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Laparoscopic versus Open Ladd's Procedure for Intestinal Malrotation

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Abstract

Background: Anomalous rotation and fixation of the intestines during fetal development leads to intestinal malrotation. Usually, it is characterized by intestinal volvulus, which might result in intestinal necrosis, and bilious vomiting. It has been estimated that 1 in 6000 live newborns have malrotation.

Aim of Study: The aim of this study is to evaluate the laparoscopic versus open Ladd's procedure for Intestinal Malrotation as regard operative details and postoperative outcome.

Patients and Methods: This retrospective study included (57) patients who underwent definitive treatment for intestinal malrotation uncomplicated with volvulus at the pediatric surgery unit at Mansoura University Children Hospital, Egypt. during the period from October 2015 to September 2022. 30 patients were treated using laparoscopic Ladd's technique and 27 patients were treated using open Ladd's technique.

Results: The children in the open operation group had a procedure lasting 83-115 minutes, whereas those in the laparoscopic group had one lasting 123-150 minutes. Although the laparoscopic group's procedure took longer than the open group's, it resulted in a shorter hospital stay and fewer incisional infections. Only laparoscopic procedures resulted in intraoperative problems such as hemorrhage (3.3%) and intestinal damage (3.3%).

Conclusion: We believe that laparoscopic Ladd's procedure is a good choice for management of malrotation with uncomplicated volvulus. The benefits of laparoscopic management of malrotation include a short hospital stay, rapid return of bowel function, minimal postoperative pain, and improved cosmosis.

Key Words: *Intestinal Malrotation – Open Ladd's Procedure.*

Introduction

ANOMALOUS rotation and fixation of the intestines during fetal development leads to intestinal malrotation. Usually, it is characterized by intestinal volvulus, which might result in intestinal necrosis, and bilious vomiting. An elevated incidence of 0.2% has been discovered in upper gastrointestinal tract investigations, with the incidence of malrotation estimated to be 1 in 6000 live births. However, autopsy reports suggest that the real frequency might reach up to 1% of the population **[1]**.

The midgut experiences the physiologic stages of herniation, rotation, retraction of the herniated loops, and fixing during the intestine's embryonic development. Abnormalities related to rotation and fixation in the midgut will result from disruption of these crucial stages. Volvulus is more common in the abnormally fixed midgut with a short mesenteric root. An blockage caused by the gut twisting is called a volvulus. The superior mesenteric artery serves as the axis around which the midgut rotates when volvulus occurs **[2]**.

The usual course of treatment for intestinal malrotation is open Ladd's surgery. Since 1995, the use of laparoscopy for intestinal malrotation in babies has progressively increased **[1]**. Nonetheless, the laparoscopic Ladd's operation remains a contentious treatment option for pediatric malrotation **[2]**. Numerous criteria, including the patient's age and the existence of volvulus, influence which surgeons prefer-open or laparoscopic. Furthermore, the results of the laparoscopic method are inconsistent, with some studies showing a significant risk of redo and a high prevalence of conversion **[3,4]**.

Patients and Methods

This is a retrospective study conducted at Pediatric Surgery Department in Mansoura University Children Hospital, by reviewing the patients' records during the period from October 2015 to September 2022. Children who underwent definitive treatment of intestinal malrotation were included in the study with exclusion of the patients that were complicated by volvulus.

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The included cases were allocated in two groups according to the surgical approach selected for repair of intestinal malrotation. Patients underwent laparoscopic approach were allocated in group A, whereas group B included cases that were treated by open Ladd's procedure.

Surgical technique:

Laparoscopic Ladd's procedure:

The kid was made to lie supine, and two functioning ports were introduced, one pararectally at the umbilical level, via the umbilicus to accommodate the camera. Preliminary exploration was directed to determine site of the cecum, presence of Ladd's bands, dilated duodenum, abnormal position of the duodenojejunal junction, presence of volvulus, and presence of chylous ascites (Fig. 1).

In cases of malrotation without volvulus, there was a ring-like peritoneal band encircling the duodenum, cecum and the ascending colon (Ladd's bands). These bands were exposed by traction of the duodenum to the right side and cecum and the ascending colon to the left side, division was done by hook and diathermy. Division of the bands was done along the whole length of the duodenum down to the duodenojejunal junction. The jejunum was now in view (Fig. 2). The duodenum and then the jejunum were pulled until the entire small bowel was on the right side and the big intestine was on the left. Finally, to see if the anterior mesentery had been sufficiently expanded, a check was done (Fig. 3). If not, the neighboring bowel was further pushed to either side and the anterior leaf of the mesentery was further incised distally.

There was a clockwise volvulus of the mesenteric stalk in certain instances. At first, we left the volvulus since it was retracting the colon to the left. After identifying and transecting each peritoneal band separating the colon, liver, and retroperitoneum, the duodenum was kocherized. Subsequently, the volvulus was undone by rotating counterclockwise. The ascending colon's mesentery was carefully avoided opening. Finally, the whole duodenum and jejunum were on the right side. Ladd's treatment was carried out in this research without an appendectomy.

