

# Clinical impact of open versus laparoscopic approach on the outcome in cases of congenital duodenal obstruction: a comparative study

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**Introduction** Congenital duodenal atresia/partial duodenal obstruction/duodenal stenosis is one of the most common variants of intestinal atresia, occurring 1 in 2500–5000 live births. The aim of this study was to compare between both the laparoscopic and open approaches for repair of congenital duodenal obstruction regarding their effects on outcome.

**Patients and methods** A total of 20 cases diagnosed with congenital duodenal obstruction (atresia, web, and stenosis) in the neonatal and pediatric surgical units of Cairo University Specialized Pediatric Hospital were studied. All cases underwent either laparoscopic or open repair. Cases associated with malrotation or multiple atresias were excluded. Patients' characteristics, including age, sex, presenting symptoms, associated anomalies, preoperative investigations, intraoperative details, and postoperative outcomes, were documented.

**Results** A total of 20 cases of duodenal obstruction were included in this study over 1 year, from January 2017 to January 2018. We did duodenoduodenostomy in 15 cases (web in the second part of duodenum, types II and III) and excision of the web in the first part of duodenum in five cases. Laparoscopic repair was done in 11 (55%) cases (diamond-shaped duodenoduodenostomy in nine cases and web excision in two cases) whereas open technique

was performed in nine (45%) cases (diamond duodenoduodenostomy in six cases, and excision of the web in three cases). The average operative time in cases of laparoscopic duodenoduodenostomy was 120 min whereas in the cases of open technique was 90 min. The average time needed until full feeding to be achieved was 6–7 days in cases done laparoscopically, whereas other group was 10–20 days. In this cohort, no stricture or leakage or wound dehiscence was found in both groups. Laparoscopic group afforded a better cosmesis and more parent satisfaction.

**Conclusion** Use of the laparoscope in duodenal obstruction in either neonates or children is a safe and easy technique, and despite being a lengthier operation, feeding could be established earlier. *Ann Pediatr Surg* 14:231–235 © 2018 Annals of Pediatric Surgery.

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## Introduction

Congenital duodenal atresia/partial duodenal obstruction/duodenal stenosis is one of the most common variants of intestinal atresia, occurring 1 in 2500–5000 live births [1]. Surgical management of duodenal obstruction includes gastrojejunostomy, duodenojejunostomy, and duodenoduodenostomy (either diamond or side to side anastomosis); however, duodenoduodenostomy is considered the most successful and physiologic procedure, which can be done by either open technique or laparoscopically [1–3].

The first laparoscopic repair of duodenal atresia was done from the beginning of the 21st century, when shortly after each other, Bax *et al.* [4] and Rothenberg [5] described their initial experience with the novel procedure. A Kansas group reported first results with high failure rate [6,7], so the approach was discontinued in 2005. In 2008, laparoscopic approach was resumed after gaining considerable experience with intracorporeal suturing and adjusting the operative technique [8]. The aim of this study is to compare the outcomes of both the laparoscopic and open approaches for repair of congenital duodenal obstruction.

## Patients and methods

This study was designed to be a prospective case series. A total of 20 patients with duodenal atresia, stenosis or obstruction (membrane/web) admitted at neonatal and pediatric intensive care units of Cairo University Specialized Pediatric Hospital were subjected randomly to operative repair either through laparoscopically or by open technique during the period from January 2017 to January 2018. Patient demographics, age, sex, presenting symptoms, and associated anomalies were documented. Preoperative investigations, for example, plain radiography and echocardiography, to exclude cardiac anomalies and laboratory studies were recorded. Intraoperative data and postoperative outcomes were documented. Cases associated with malrotation or multiple atresias were excluded. The protocol of this study was approved by the research ethical committee of the Pediatric Surgery Department, Faculty of Medicine, Cairo University. Informed written consent was obtained from the parents of all patients.

## Preoperative details

Nasogastric decompression of the stomach and fluid resuscitation were started after admission. Fluid, electrolyte,

and acid–base imbalances were corrected. Broad-spectrum antibiotics and 1 mg vitamin K were administered. Once the patient was stabilized, the operation was done.

