotomy group. There were no wound-related complications in laparoscopic group. Thus, overall rate of intraoperative and postoperative complications was significantly higher in open laparotomy group ($p = 0.000$). Children in laparoscopic group were fed on postoperative day 2–4 (mean = 2.58) and no total parenteral nutrition was required for any patient in this group.

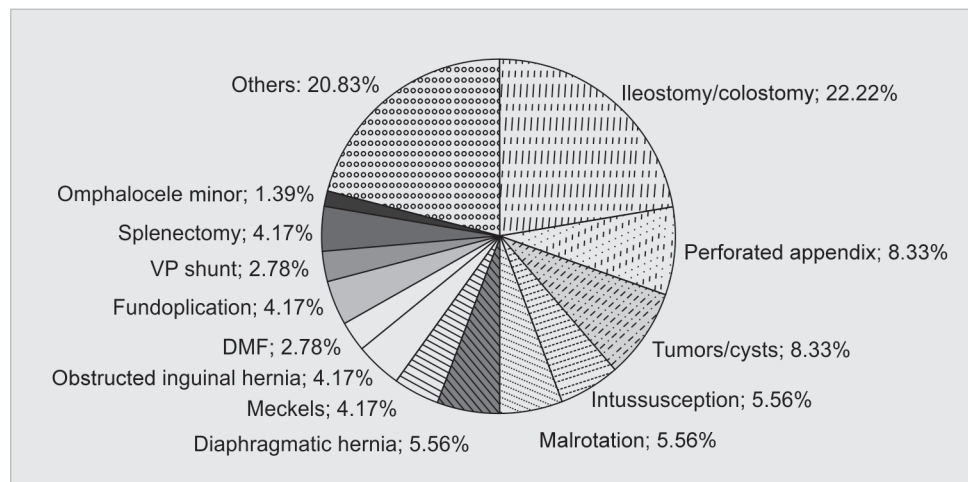


Fig. 1: Previous surgeries performed in all 72 patients with adhesive bowel obstruction

While in open laparotomy group oral feeds were delayed until day 5–9 (mean = 5.9) and total parenteral nutrition was required in many (36) of these cases length of hospital stay in laparoscopic group (range = 3–8 days, mean = 5.5 days) was significantly shorter ($p \leq 0.05$) than open laparotomy group (range = 6–27 days, mean = 11.3 days). Thus, over all postoperative recovery was better in the laparoscopic group (Table 1). After discharge, all patients were followed in outpatient department for any symptom or recurrence of adhesions for a minimum period of 12 months. Patients operated by open laparotomy follow-up for a period of 12–84 months and laparoscopic group patients were followed up from 12 months to 60 months after adhesiolysis. None of the patients in either group developed recurrence after surgery.

DISCUSSION

In this retrospective study, we reviewed all cases of adhesive bowel obstruction managed in our department from January 2007 to September 2017. Nonoperative management was started in all children after admission and it was successful in eight of our cases. Initial conservative management is adopted in adult and pediatric practice for management of adhesive bowel obstruction but the success of conservative treatment in children varies between different studies.^{11–14} Certain pediatric surgical procedures like ileostomy closure or formation, Ladd's procedure for malrotation, appendectomy for perforated appendix and tumor surgery are more prone to adhesion formation.^{6,15–17} In our series, ileostomy or colostomy closure after anorectal malformation, Hirschsprung's disease and necrotizing

