Laparoscopic duodenoduodenostomy in the neonate
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Abstract
Background: Minimally invasive procedures are performed in neonates for an ever-expanding list of congenital anomalies. The laparoscopic repair of duodenal atresia and stenosis in the neonate is one such indication.

Method: We report our experience with the laparoscopic duodenoduodenostomy for duodenal atresia and stenosis in the neonate over the past 4 years. A retrospective chart review was conducted on all cases of duodenal atresia and stenosis diagnosed at our center between January 2004 and January 2008.

Results: Seventeen neonates underwent laparoscopic duodenoduodenostomy successfully during the period. Patient weight at surgery ranged from 1.35 to 3.75 kg. Most were operated on within the first week of life. Many had associated anomalies. There were no conversions to an open procedure, no intraoperative complications, and no anastomotic leaks observed. Time to full feeds averaged 12 days.

Conclusions: Laparoscopic duodenoduodenostomy in the neonate can be safely and successfully performed with excellent short-term outcome.

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1. Background

Duodenal atresia and stenosis are intrinsic duodenal obstructions occurring in 1 in 6000 live births and are often associated with other anomalies including trisomy 21 and cardiac malformations. The diagnosis is increasingly made by prenatal ultrasound and confirmed at birth with a plain abdominal x-ray demonstrating the classic double-bubble sign [1].

The management of the patient with duodenal atresia has steadily evolved since the first report of surgical correction of intrinsic duodenal obstruction by Ladd in 1931 [2]. At that time, reported mortality was 40%. Over the last few decades, advancements in neonatal intensive care, parenteral nutrition, and management of associated anomalies, and improvements in operative technique and postoperative care have improved the outlook for patients born with this condition. Mortality has been reduced to 5% to 10% and is now related mostly to associated anomalies, primarily cardiac [1,3].

Various techniques have been described for the repair of duodenal atresia, but the diamond-shaped duodenoduodenostomy described by Kimura in 1990 [4] has become the standard. The introduction of advanced laparoscopic techniques in the neonate has more recently led to a new surgical approach, the laparoscopic duodenoduodenostomy [5-8].

Our early experience with laparoscopic duodenoduodenostomy was published in 2002 [5]. Since that time, our senior surgeon has continued to repair most congenital duodenal obstructions using this technique. In 2004, the...
other surgeons in the practice began using the laparoscopic technique as well; and our practice has evolved to correct most patients who present with duodenal obstruction at birth, or later, with this technique, reserving open surgery for those cases with a relative contraindication to the laparoscopic approach. In this article, we report our experience performing laparoscopic duodenoduodenostomy over this recent 4-year period.

2. Methods

We conducted a standardized chart review of all records from our institution from January 2004 to January 2008. All cases with a diagnosis code for “intestinal atresia” (International Classification of Diseases, Ninth Revision code 751.1) were obtained and then hand screened by the author (SK) to select only those cases of duodenal atresia or stenosis. All cases of neonatal duodenal obstruction seen in our institution were then reviewed. Data collected included method of diagnosis, associated anomalies, patient age and weight at surgery, operative procedures performed, operative time, any intraoperative complications, and postoperative course.

Our operative approach has been described previously and is summarized here [5]. A 4-mm port is placed at the umbilicus for a 30° laparoscope. A 3-mm port is placed just within the right lower quadrant, and a 5-mm port is placed just within the left upper quadrant for introduction of the suture. With the surgeon standing at the patient’s feet, the duodenum is Kocherized; and the dilated proximal and decompressed distal segments are identified. A proximal transverse and distal longitudinal duodenotomy is then made. A diamond-shaped anastomosis is performed with either a separate running suture for the posterior and then anterior wall, or single interrupted stitches of Vicryl or polydioxanone (surgeon’s choice). Intracorporeal knot tying is used. An extra port can be placed in the right upper quadrant to help retract the liver and set up the anastomosis. Alternatively, the apical stitch can be tied and brought out through the abdominal wall to assist with retraction and align the enterotomies for the anastomosis. The distal bowel is examined in all cases to ensure that there are no obvious secondary atresias.

3. Results

Nineteen cases of neonatal duodenal obstruction were identified, 17 of which were repaired laparoscopically. Of the 2 repaired with an open procedure, one was a 29-week premature baby born at 986 g; and the other was a 33-week premature baby weighing 1.8 kg who had associated meconium peritonitis and other anomalies. Fourteen were diagnosed with duodenal atresia and 3 with duodenal stenosis. Twelve had been diagnosed prenatally (71%). Multiple associated anomalies were seen in our patients including trisomy 21, cardiac anomalies, imperforate anus, renal anomalies, pancreatic anomalies, and malrotation. Trisomy 21 was the most common anomaly, found in 7 of our patients (41%). Ten of the patients were born prematurely (59%).