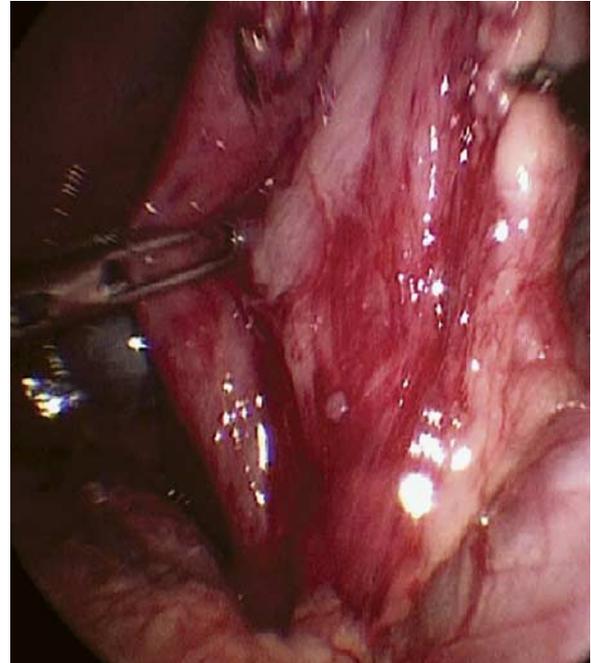
**Operative techniques**

**Laparoscopic approach**

- (1) After induction of general anesthesia, sterilization and draping of the patients was done. The surgeon stood at the foot of the operating table, whereas the camera assistant stood to his left and the scrub nurse to his right side. The laparoscopic tower was placed at the head of the operating table.
- (2) The procedure was started by introducing a 5-mm trocar (open method) through the umbilicus, and insufflation with CO<sub>2</sub> (5 mmHg, 2 l/min) was achieved. Then two additional 3-mm trocars in neonates were inserted under direct vision in the lower right quadrant and left middle quadrant.
- (3) We mobilized the colon to the left side of the abdomen to gain access to the area of the duodenum, and then we introduced two stay sutures transcutaneously (Fig. 1), one through the falciform ligament to elevate the liver and the other into the bulky part of the duodenum to provide better exposure of the distal part of the duodenum (Fig. 2), which was mobilized sufficiently to allow a tension-free anastomosis (Fig. 3).
- (4) We incised the distal duodenum longitudinally with scissors and the proximal part transversely for a diamond-shaped repair anastomosis using 5-0 vicryl interrupted sutures (Figs 4–7).
- (5) In two cases of duodenal web, in one of them, we identified the constricting part of the duodenum between proximal dilated and distal collapsed part, and in the other case, the site of the web was detected by passing the orogastric tube through the pylorus into the duodenum and noting the indentation

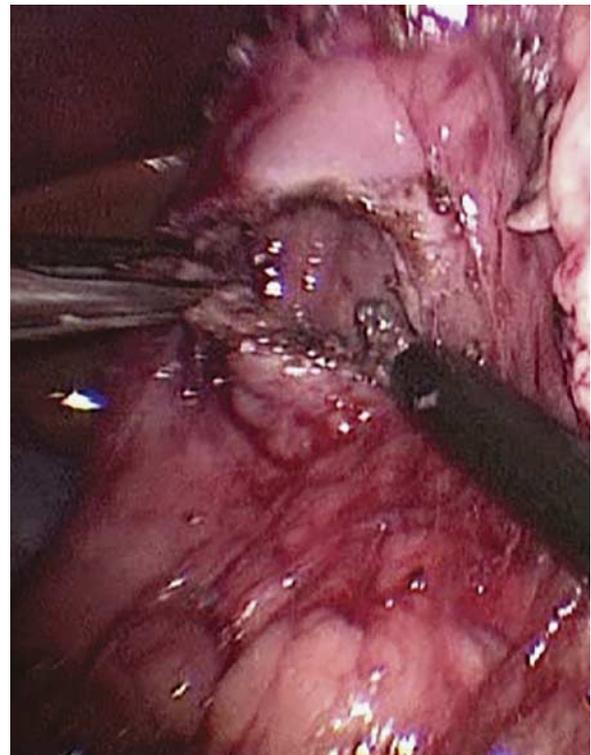
of the duodenal wall caused by tenting of the web. A longitudinal duodenotomy was done along the site of this indentation. Excision of the lateral part of the web was done before repair, and duodenotomy was

**Fig. 2**



Dissection of the distal part of the duodenum.

**Fig. 3**



Incision of the proximal part of the duodenum.

**Fig. 1**



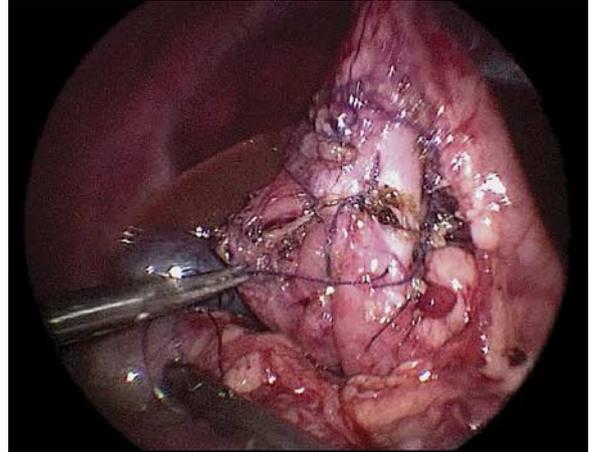
Transcutaneous traction of the distended part of the duodenum.

