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Review Article

Evidence review of the Applicability of Laparoscopic Surgery in Jejunoileal Atresias

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Abstract:

Background: *Jejunoileal obstruction is a congenital condition where a segment of the jejunum or ileum is either absent (atresia) or obstructed (stenosis) due to improper fetal development. It occurs in approximately 1 in 5,000 live births. Prenatal diagnosis relies on ultrasound and fetal MRI, while postnatal presentation includes bilious vomiting and abdominal distension. Surgical intervention is required, with laparoscopic and laparoscopy-assisted approaches being increasingly utilized.*

Objective: *This study aims to review available literature on the advantages and disadvantages of laparoscopic treatment for jejunoileal atresia.*

Methods: *A systematic literature search was conducted in PubMed, Medline, and Google Scholar using PRISMA guidelines. Only original research articles were included, excluding literature reviews. Data were collected and analyzed in Excel.*

Results: *A total of 14 articles published between 2004. and 2023, including 260 patients (51.3% female, 48.7% male), were analyzed. The mean age at surgery was 3.2 days. Most patients (n=233) underwent laparoscopically assisted surgery, while 27 had full laparoscopic procedures. The conversion rate was 1.5%. The most common complication was adhesive ileus (n=8), with an overall complication rate of 7.7%. Mortality was 3.45%, with short bowel syndrome being the leading cause. Associated anomalies were observed in 24.6% of cases.*

Conclusion: *Laparoscopic and laparoscopy-assisted approaches are safe and feasible for jejunoileal atresia, with low complication and mortality rates. Future research should focus on optimizing surgical techniques and improving long-term outcomes, particularly for patients with short bowel syndrome.*

Keywords: *Jejuno-ileal atresia, laparoscopy, surgery.*

Introduction

Jejuno-ileal obstructions are congenital conditions where a segment of the jejunum or ileum is absent (atresia) or obstructed (stenosis) due to improper development during fetal growth. They occur in approximately 1 in 5,000 live births [1,2]. The jejunoileal obstruction could be suspected during intrauterine development based on polyhydramnios and dilated intestinal coils. In such cases, fetal magnetic resonance imaging is of great importance [3]. If not detected prenatally, a child with jejunoileal atresia or stenosis may present with abdominal distension and bilious vomiting after birth. Meconium may be normal. Associated anomalies, such as cystic fibrosis, malrotation, Down syndrome, and Hirschsprung's disease, are present in less than 10% of cases [4]. Jejunoileal obstructions are divided into four types. Type I is mucosal atresia; Type II is characterized by two atretic ends connected by a band of fibrous tissue. Type IIIA consists of two atretic ends separated by a V-shaped mesenteric defect. Type IIIB is also known as the apple peel anomaly, and Type IV includes multiple atresias [5]. The treatment of atresia is primarily surgical. Historically, this involved performing a transverse supraumbilical laparotomy, which included bowel resection and the formation of anastomoses or the formation of an appropriate stoma. This traditional approach is associated with a significant risk of various complications and results in substantial postoperative scarring, which can pose aesthetic concerns for the patient [6]. Since 2008 a minimally invasive surgery has been increasingly utilized in the management of this condition [7].

This paper aims to review the available literature to indicate the advantages and disadvantages of laparoscopic treatment of jejunoileal atresia.

Material and Methods

We conducted a comprehensive literature search in PubMed, Medline, and Google Scholar using the keywords 'laparoscopy' and 'jejunoileal atresia.' The articles were selected using PRISMA guidelines. This study exclusively included original research articles, while literature reviews were excluded. The data were collected in Excel® sheets and analyzed.

Results

This study included 14 articles published between 2004. and 2023. The total number of patients was 260 (51,3% females and 48,7% males), with the mean age at surgery 3,2 days (min 0, max 5,4).

