

Modified Bianchi pyloromyotomy versus laparoscopic pyloromyotomy for patients with infantile hypertrophic pyloric stenosis: intraoperative considerations and parents' satisfaction

Wesam Mohamed, Ahmed M.K. Wishahy, Tamer Y.M. Yassin, Ayman Hussein, Ahmed Arafa, Mohamed S. Abdel Monsif and Mamdouh Abo El Hassan

Introduction Infantile hypertrophic pyloric stenosis is a common cause of persistent nonbilious vomiting during infancy. Ramstedt pyloromyotomy through right upper quadrant transverse incision is the conventional treatment. The laparoscopic and Tan-Bianchi approaches were introduced to improve the cosmesis and decrease postoperative morbidity. In this study, we compared between laparoscopic and modified Bianchi approaches regarding intraoperative technical considerations and postoperative outcomes.

Patients and methods The study included 40 patients with infantile hypertrophic pyloric stenosis. Overall, 20 patients underwent laparoscopic pyloromyotomy (LP) and the other 20 patients underwent modified Bianchi pyloromyotomy (MBP). Patients' characteristics, including age, sex, gestational age, and associated comorbidities, were documented. Intraoperative details and complications and postoperative outcomes were recorded.

Results The operative time and intraoperative complications including mucosal perforation and bleeding did not significantly differ between both the groups. From the laparoscopic group, one (5%) case was complicated by mucosal perforation and converted to open and another case (5%) developed hypercapnia. There was no statistically significant difference between the two groups

regarding time till full feed ($P=0.648$) and postoperative hospital stay ($P=0.082$). In addition, there was no statistically significant difference between the two groups regarding postoperative complications, with one (5%) case from the laparoscopic group underwent incomplete myotomy and required redo-operation and another case (5%) developed wound infection. MBP had a significantly more parent satisfaction regarding cosmesis than LP ($P=0.016$).

Conclusion MBP is comparable to LP regarding intraoperative complications and postoperative outcomes; however, the modified Bianchi approach offered more parent satisfaction than laparoscopic approach. *Ann Pediatr Surg* 14:222–224 © 2018 Annals of Pediatric Surgery.

Annals of Pediatric Surgery 2018, 14:222–224

Keywords: laparoscopic, modified Bianchi, pyloric stenosis, pyloromyotomy

Department of Pediatric Surgery, Faculty of Medicine, Cairo University, Cairo, Egypt

Correspondence to Tamer Y.M. Yassin, MD, FRCS, No. 98, 36th street, District 3, Area 5, Fifth Settlement, New Cairo, Cairo 11835, Egypt
Tel: +20 100 140 9560; fax: +20 22 562 7014;
e-mail: tamer.yassin@kasralainy.edu.eg

Received 19 April 2018 accepted 29 July 2018

Introduction

Infantile hypertrophic pyloric stenosis (IHPS) is one of the most common surgical diseases of infancy that requires surgery for associated vomiting [1]. Ramstedt pyloromyotomy is the standard surgical treatment, which can be performed through the conventional right upper quadrant transverse incision approach or through the Tan-Bianchi approach and the more recently introduced laparoscopic technique [2,3]. Tan-Bianchi approach offered a better cosmetic result when compared with the traditional open technique; however, it was associated with a longer operative time and a longer time to full feeds when compared with the laparoscopic approach [4,5], and there were high wound complications rates in series using Tan-Bianchi approach alone (range, 5–20%) [6,7].

The aim of this study is to compare between laparoscopic and modified Bianchi approaches for pyloromyotomy in infants with IHPS regarding intraoperative technical considerations and their effect on the postoperative outcomes.