Fig. 4



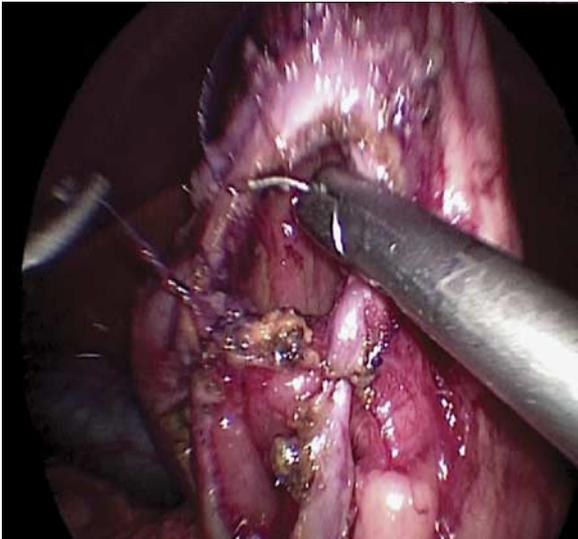
Incision of the distal part of the duodenum.

Fig. 6



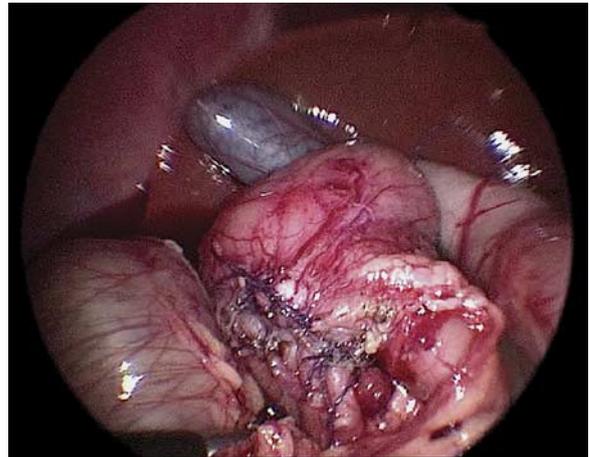
Anastomosis of the anterior part of the duodenum.

Fig. 5



Anastomosis of the posterior part of the duodenum.

Fig. 7



Appearance after completed anastomosis.

closed transversely in one layer with vicryl 5-0 interrupted sutures.

#### **Open approach**

The abdomen was explored thoroughly. Kocherization of the duodenum was done, and the dilated proximal duodenum was identified. When there was a significant gap between the proximal and distal ends, the distal duodenum was mobilized.

A duodenoduodenostomy was the procedure of choice using a diamond-shaped technique. A transverse incision was made in the proximal duodenum and a longitudinal incision of the same length in the distal segment.

The site of the ampulla of Vater was detected through gentle pressure on the gall bladder, and then saline was injected through a small catheter passing through the distal duodenotomy to exclude other distal atresia.

Thereafter, a single layer anastomosis with 6-0 vicryl interrupted sutures was done.

In cases of duodenal web, the ampulla was identified and the web was excised from the lateral duodenal wall, leaving the medial alone to avoid damaging the sphincter of Oddi or ampulla. The resection line was oversewn with 6-0 vicryl interrupted sutures, and the duodenotomy was closed transversely in one layer as described before.

#### **Postoperative care**

We started oral feeding when bowel sounds were heard, the stool was passed, and the gastric aspirate was limited (<1 ml/kg/h of clear or pale-green fluid). Oral feeding was gradually introduced, starting with clear fluids and aspirating the stomach before each feed.

#### **Results**

A total of 20 patients admitted to Cairo University Specialized Pediatric Hospital during the period from

**Table 1 Comparison between open and laparoscopic approaches regarding operative times, duration till full feeds, duration of admission, and postoperative complications**

Duodenal atresia	Excision of the web (open technique)	Excision of the web (laparoscopic)	Duodenoduodenostomy (open)	Duodenoduodenostomy (laparoscopic)
Number	3	2	6	9
Mean operative time (min)	60	90	90	120
Duration needed until full oral feeding (days)	Mean = 8 Median = 8	Mean = 7 Median = 6	Mean = 12 Median = 11	Mean = 7 Median = 8
Duration of admission (days)	Mean = 8.6 Median = 9	Mean = 8 Median = 7	Mean = 14 Median = 12	Mean = 9.5 Median = 9
Stricture	0	0	0	0
Leakage	0	0	0	0

January 2017 to January 2018 were studied. There were 11 (55%) males and nine (45%) females. The study included 12 (60%) cases of duodenal atresia in neonates (three cases of web in the first part of the duodenum, four cases of web in the second part, two cases of annular pancreas, two cases type II, and one case type III), and eight (40%) of cases duodenal obstruction in infants ranging from 5 months to 2 years of age (two cases of web in the first part of the duodenum and six cases of web in the second part).