Most patients underwent laparoscopically assisted surgery, n=233, and n=27 had full laparoscopic surgeries. All patients with full laparoscopic surgeries were operated on in a single center in a study published by Zhao et al. (8). Of the 66 patients, there were 27 full laparoscopies and 39 laparoscopy-assisted; at the same time,

this study had the largest number of patients (Fig. 1). The number of conversions was n=4 (1,5%), and the described reasons for conversions were 2 cases of coexistence of meconium peritonitis complicated with perforation; 1 case over distended bowel with no working space and in 1 case the conversion was made due to cardiopulmonal compromise. The average duration of surgery was 88,7min (min 40, max 180 minutes).

Regarding types of atresia in two articles (60 patients), the type of atresia was not defined. Jejunal stenosis was present in n=30 patients, ileal stenosis n=1, jejunal atresia n=36, ileal atresia n=23, jejunoileal atresia n= 10, and jejunal diaphragm n=.1. Exact types of small bowel atresias which were described are presented in Fig. 2.

Different positions of instruments were used: the position of instruments in the right lower quadrant n =24, in the left lower quadrant n=22, left upper n=66, and subcostal n = 3; others were not precise. The size of the instruments was not described in other articles. The sizes of ports and instruments are given in Fig. 3.

Intraoperative complications occurred in only one patient due to cardiopulmonary compromise. The rate of surgery-related complications is low at 7.7%, as they occur in n=20 patients. The following complications were described: anastomosis leak n=2, cholestasis n=1, diarrhea n=1, malnutrition n=1, adhesive ileus n=8, functional ileus n=2, necrotizing enterocolitis n=1, wound infection n=1, intestinal occlusion due to incomplete web n=2, anastomosis obstruction n=1. Thus, it could be concluded that laparoscopy-assisted or full laparoscopic surgery is safe and feasible in jejuno-ileal atresia management.

Overall mortality was 3.45% (n=9), with short bowel syndrome as a leading cause of mortality present in n=3 patients. Regarding other causes, there were ileus associated with pneumonia, ileus, septic shock, and intestinal perforation in one patient each and the cause of death was unknown n=2 patients.

Association with other conditions was present in n=64 (24,6%) patients, and conditions are given in Table 1.

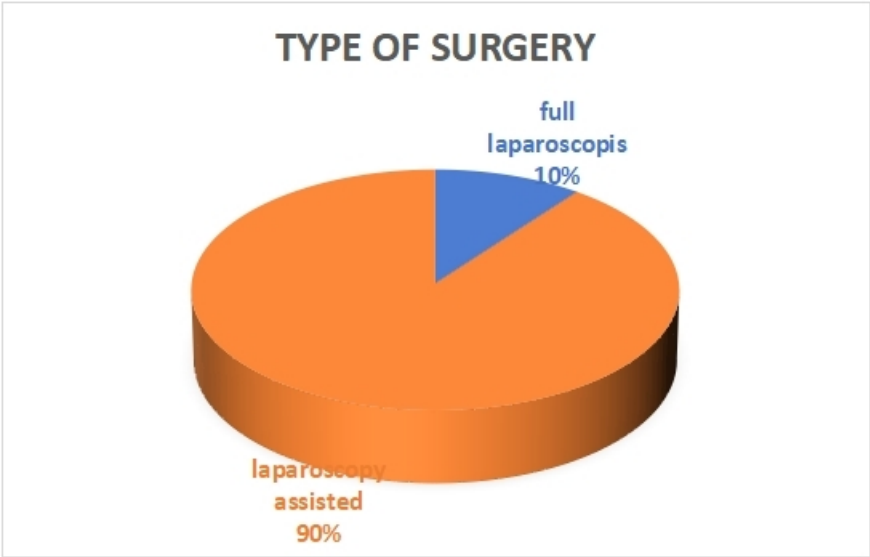

Figure 1: Type of surgery applied The majority of patients underwent laparoscopy-assisted surgery (90%), while fully laparoscopic procedures were performed in 10% of cases.