Patients and methods

Data collection

After obtaining approval from the Research Ethics Committee of the Faculty of Medicine, Cairo University, 40 patients were recruited prospectively in this comparative trial. Written informed consent was obtained from the child's parent or guardian. Patients with IHPS presented to our institution over an 18-month period were randomized based on computer-generated simple randomization numbers into two groups. Infants aged from 2 weeks to 3 months with definite diagnosis of IHPS were indicated for open or laparoscopic pyloromyotomy (LP) whereas premature infants unfit for laparoscopy, having severe respiratory or cardiac comorbidities, were excluded from the laparoscopic approach. A total of 20 patients underwent LP, whereas the remaining were operated using modified Bianchi incision for pyloromyotomy (MBP). In the original procedure, Tan-Bianchi used supraumbilical fold incision starting at 3 o'clock position and ending at 9 o'clock position and sometimes with small transverse skin extensions at the angles of the wound for a larger pyloric mass.

In MBP, we used a three-quarter circle supraumbilical fold incision following the curve of the umbilicus starting at 3 o'clock position then to 9 o'clock position and ending at 6 o'clock position. Patients' characteristics, including age, sex, and gestational age, and associated comorbidities, were documented. Intraoperative details, including operative time and complications of each approach, were recorded. Postoperative outcomes, including time to full feeding, postoperative vomiting, hospital stay, early complications, and final outcomes, were compared.

Every patient's guardian was asked to give a score of his/her satisfaction regarding the cosmetic appearance of the scar, how he/she feels about this kind of technique, and whether he/she feels his/her child has become normal or not after the operation in terms of weight gain and relief of symptoms, particularly postoperative vomiting. Each item was graded from 1 to 10, where 1 being not satisfied at all and 10 being very satisfied with the result. The overall score was compared between the two groups [1].

Operative technique

Modified Bianchi pyloromyotomy

MBP was started by using a three-quarter circle supraumbilical fold incision following the curve of the umbilicus. The epigastric skin was undermined, and the peritoneal cavity opened through the linea alba. The stomach was grasped proximal to the pylorus with noncrushing clamp, and then the pylorus can be gently delivered through the wound. A seromuscular incision was made with a scalpel at the longitudinal axis of the pylorus, commencing 1–2 mm proximal to the prepyloric vein along the gastric antrum at least 0.5–1.0 cm from the antropyloric junction. Then pyloric muscle was spread widely till the intact mucosa bulges as evidence of a satisfactory myotomy. The stomach was inflated through the nasogastric tube to exclude mucosal perforation. Then the pylorus was returned back into the abdomen, and rectus sheath and skin were approximated.

Laparoscopic pyloromyotomy

LP was started by insertion of 5-mm umbilical port using open technique. Pneumoperitoneum was established to a pressure of 8 mmHg, and insufflation rate set at 1 l/min. A 5-mm 30° camera was introduced through the umbilical port. A 3-mm atraumatic grasper was placed directly without port through a right upper quadrant stab incision used to retract the inferior border of the liver superiorly and expose the hypertrophic pylorus. A 3-mm retractable myotomy knife is inserted directly through a left upper quadrant stab incision. The duodenum was then grasped just distal to the pyloric mass, retracted in lateral and slightly anterocephalic direction to expose the avascular surface of hypertrophic pylorus. A seromuscular incision was made over the hypertrophic pylorus with the myotomy knife starting at 1–2 mm proximal to the pyloroduodenal junction extending onto the gastric antrum at least 0.5–1.0 cm proximal to antropyloric junction. The myotomy knife was then replaced by LP spreader to complete the pyloromyotomy.

To test for the mucosal injury, the stomach was inflated through the nasogastric tube (160–180 ml) as in open techniques.

Table 1 Demographic data

| | n (%) (N=40) |
|-----------------|--------------|
| Gestational age | |
| Preterm | 10 (25) |
| Full term | 30 (75) |
| Age (days) | |
| Mean ± SD | 41.48 ± 9.73 |
| Range | 26–60 |
| Sex | |
| Female | 10 (25) |
| Male | 30 (75) |