enterocolitis, appendectomy for perforated appendix, Meckel's diverticulectomy, open surgery for intussusception, various tumors and cyst excisions, and Nissen fundoplication were among frequent surgical procedures, which led to the adhesive intestinal obstruction (Fig. 1). Historically, laparotomy with lysis of adhesions has been the conventional management for adhesive small bowel obstruction in children.^{18,19} In the adult literature, there have been multiple retrospective publications demonstrating the utility of laparoscopy in the treatment of adhesive small bowel obstruction. They show earlier recovery of bowel function and reduced length of stay and decreased incisional complications. In addition, laparoscopy has the theoretical advantage of reducing additional adhesion formation and thus recurrence.^{20,21} There are no randomized, controlled trials in the literature that examine the role of laparoscopy in treating adhesions in children and there are actually few publications that examine the role of laparoscopy in the management of adhesions in children. However, recent review articles and case series advocate laparoscopic management of adhesive bowel obstruction in children.^{8–10} At our institute, we have adopted laparoscopic adhesiolysis since 2012. Our conversion rate of 10.3% is lower than 23–30% conversion rate reported by other investigators.^{8,22–24} All our laparoscopic adhesiolysis surgeries are performed by an experienced pediatric surgeon who is well versed with advanced laparoscopic skills in children. We always try to keep laparoscopic adhesiolysis as first case in our operation theater in morning hours as far as possible so that operating surgeon can work at ease in comfortable environment. First, trocar is placed by open technique. We lyse adhesion with sharp dissection and energy device was used cautiously to divide

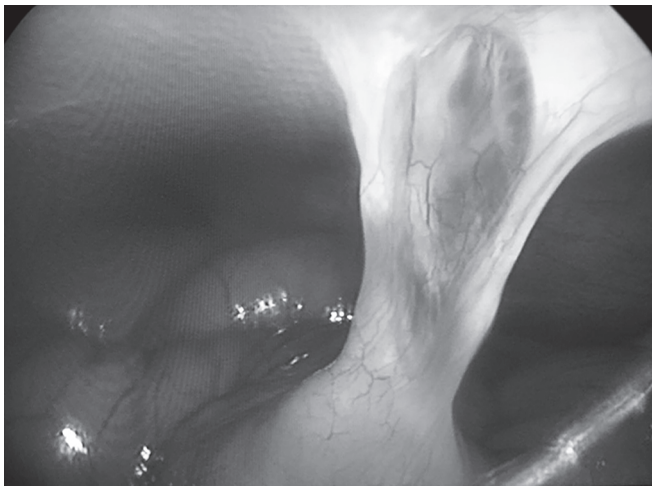


Fig. 2: Laparoscopic view of single adhesive band

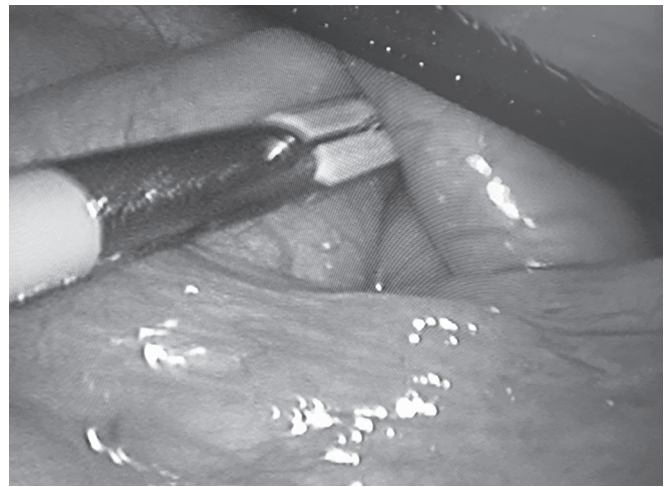


Fig. 3: Laparoscopic view of multiple adhesive bands between bowel loops

Table 1: Comparing outcome between open and laparoscopic group

	Mean age in months	Mean weight in kilograms	Day of start in minute mean	Complications			Day of start of oral feeds (mean)	Length of hospital stay in days (mean)
				ST	RA	WI		
Open laparotomy (n = 42)	51.8 ± 38.9	19.59 ± 13.2	122 ± 18	20	15	6	5.95 ± 1.56	11.38 ± 4.13
Laparoscopic (n = 26)	56.19 ± 35.79	17.50 ± 8.49	138 ± 19	0	0	0	2.58 ± 0.57	5.50 ± 1.39
Paired t test p value	0.400**	0.923**	0.670**	0.000*			0.000*	0.000*