Open Ladd's procedure:

An incision was made in the right upper transverse abdominal region while the patients were in a supine position. The gut resets itself if volvulus occurs, generally in a counterclockwise direction. The appendectomy was not done, and the abdominal incision was closed after Ladd's bands were severed to cause the duodenum to fall vertically down the right side of the spine, the small intestine on the right side of the abdomen, and the colon on the left.

Both groups were compared regarding sex, age and body weight at time of operation, operative time, hospital stay (from operation to discharge), and the incidence of postoperative complications.

Fig. (1): Abnormal site of cecum and appendix (subhepatic) with Oedematous mesenteric stalk.

Fig. (2): Taction of the duodenum to identify Ladd's bands.

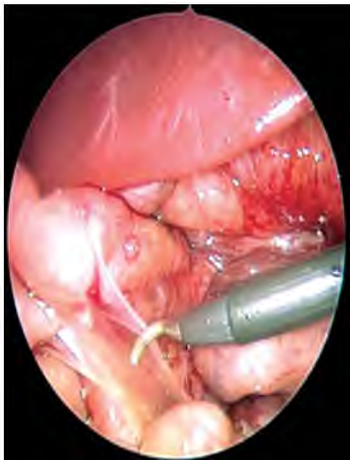

Fig. (3): The mesenteric stalk is widened anteriorly by cutting the anterior mesenteric.

Results

Retrospective revision of patients' records revealed that 66 patients underwent surgical correction of intestinal malrotation during the period of the study. Nine patients were complicated by volvulus and were excluded from the study. Accordingly, 57 children were included in the study, with 30 patients were treated by laparoscopic Ladd's technique and allocated in group A and 27 patients included in group B, as they were treated by open technique.

Both groups were comparable regarding sex, patients' age and body weight at time of operation with no statistically significant difference that can affect the outcome (Table 1).

The children in the open operation group had a procedure lasting 83-115 minutes, whereas those in the laparoscopic group had one lasting 123-150 minutes. Although the laparoscopic group's procedure took longer than the open group's, it resulted in a shorter hospital stay and fewer incisional infections. Only laparoscopic procedures resulted in intraoperative problems such as hemorrhage (3.3%) and intestinal damage (3.3%).

Table (1)

	Open (n = 27)	Laparoscopy (n = 30)
Weight (kg)	4.5-13	3-12.5
Gender (M/F)	15/12	19/11
Age	1.5 m-3.5 y	15 d-3 y
Operative time	83-115 min	123-150 min
Hospital stay	2-4 d	3-7 d

Early postoperative complications include port-site infection, fibrinous adhesive intestinal obstruction, and without any reported mortalities (Table 2).

Table (2)

	Open (n = 27)	Laparoscopy (n = 30)
Port-site infection-wound infection	4 (14.8%)	1 (3.3%)
Fibrinous adhesive intestinal obstruction	3 (11%)	0
Paralytic ileus	2 (7.4%)	1 (3.3%)
Feeding difficulties	3 (11%)	2 (6.7%)
Mortality	0	0

Reoperation rates were 3.7% for open surgery and 10% for laparoscopic procedures. The primary reason for the need for a second procedure was an adhesion intestinal blockage during the first one. Recurrent volvulus, adhesion intestinal blockage, and incomplete Ladd's operation were observed in the laparoscopic group.

Discussion

In newborns and babies, duodenal blockage is frequently caused by intestinal malrotation. Abnormal twisting and fixing of the intestine is known as malrotation **[1]**, and it can result in chyloascites **[2],** abdominal discomfort, and intestinal torsion necrosis. The benefits of laparoscopic surgery include decreased postoperative discomfort, an attractive incision, and less invasiveness, notwithstanding the controversy surrounding the laparoscopic Ladd's operation for neonates **[3-6]**. Volvulus will cause a longer healing period after surgery **[7]**. Ages may also differ in how they heal.

Children who had laparoscopic surgery in this research stayed shorter and experienced a lower risk of incision infection (2-4d, 0) compared to open procedure (3-7d, 14.8%), respectively. Children in our study had an incision infection rate for laparoscopy of 3.3% and an open technique of 14.8%, which is comparable to earlier research **[3]**. Extended hospital stays and long-term incision dressings are necessary in cases of incision infection.

Our study's duration of stay is comparable to earlier research **[8].**

Usually, being able to obtain appropriate nutrition and ruling out any difficulties is our threshold for release. After the infant has had enough feedings, doctors may be more likely to release them because laparoscopic surgery seldom results in incisional infection.

There was no conversion rate in our investigation; the large series reported conversion rates between 8 and 45% **[9,10,11,12].** We also found that the laparoscopic technique is safe for young patients.

In this investigation, two trocars were inserted pararectally at the level of the umbilicus, and a laparoscopic trocar was inserted into the umbilical cord for observation. This enables the surgeon to carry out the procedure in comfort. The process was not the same as Pham's account **[9],** which said that two trochers were inserted into the right lower and right abdomen.