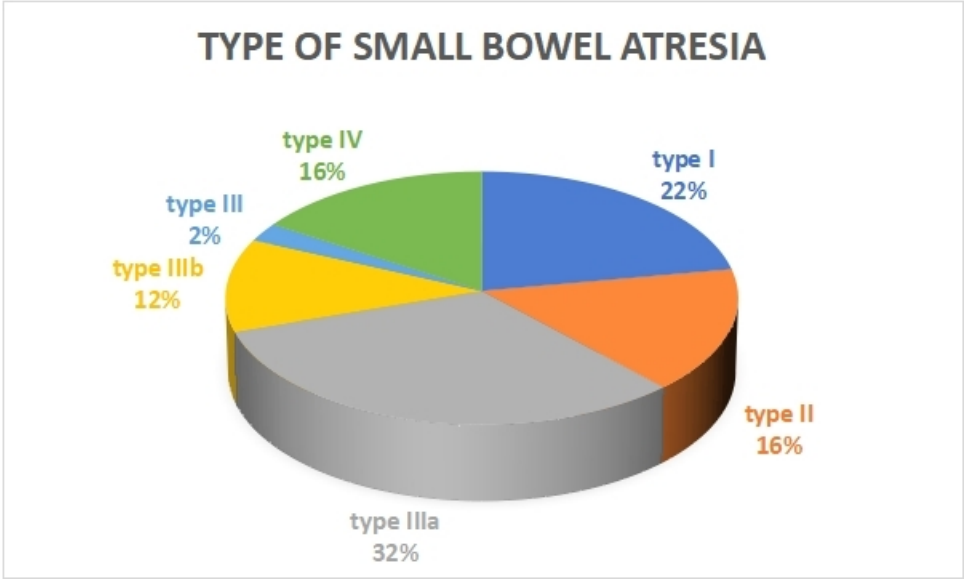

Figure 2: Types of small bowel atresia

Type IIIa was the most frequent form (32%), followed by type I (22%). Types II and IV each accounted for 16%, while type IIIb represented 12% of cases. Type III atresia without further subclassification was observed in 2% of patients.