*p value <0.05 is significant; **p value >0.05 is insignificant

ST, serosal tear

RA, resection and anastomosis

WI, wound infection

thick vascular bands away from the bowel wall. We always run the bowel from duodeno-jejunal junction till ileo-caecal area to make sure we lyse all adhesions and to inspect the bowel for any iatrogenic injury. While comparing intraoperative and postoperative complications in our open laparotomy group and laparoscopic group we observed that serosal tear happened in 20 out of 42 open surgery cases while no such injuries occurred in laparoscopic group. This could be because of the fact that in laparoscopic group adhesions were divided more precisely and always under magnified vision. Serosal tears and subsequent bleeding could be one of the reasons for prolonged ileus in open surgery cases. In 15 (35%) out of 42 cases managed by open laparotomy resection anastomosis of the intestine was done which will definitely delay recovery of intestinal function. Laparoscopic incisions have a lower incidence of wound related complications and this was evident in our study as well where six cases had seroma or wound infection in laparotomy group. There was no wound related complication in laparoscopic group which could be one reason for shorter hospital stay in this group of patients. Lee et al. studied a large, pediatric administrative database to examine the management of adhesive small bowel obstruction and found that laparoscopic treatment was associated with shorter median length of stay (6 vs 8 days), lower postoperative complication rates (5.6% vs 10.4%), and lower mean total hospital costs.²⁵ Although our study has limitations like retrospective nature of the study and small sample size but our results are encouraging to continue laparoscopic management of adhesive bowel obstruction. Results from our study indicate that time to start oral feeds (2.5 vs 5.9 days), length of hospital stay in days (5.5 vs 11.3), and serosal tear rate (0 vs 20), need for resection anastomosis (0 vs 15) were significantly lower ($p \leq 0.05$) in laparoscopic group in comparison to open laparotomy group. Thus, we conclude that laparoscopic management of adhesive bowel obstruction in children can be safely carried out by an experienced laparoscopic pediatric surgeon and it is associated with better outcome in form of early starting of oral feeds, shorter length of hospital stay, and less complications in comparison to open laparotomy although more randomized control studies are required to support our observations.