We did duodenoduodenostomy in 15 cases (cases of web in the second part of the duodenum, types II and III), and excision of the web in the first part of the duodenum was done in five cases. Laparoscopic repair was done in 11 (55%) cases (diamond duodenoduodenostomy in nine cases and web excision in two cases) whereas open technique was performed in nine (45%) cases (diamond duodenoduodenostomy in six cases and excision of the web in three cases). The average operative time in cases of laparoscopic duodenoduodenostomy was 120 min whereas in the cases of open technique was 90 min. The average time needed until full feeding to be achieved was 6–7 days in cases done laparoscopically, whereas in the other group was 10–20 days. In this cohort, no stricture, leakage, or wound dehiscence was found in both groups. Laparoscopic group afforded a better cosmesis and more parent satisfaction (Table 1).

Of 12 cases of neonatal duodenal atresia, nine cases presented with bilious vomiting and three cases presented with nonbilious vomiting, whereas in children with duodenal atresia, the presenting symptom was bilious vomiting in six cases and nonbilious vomiting in two cases.

## Discussion

Minimal invasive surgery is a safe procedure in cases of duodenal atresia/partial duodenal obstruction/duodenal stenosis.

In this study, we had 12 cases of duodenal atresia in neonates (three cases of web in the first part of the duodenum and four cases of web in the second part, two cases of annular pancreas, two cases of type II, and one case type of III) and eight cases of duodenal atresia in children (two cases of web in the first part of the duodenum and six cases of web in the second part), whereas Mustafawi and Hassan [9] reported 21 (52.5%) of

40 cases of duodenal atresia had a type I atresia, 5% had a type II atresia, and one (2.5%) case had a type III atresia.

The incidence of associated congenital anomalies in this study was 35%, including congenital heart disease ( $n = 2$ , 10%), trisomy 21 ( $n = 4$ , 20%), and tracheoesophageal fistula ( $n = 1$ , 5%), whereas Choudhry *et al.* [10] reported that 71% of all cases in their series had associated anomalies, including congenital heart disease (24%), trisomy 21 (19%), malrotation (12%), gastroschisis (9%), esophageal atresia (8%), anal atresia (6%), volvulus (5%), colon atresia (3%), mucoviscidosis (3%), and finally Meckel diverticulum (2%).

The average operative time in web excision in open repair was 60 min and in laparoscopic repair was 90 min, whereas in duodenoduodenostomy, it 90 min in open and 120 min in laparoscopic, whereas Parmentier reported that average operative time in cases of laparoscopic duodenoduodenostomy was 90 min [11].

In this study, in the five cases of web excision, feeding was started on the third day regardless of the type of technique, whereas in the 15 cases of duodenoduodenostomy, total parental nutrition was started on the second day, and then oral feeding after 4–5 days, whether open or laparoscopic.

The time to achieve full feeding was 7 days in cases of laparoscopic duodenoduodenostomy and 12 days for those performed by open technique. This means cases done laparoscopically require less time to achieve full feeding if compared with those done by open repair. Spilde *et al.* [12] compared laparoscopic and open procedures and demonstrated that time to initiation of feeding was shorter in cases completed laparoscopically (5–8 days for laparoscopic vs. 8–11 days for open groups), as was the time to discharge (12–21 days for laparoscopic vs. 20–24 days for open groups).

In five cases of web excision only, cases were discharged in 1–2 weeks, whereas in the 15 cases of duodenoduodenostomy, cases done laparoscopically were discharged earlier than those done by open technique (9 vs. 14 days).

In our series, no anastomotic leakage, stenosis or wound dehiscence was encountered in both techniques (open or laparoscopic); however, laparoscopic repair provided a better cosmetic result and more parent satisfaction than open repair. Our results are comparable to Kay *et al.* [13] who reported a series of 17 laparoscopic duodenoduodenostomy procedures with no short-term complications

and excellent results, apart from the excellent cosmetic benefit of laparoscopy.

### Conclusion

Use of the laparoscope in duodenal obstruction in either neonates or children is a safe and easy technique, and despite being a lengthier operation, feeding could be established earlier, taking less time in hospital until full feeding orally, and overcoming difficulty in obtaining and maintaining parenteral nutrition for long time.

### Conflicts of interest

There are no conflicts of interest.

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