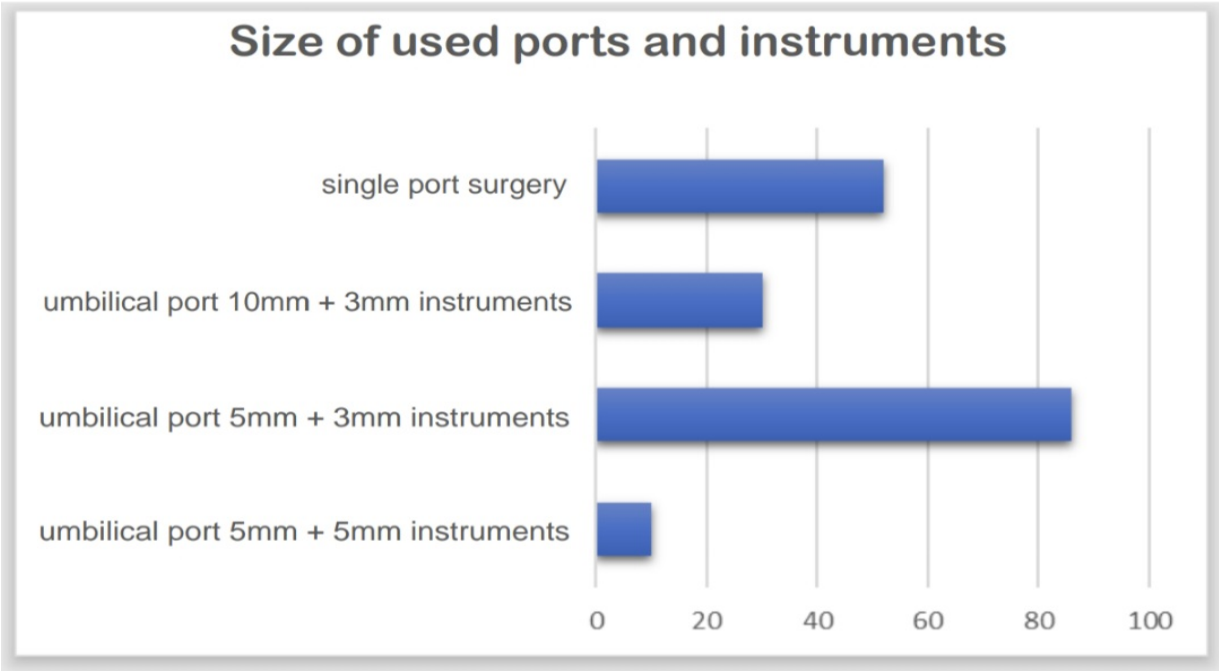

Figure 3: The size of used ports and instruments

Umbilical access with a 5-mm port combined with 3-mm instruments was the most commonly used configuration. Single-port surgery was also frequently performed. Less commonly, an umbilical 10-mm port with 3-mm instruments was used, while the 5-mm + 5-mm instrument configuration was applied in a small proportion of cases.

Associated condition	Number of patients
Congenital heart disease (structural cardiac defects, septal defects ASD, VSD, etc.)	17
Congenital heart disease associated with hypospadias	1
Meconium peritonitis	9
Corpus callosum hypoplasia with right renal agenesia	1
Gallbladder agenesis	1
Craniomaxillofacial deformity	1
Multiple spinal malformations	1
Digestive tract malformations (including Diverticulum of Meckel and malrotations)	30
Cryptorchismus	1
Inguinal hernia	1
Biliary atresia	1

Table 1: Other conditions associated with small bowel atresia

Legend: The most frequently observed associated conditions were digestive tract malformations, including Meckel's diverticulum and intestinal malrotation (n = 30), followed by congenital heart disease (n = 17). Meconium peritonitis was present in nine patients. All other associated anomalies occurred sporadically.

Discussion

Jejunoileal obstruction is a significant cause of intestinal obstruction in children, most commonly occurring as atresia (complete luminal blockage) or stenosis (partial blockage), with an incidence of 1 in 5,000 newborns. Prenatal diagnosis is made by ultrasound, with possible confirmation by fetal MRI, while postnatally, it manifests as bilious vomiting and abdominal distension. There is four types of jejunoileal atresias [5]. In two studies included in our review, comprising a total of 60 patients, the specific type of atresia was not defined in certain cases. Among the identified cases, jejunal stenosis was observed in 30 patients, ileal stenosis in one patient, jejunal atresia in 36 patients, ileal atresia in 23 patients, jejunoileal atresia in 10 patients, and jejunal diaphragm in one patient. Type IIIa atresia was the most common, accounting for 32% of cases, while Type IIIb was the rarest, observed in 12% of cases, which coincided with literature data [10].

In this study, a significant portion of patients (approximately 24.6%) exhibited associated anomalies alongside intestinal atresia. This prevalence aligns with the literature, where anomalies like malrotation, Down syndrome, and cystic fibrosis are known to co-occur with intestinal atresia, particularly jejunal atresia, with increased frequency compared to ileal atresia [4]. The data reinforces that congenital heart disease (CHD) is a common co-morbidity observed in 17 cases. Notably, a single case involved CHD associated with hypospadia, which highlights the diversity and potential complexity of congenital anomalies seen in patients with intestinal atresia [8].

Among the anomalies, digestive tract malformations (30 cases), such as Meckel's diverticulum and malrotation, were the most frequently reported, consistent with the gastrointestinal system's susceptibility to developmental interruptions that can coincide with atresia. Meconium peritonitis was present in nine cases, which is commonly associated with intestinal perforation and highlights the increased risk of prenatal complications in affected individuals. The unique occurrences of corpus callosum hypoplasia with right renal agenesis, gallbladder agenesis, craniomaxillofacial deformities, multiple spinal malformations, cryptorchidism, inguinal hernia, and biliary atresia, though individually rare, underscore the broad spectrum of anomalies that may accompany intestinal atresia [11].