While numerous research **[8,11,13]** have documented a quick recovery of peristalsis following laparoscopic surgery, our study did not discover a statistically significant advantage for the laparoscopic group in terms of postoperative intestinal function recovery compared to earlier findings **[14,15]**. The time of the first postoperative defecation serves as our yardstick for measuring intestinal function recovery. The inconsistent and subjective nature of the gut function assessment approach might account for the variation in findings. The larger percentage of midgut volvulus in our research might be another factor contributing to the recovery differences.

Simultaneously, we discovered that the laparoscopic group's operation time was lengthier than the open group's. Numerous research support this conclusion *[13,16,17]*. Our operating time is comparable to that of the earlier research *[12,10]*. The large number of kids with volvulus in our research might be the cause of this.

According to several accounts, the difficulties of twisting and redoing a laparoscopic Ladd's treatment is substantially higher than that of open surgery. To ascertain the long-term effectiveness of laparoscopic surgery, however, a longer period of follow-up is required. It has been reported that the rate of postoperative adhesive obstruction following open Ladd's surgery can reach 13%; our rate of postoperative adhesive intestinal obstruction is comparable to around 11%. Postoperative intestinal adhesion obstruction may result from the inevitable and substantial dissociation of Ladd's band during surgery *[3,18]*.

In the current analysis, there was a 3.7% incidence of reoperation for open surgery and a 10% likelihood for laparoscopic procedures. The primary reason for the need for a second procedure was an adhesion intestinal blockage during the first one. Recurrent volvulus, adhesion intestinal blockage, and incomplete Ladd's operation were observed in the laparoscopic group. Despite this, the reoperation rate of 8.1% is comparable to laparotomy rates reported in previous literature *[7,19]*.

Even though intestinal malrotation in conjunction with other gut anomalies is uncommon *[20]*, it might be challenging to identify after surgery. Intensive high frequency coagulation may be the cause of our case of necrotizing enterocolitis, despite the fact that there have been several research on the condition *[21,22]*. It implies that when feeding, we should be aware of the abdominal symptoms. It appears that complications are inevitable in both open and laparoscopic Ladd's procedures, with a potential for reoperation *[19,23]*.As such, it is critical to notify the family upon discharge in order to prevent irreparable volvulus necrosis.

Conclusion:

We believe that laparoscopic Ladd's procedure is a good choice for management of malrotation due to a short hospital stay, rapid return of bowel function, minimal postoperative pain, improved cosmosis and less early post-operative complications but it has prolonged operative time with more late postoperative complications.

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إجراء تقنية لاد بالمنظار مقابل الفتح الجراحى لسوء الدوران المعوى

مقدمة: سوء الدوران المعوي هو نتيجة لدوران الأمعاء غير الطبيعى وتثبيته أثناء فترة تكون الجنين. وعادة ما يتميز بالقىء الصفراوى وانفتال الأمعاء، مما قد يؤدى إلى نخر الأمعاء. تقدر نسبة حدوث سوء الدوران بـ ١ من كل ٦٠٠٠ مولود حى. أثناء التطور الجنينى المعوى، يمر المعى المتوسط بالمراحل الفسيولوجية التالية: الانفتاق، والدوران، وتراجع الحلقات المنفتقة، والتثبيت. سيؤدى تعطيل هذه الخطوات الحاسمة إلى تشوهات دوران وتثبيت المعى المتوسط. يكون المعى المتوسط المشوه ذو الجذر المساريقى القصير عرضة للانفتال. يتم تعريف الانفتال على أنه التواء فى الأمعاء يسبب الانسداد. فى حالة الانفتال، يدور المعى المتوسط حول محور الشريان المساريقى العلوى.

إجراءالفتح الجراحى بتقنية لاد هو العلاج القياسى لسوء دوران الأمعاء. تم تطوير استخدام تنظير البطن لعلاج سوء الدوران المعوي عند الرضع تدريجيًا منذ عام ١٩٩٥ ومع ذلك، فإن إجراء لاد بالمنظار لسوء الدوران عند الأطفال لا يزال نهجاً مثيرًا للجدل. قد يؤدى عمر المريض والتواءه إلى نتيجة مختلفة. قد يكون ذلك بسبب النسبة العالية من النقل وارتفاع مخاطر الإعادة.

طُرق اختيار المريض: شملت هذه الدراسة بأثر رجعى (٥٧) مريضاً خضعوا للعلاج النهائى لسوء الدوران المعوى فى وحدة جراحة الأطفال فى مستشفى الأطفال بجامعة المنصورة، مصر. خلال الفترة من أكتوبر ٢٠١٥ إلى سبتمبر ٢٠٢٢، تم علاج ٣٠ مريضاً بتقنية لاد بالمنظار و٢٧ مريضاً بتقنية لاد المفتوحة.

معايير الاشتمال هى كما يلى: تم تشخيص الرضيع على أنه سوء دوران معوى دون نخر معوى. معايير الاستبعاد: تم تشخيصه على أنه سوء دوران معوى مع انفتال معقد.

الهدف من العمل: الهدف من هذه الدراسة هو تقييم إجراء لاد بالمنظار مقابل إجراء لاد المفتوح لسوء الدوران المعوى فيما يتعلق بتفاصيل العملية ونتائج ما بعد الجراحة والمضاعفات.