Table 2 Intraoperative and postoperative data comparison

| Characteristic | Laparoscopic (N=20) | Modified Bianchi (N=20) | P value |
|------------------------------------------------|---------------------|-------------------------|---------|
| Operative time (mean ± SD) (min) | 22.35 ± 7.21 | 22.30 ± 3.83 | 0.978 |
| Mucosal perforation | 1 | 0 | 0.311 |
| Bleeding | 0 | 0 | |
| Conversion to open | 1 | 0 | 0.311 |
| Time to full feeding (mean ± SD) (h) | 20.85 ± 3.48 | 21.40 ± 4.04 | 0.648 |
| Persistent emesis | 1 | 0 | 0.311 |
| Wound infection | 0 | 1 | 0.311 |
| Postoperative hospital stay (mean ± SD) (days) | 2.75 ± 0.72 | 2.40 ± 0.50 | 0.082 |
| Parents satisfaction (mean ± SD) | 7.60 ± 0.82 | 8.30 ± 0.92 | 0.016 |

Statistical analysis

Results analysis was presented as mean and SD, and nonparametric data were presented as median and interquartile range. Data were presented as count and percentage for categorical variables. Groups of patients were compared using χ^2 test for categorized variables and using Paired (Student's) *t* test and Kruskal–Wallis test for continuous variables. The data were analyzed using statistical package for the social sciences (SPSS 20; IBM, Armonk, New York, USA); *P* value less than 0.05 was taken as a significant.

Results

A total of 40 patients with IHPS underwent either LP (*n* = 20) or MBP (*n* = 20). Demographics, intraoperative details, and postoperative outcomes are presented in Tables 1 and 2.

The preoperative range and mean of weight of cases that underwent MBP were 3–4.5 and 3.43 ± 0.43 kg, respectively, whereas those of cases that underwent LP were 2.7–4 and 3.40 ± 0.41 kg, respectively.

The operative time and intraoperative complications including mucosal perforation, bleeding, conversion to open, and hypercapnia did not significantly differ between both the groups. From the laparoscopic group, one (5%) case was complicated by mucosal perforation and converted to open and another case (5%) developed hypercapnia. The mean time till full feeding and postoperative hospital stay were similar between the two groups, with no statistically significance difference. Time till full feeding was 20.85 ± 3.48 h in LP versus 21.40 ± 4.04 h in MBP (*P* = 0.648), and postoperative hospital stay was 2.75 ± 0.72 and 2.40 ± 0.50 days for LP and MBP, respectively (*P* = 0.082).

In addition, there was no statistically significant difference between the two groups regarding postoperative complications. Moreover, 5% ($n=1$) of the patients from the laparoscopic group experienced persistence of vomiting secondary to incomplete myotomy necessitating redo-operation, and 5% ($n=1$) from the MBP group developed wound infection. MBP had a significantly more parent satisfaction than LP, with mean scores of 8.30 ± 0.92 versus 7.60 ± 0.82 , respectively ($P=0.016$).

Discussion

In 1986, Tan-Bianchi described an approach in which a pyloromyotomy was performed through a supraumbilical incision that yielded a superior cosmesis [3]. Since Alain *et al.* [2] introduced the LP, this approach has been gaining popularity owing to potential advantages, particularly better cosmesis and less postoperative pain and lower complication rates when compared with the conventional right upper quadrant horizontal incision approach. In our study, we compared LP and MBP approaches regarding intraoperative details and postoperative outcomes.

When compared with the laparoscopic approach, one of the drawbacks of Tan-Bianchi pyloromyotomy reported by Greason *et al.* [4] in their series that it was more traumatic than the laparoscopic approach was owing to the rough manipulation of and traction on the pyloric mass to deliver it through the wound, increasing the incidence of serosal lacerations, resulting in earlier time to full feeds and lower postoperative vomiting rate in cases managed laparoscopically. However, in our study, this finding had no significant effect on the postoperative hospital stay. Although some authors reported that the Tan-Bianchi was associated with a longer operative time, which may result from the technical difficulty to deliver the pyloric mass [4,8], our results did not show any significant delay. Similar to our findings, wound infection rate in the series using the Tan-Bianchi approach was 13.6% (range, 0–20%) [6,7].