REFERENCES

- Menzies D. Peritoneal adhesions. Incidence, cause, and prevention. *Surg Annu* 1992;24(Pt 1):27–45.
- Luijendijk RW, de Lange DC, Wauters CC, et al. Foreign material in postoperative adhesions. *Ann Surg* 1996;223(3):242–248. DOI: 10.1097/00000658-199603000-00003.
- Lautz TB, Barsness KA. Adhesive small bowel obstruction-acute management and treatment in Children. *Semin Pediatr Surg* 2014;23(6):349–352. DOI: 10.1053/j.sempedsurg.2014.06.006.
- Festen C. Postoperative small bowel obstruction in infants and children. *Ann Surg* 1982;196(5):580–583. DOI: 10.1097/00000658-198211000-00012.
- Grant HW, Parker MC, Wilson MS, et al. Population based analysis of the risk of adhesion-related readmissions after abdominal surgery in children. *J Pediatr Surg* 2006;41:1453–1456. DOI: 10.1016/j.jpedsurg.2006.04.023.
- Grant HW, Parker MC, Wilson MS, et al. Adhesions after abdominal surgery in children. *J Pediatr Surg* 2008;43:152–157. DOI: 10.1016/j.jpedsurg.2007.09.038.
- O'Connor DB, Winter DC. The role of laparoscopy in the management of acute small-bowel obstruction: a review of over 2000 cases. *Surg Endosc* 2012;26(1):12–17. DOI: 10.1007/s00464-011-1885-9.
- Apelt N, Featherstone N, Giuliani S. Laparoscopic treatment for adhesive small bowel obstruction: is it the gold standard in children too? *Surg Endosc* 2013;27(10):3927–3928. DOI: 10.1007/s00464-013-2891-x.
- Anderson SA, Beierle EA, Chen MK. Role of laparoscopy in the prevention and in the treatment of adhesions. *Semin Pediatr Surg* 2014;23(6):353–356. DOI: 10.1053/j.sempedsurg.2014.06.007.
- Alemayehu H, David B, Desai AA, et al. Laparoscopy for small bowel obstruction in children-An Update. *J Laparoendosc Adv Surg Tech A* 2015;25(1):73–76. DOI: 10.1089/lap.2014.0228.
- Devens K. Recurrent intestinal obstruction in the neonatal period. *Arch Dis Child* 1963;38:118–119. DOI: 10.1136/adc.38.198.118.
- Janik JS, Ein SH, Filler RM, et al. An assessment of the surgical treatment of adhesive small bowel obstruction in infants and children. *J Pediatr Surg* 1981;16(3):225–229. DOI: 10.1016/S0022-3468(81)80669-0.
- Akgur FM, Tanyel FC, Buyukpamukcu N, et al. Adhesive small bowel obstruction in children: the place and predictors of success for conservative treatment. *J Pediatr Surg* 1991;26:37–41. DOI: 10.1016/0022-3468(91)90422-P.
- Vijay K, Anindya C, Bhanu P, et al. Adhesive small bowel obstruction (ASBO) in children—role of conservative management. *Med J Malaysia* 2005;60(1):81–84.
- Murphy FL, Sparnon AL. Long-term complications following intestinal malrotation and the Ladd's procedure: a 15-year review. *Pediatr Surg Int* 2006;22(4):326–329. DOI: 10.1007/s00383-006-1653-4.
- Tsao KJ, St Peter SD, Valusek PA, et al. Adhesive small bowel obstruction after appendectomy in children: comparison between the laparoscopic and open approach. *J Pediatr Surg* 2007;42(6):939–942. DOI: 10.1016/j.jpedsurg.2007.01.025[discussion 942].
- Aguayo P, Ho B, Fraser JD, et al. Bowel obstruction after treatment of intra-abdominal tumors. *Eur J Pediatr Surg* 2010;20(4):234–236. DOI: 10.1055/s-0030-1253401.
- Wilkins BM, Spitz L. Incidence of postoperative adhesion obstruction following neonatal laparotomy. *Br J Surg* 1986;73(9):762–764. DOI: 10.1002/bjs.1800730929.
- Jolley SG, Tunell WP, Hoelzer DJ, et al. Postoperative small bowel obstruction in infants and children: a problem following Nissen fundoplication. *J Pediatr Surg* 1986;21(5):407–409. DOI: 10.1016/S0022-3468(86)80509-7.
- Mancini GJ, Petroski GF, Lin WC, et al. Nationwide impact of laparoscopic lysis of adhesions in the management of intestinal obstruction in the US. *J Am Coll Surg* 2008;207(4):520–526. DOI: 10.1016/j.jamcollsurg.2008.04.026.
- Kelly KN, Iannuzzi JC, Rickles AS, et al. Laparotomy for small-bowel obstruction: first choice or last resort for adhesiolysis? A laparoscopic approach for small-bowel obstruction reduces 30-day complications. *Surg Endosc* 2014;28(1):65–73. DOI: 10.1007/s00464-013-3162-6.
- Becmeur F, Besson R. GECL. Treatment of small-bowel obstruction by laparoscopy in children multicentric study. *Eur J Pediatr Surg* 1998;8(6):343–346. DOI: 10.1055/s-2008-1071229.
- Shalaby R, Desoky A. Laparoscopic approach to small intestinal obstruction in children: a preliminary experience. *Surg Laparosc Endosc Percutan Tech* 2001;11(5):301–305. DOI: 10.1097/00129689-200110000-00003.
- Aguayo P, Fraser JD, Ilyas S, et al. Laparoscopic management of small bowel obstruction in children. *J Laparoendosc Adv Surg Tech A* 2011;21(1):85–88. DOI: 10.1089/lap.2010.0165.
- Lee J, Tashjian DB, Moriarty KP. Surgical management of pediatric adhesive bowel obstruction. *J Laparoendosc Adv Surg Tech A* 2012;22(9):917–920. DOI: 10.1089/lap.2012.0069.