Most patients were operated on during the first week of life (average, 5 days; range, 1-33 days); and many had other operative procedures performed concurrently including Broviac placement, laparoscopic Ladd procedure, and repair of imperforate anus. Patient weights at the time of surgery ranged from 1.35 to 3.76 kg, with an average of 2.37 kg. Six of the 17 cases were performed by the senior surgeon, with the remaining 11 cases divided among 4 other surgeons in the practice for whom these represented their first experiences with the technique. All cases were completed laparoscopically, and there were no intraoperative complications. In all cases, the distal bowel was examined for any distal atresias, although none were found. Operative time obtained was that recorded by the anesthesiologist from initial operative start time to final skin closure. Detailed data on operative time for the laparoscopic duodenoduodenostomy alone (ie, excluding time for additional procedures) were not available in all cases. The average total operative time for those cases where these data were available was 105 minutes.

There were no postoperative leaks, no missed distal intestinal obstructions, and no short-term complications. Time to initiation of feeds averaged 8 days (range, 3-18 days), and time to full feeds averaged 12 days (range, 5-28 days).

4. Discussion

The prognosis for babies born with duodenal atresia and stenosis is excellent. Prompt diagnosis is the norm, leading to timely surgical correction when associated anomalies permit. Minimally invasive surgery is being performed for an expanding list of indications in the neonate. Many operators believe that these techniques confer numerous benefits to the patient, including shorter recovery times and in many cases shorter hospitalization, less pain, and less adhesion formation and scarring [9,10].

Duodenal atresia is another diagnosis that proves to be amenable to a minimally invasive technique. The proximal nature of the atresia means the entire jejunum and ileum are decompressed, allowing for excellent work space even in babies less than 1.5 kg. The magnification of the laparoscope helps achieve an accurate anastomosis even in bowel with a diameter of less then 5 mm. The lack of distal bowel manipulation seems to result in a shorter ileus and earlier initiation of feeds. This was evident in our initial report and has been confirmed in a recent report by Spilde et al [8]. They compared the laparoscopic and open approach to congenital duodenal obstruction and showed significantly shorter time to initiation of feeds, time to full feeds, and postoperative hospitalization in their laparoscopic group.
The few reports that followed our initial 2002 study suggested that the laparoscopic approach to congenital duodenal obstruction using conventional suturing techniques was associated with an unacceptable postoperative leak rate. This prompted the introduction of the U-clip in Kansas City to accomplish the anastomosis laparoscopically [7,8]. All of our cases have been performed with conventional suturing techniques without any observed leaks. Based on surgeon preference, we have used both a running and interrupted suture line without complication. The fact that all surgeons in the group have been able to accomplish this without issue suggests that the laparoscopic duodenoduodenostomy is safe and effective in surgeons with adequate laparoscopic skills.

Although in our series we did not have any clear cases of a duodenal web, we would advocate laparoscopic duodenoduodenostomy over duodenotomy with web excision out of concern for possible injury to the ampulla in a small neonate.

One reported disadvantage of the laparoscopic approach is the reduced ability to detect distal atresias. These are rare in duodenal atresia; and if time is taken laparoscopically to run the bowel, only a type I atresia should be missed. We feel the advantages of the laparoscopic approach outweigh this small risk.

Our data, representing the early experience of a number of surgeons, show that with advanced laparoscopic skills, laparoscopic duodenoduodenostomy can be performed with no bleeding, no conversions, and no postoperative anastomotic leaks using conventional suturing techniques. In our extended series, time to feed varied widely and tended to be longer than was reported in our initial experience. This may have been due in part to the large number of premature babies in our group and to a conservative approach on the part of the more junior treating physicians for whom this was a novel technique. As our experience increases, we would expect shorter operative times and quicker time to feeds. We have seen this already with some of our other neonatal laparoscopic and thoracoscopic cases, although we have not published those data.

This is a report focusing on short-term results alone. Long-term outcomes are not yet available for this newer approach, but it would be expected that late complications would be similar to those seen with essentially the same surgical procedure performed with an open approach. Further study will be necessary to determine this for certain.

In summary, our experience demonstrates that laparoscopic duodenoduodenostomy can be performed safely and successfully in the neonate with excellent short-term outcomes. Surgeons with experience in advanced laparoscopic techniques can learn the laparoscopic duodenoduodenostomy and have excellent results. Special instruments are not necessary, as conventional suturing techniques can be used with similar results as those seen with the U-clip.

References