Alberti *et al.* [9] modified the Tan-Bianchi approach with a right semicircular umbilical incision, so keeping all the incisions in the same axis, allowing for delivery of a larger pylorus, decreasing the amount of wound retraction and consequently, and decreasing hematoma formation and wound infection rates, despite the use of prophylactic antibiotics with this approach.

In our study, the operative time did not differ significantly between the two groups ($P=0.97$). Moreover, there was no statistically significant difference between the two groups regarding time to full feeding ($P=0.64$), postoperative hospital stay ($P=0.082$), and wound infection rates (one case developed superficial wound infection in the MBP group and none in the LP group) ($P=0.31$).

This study revealed that intraoperative and postoperative complications did not differ significantly between both the groups. The overall lower complication rate associated with MBP in comparison with LBP and nearly equal postoperative stay may be attributed to the three-quarter circle supraumbilical fold incision we used with gentle traction on the stomach and pylorus, allowing easier manipulation of the pyloric mass and avoiding prolonged ileus.

Despite that, authors who advocate LP, claiming that it offers better cosmetic appearance, their assertions have not been based on the systematic evaluation of patient outcomes. To the best of our knowledge, none of them addressed this point based on parents' own views in comparison with the modified Bianchi approach. Indeed, laparoscopy has gained popularity for its minimal incisions. Nevertheless, MBP yielded a significantly more parent satisfaction in our study. In addition, although MBP may be associated with a more postoperative pain owing to a relatively long midline fascial incision, the administration of postoperative analgesia may relieve this potential undesirable outcome. We believe that MBP can be a better substitute for LP, at least in low-income countries. However, larger sample size and longer follow-up period are recommended.

Conclusion

MBP is comparable to LP regarding intraoperative complications and postoperative outcomes. However, the modified Bianchi approach offered more parent satisfaction than laparoscopic approach.

Conflicts of interest

There are no conflicts of interest.

References

- Siddiqui S, Heidel RE, Angel CA, Kennedy AP Jr. Pyloromyotomy: randomized control trial of laparoscopic vs open technique. *J Pediatr Surg* 2012; **47**:93–98.
- Alain JL, Grousseau D, Terrier G. Extramucosal pyloromyotomy by laparoscopy. *Surg Endosc* 1991; **5**:174–175.
- Tan KC, Bianchi A. Circumumbilical incision for pyloromyotomy. *Br J Surg* 1986; **73**:399.
- Greason KL, Allhouse MJ, Thompson WMR, Rappold JF, Downey EC. A prospective, randomized evaluation of laparoscopic versus open pyloromyotomy in the treatment of infantile hypertrophic pyloric stenosis. *Pediatr Endosc Innov Tech* 1997; **1**:175–179.
- Fujimoto T, Lane GJ, Segawa O, Esaki S, Miyano T. Laparoscopic extramucosal pyloromyotomy versus open pyloromyotomy for infantile hypertrophic pyloric stenosis: which is better? *J Pediatr Surg* 1999; **34**:370–372.
- Ali Gharaibeh KI, Ammari F, Qasameh G, Kasawneh B, Sheyyab M, Rawashdeh M. Pyloromyotomy through circumumbilical incision. *J R Coll Surg Edinb* 1992; **37**:175–176.
- Takamizawa S, Obatake M, Muraji T, Tsuguwa C, Nishijima E, Satoh S. Supraumbilical pyloromyotomy: comparison between intracorporeal and extracorporeal approaches. *Pediatr Surg Int* 2004; **20**:101–104.
- Kim SS, Lau ST, Lee SL, Schaller R Jr, Healey PJ, Ledbetter DJ, *et al.* Pyloromyotomy: a comparison of laparoscopic, circumumbilical, and right upper quadrant operative techniques. *J Am Coll Surg* 2005; **201**:66–70.
- Alberti M, Cheli M, Locatelli G. A new technical variant for extramucosal pyloromyotomy, The Tan-Bianchi operation moves to the right. *J Pediatr Surg* 2004; **39**:53–56.