This study analyzes laparoscopic surgery in jejuno-ileal atresia management, emphasizing its safety and feasibility. The variability in the positions of instruments highlights the flexibility required during surgery, with the most common position being the left upper quadrant (n=66) and all patients being from a single study [8], followed by the right lower (n=24), left lower (n=22), and subcostal (n=3) positions [11-13]. The exact position and choice of instruments can depend on each case's specific anatomical and pathological characteristics. While the sizes of instruments were not reported in comparable studies, the inclusion of these data in this study, as illustrated in Graph 3, adds valuable insight into procedural specifics.

The intraoperative complication rate in laparoscopic surgery was remarkably low, with a single instance of cardiopulmonary compromise reported [8]. In 7.7% of patients, postoperative complications were varied but generally manageable. Adhesive ileus was the most frequent complication (n=8), followed by functional ileus (n=2) and anastomotic-related issues, including leaks (n=2) and obstructions (n=1). The rare but severe complications, such as necrotizing enterocolitis (n=1), highlight the need for vigilant postoperative care to minimize risks [14]. Compared to open surgery, studies have shown that laparoscopic techniques generally offer a lower complication rate. For instance, open surgery is associated with a higher incidence of postoperative adhesive ileus, which is more frequent and severe [11,12]. Additionally, the rate of anastomotic leaks and postoperative infections tends to be lower in laparoscopic surgery compared to traditional open approaches [13].

The mortality rate in this study (3.45%, n=9) is comparable to or lower than rates reported in similar studies, reflecting improvements in surgical and perioperative management. Short bowel syndrome, which accounted for the majority of deaths (n=3), remains a significant challenge in this patient population, often requiring long-term nutritional and medical support [15]. Other causes of mortality, including ileus with pneumonia, septic shock, and intestinal perforation, underscore the complexity of managing these cases, where multifactorial risks play a role.

In conclusion, this study reinforces that laparoscopic and laparoscopy-assisted approaches are effective and safe for treating jejunoileal atresia, with low complication and mortality rates. Future studies focusing on optimizing instrument positioning, reducing postoperative complications, and addressing the long-term outcomes of patients, especially those with short bowel syndrome, will further enhance the safety and efficacy of these techniques.

Conclusion

This case series demonstrates that hematopoietic stem cell transplantation (HSCT) can be successfully performed in pediatric patients with severe aplastic anemia (SAA) complicated by multidrug-resistant organism (MDRO) infections when meticulous infection control and multidisciplinary management are implemented, given that those patients proceed to transplant in their best possible condition, being afebrile, with negative cultures and stable to improved radiological evidence of infections. Despite the traditionally high risk associated with MDRO colonization or infection, our experience shows that early HSCT, guided by individualized antimicrobial strategies and close collaboration between infectious disease and transplant teams, can achieve favorable outcomes.

The key determinants of success included early infection stabilization, aggressive infection surveillance, and prompt neutrophil engraftment. These factors collectively facilitated immune recovery and minimized infection-related complications. Although one patient in our series succumbed to carbapenem-resistant Klebsiella pneumoniae sepsis, the remaining patients demonstrated sustained donor chimerism and long-term infection-free survival.

Our findings support the position that active or recent MDRO infection should not constitute an absolute contraindication to proceeding with HSCT in pediatric SAA. Timely transplantation, combined with rigorous infection control, can offer a curative outcome for these high-risk patients. Future multicenter studies are needed to develop standardized guidelines for pre-transplant infection stabilization, peri-transplant antimicrobial management, and post-transplant infection surveillance in this vulnerable population.

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