



Is the Hook Efficient for Laparoscopic Pyloromyotomy?

Fahmy M. Fahmy^{1*}, Hamed M. Seleim¹, Akram M. Elbatarny¹
and Mahmoud A. Elafifi¹

¹Pediatric Surgery Unit, Department of General Surgery, Tanta University Hospital,
Faculty of Medicine, Tanta University, Tanta, Egypt.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: to evaluate the efficacy of the hook in performing laparoscopic pyloromyotomy.

Study Design: prospective study.

Place and Duration of the Study: pediatric surgery unit at general surgery department at Tanta university hospitals, between June 2019 and July 2020.

Patients and Methods: This study was carried out on 15 infants (12 males and 3 females) suffering from infantile hypertrophic pyloric stenosis (IHPS). Patients were evaluated according to their age, weight, onset and duration of projectile non bilious vomiting and abdominal ultrasound was done measuring the pyloric muscle thickness and length. Patients were evaluated for dehydration then operated after resuscitation. Three ports/stab incisions were used: one for the telescope at the umbilicus (5 mm), then two working ports/stab incisions at the right anterior axillary line at the level of the umbilicus and at the left of the midline above the level of the umbilicus (3 mm). After fixation of the pyloric mass, pyloromyotomy was performed using the hook. Operative time was calculated. Intraoperative difficulties in using the hook were assessed. Postoperative feeding, pain and cosmesis were assessed.

Results: The mean age at time of presentation was 34.4 days. The mean operative time was 44.5

*Corresponding author: E-mail: fahmy.mohamed@med.tanta.edu.eg;

min. Mucosal perforation occurred at one case. Mean time to full oral feeding was 9.8 h except the perforated case. Postoperative pain using NIPS was mild in 26.67%, moderate in 66.67% and severe in 6.67%. Postoperative hospital stay was 1 day in all cases except the perforated case.

Conclusion: Laparoscopic pyloromyotomy can be done using the hook and has a good outcome and excellent cosmesis. Hook is used for making the incision of pyloromyotomy by using the high cutting mode in continuous incision without hesitancy. Adequate depth of the incision -by the back of cold hook- is essential for easy spreading.

Keywords: Hook electrocautery; laparoscopic pyloromyotomy; IHPS.

1. INTRODUCTION

Infantile hypertrophic pyloric stenosis (IHPS) is one of the frequent indications for surgical intervention in infancy, that occurs in approximately 3 per 1000 live births [1]. In 1912, Ramstedt introduced the technique of extra mucosal pyloromyotomy to become the standard operation till date [2]. Alain was the first to describe laparoscopic pyloromyotomy (LP) in 1991[3] since then, many pediatric surgeons have been shifting to LP due to a better cosmetic result, shorter hospital stay, shorter time to full feeds [4]. Nevertheless, specialized instruments like the pyloric grasper, retractable pyloromyotomy knife or pyloric spreader may not be available to every pediatric surgeon, especially in centers with limited resources. So many modifications have been introduced on the laparoscopic technique, regarding the instrument used for performing pyloromyotomy [5]. We aimed to evaluate the efficiency of the hook in performing the pyloromyotomy.

2. PATIENTS AND METHODS

This study was carried out on 15 consecutive patients (12 males and 3 females) who presented to the Pediatric Surgery Unit of Tanta University Hospitals with established diagnosis of IHPS during the period from June 2019 to July 2020. Patients were evaluated according to their age, weight, onset and duration of projectile non bilious vomiting and abdominal ultrasound was done measuring the pyloric muscle thickness and length. Preoperative resuscitation was initiated according to the degree of electrolyte abnormality and the level of dehydration. Using 5% dextrose, 0.45% normal saline in a ratio of 1:1 and 20 mEq/L of potassium chloride with a dose of 30-50ml/kg for mild dehydration, 50-70 ml/kg for moderate dehydration and 70-90 ml/kg for severe dehydration over 6 hours, then maintenance dose of 100 ml/kg/day.

Under general anaesthesia with endotracheal intubation, the patient was placed in supine cross-table position on a warming mattress. The surgeon stood at the baby's leg, with the assistant on his left side both facing the monitor, which is placed at the baby's head.

A 5 mm 30° telescope was inserted at the umbilicus using the open Hassons' method through a transumbilical incision. Insufflation was started at a flow of 0.5 L/min and gradually increased to 1.5-2 L/min and a pressure of 8-10 mmHg.

Two 3 mm working instruments are placed either through ports or stab incisions; the right incision was at the right anterior axillary line at or the level of the umbilicus, while the left one is placed to the left of the midline above the level of the umbilicus (Fig. 1).

After exploration and identification of the pyloric mass; the duodenum is grasped just distal to the pyloric olive by an atraumatic long jaw grasper which is inserted through the right port.

The diathermy is set to a power of 30-40 watts using the cutting mode (ERBE VIO 300 S®). Using 3-mm hook with electrocautery and using short bursts, the pyloric mass is incised starting 2 mm from the prepyloric vein (or distal end of the mass) and extending proximally to 0.5–1 cm into the gastric wall (Fig. 2). After completing the incision, the cold hook is used to deepen the incision at the center of the mass. Enough depth is essential to admit the jaws of the spreading instrument. The hook is withdrawn, then a 3 mm grasper or Maryland's dissector (used tip up) is inserted through the left port and is used to spread the muscle at the deep part of the incision made at center of the mass; Spreading was done carefully until the mucosa bulges (Fig. 3). The myotomy was spread distally & proximally very carefully. The camera should be very close during spreading at the proximal and distal ends to detect any mucosal tears.



Fig. 1. Port sites

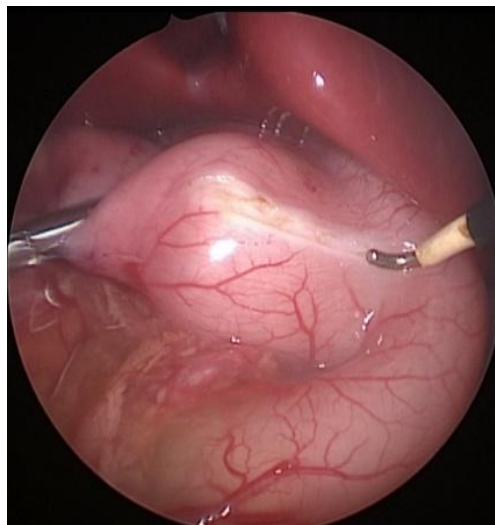


Fig. 2. Initial incision using the hook electrocautery



Fig. 3. Grasper is spreading at the center of the mass

Mucosal perforation is checked by insufflation of a 60 ml air via the nasogastric tube, while bathing the myotomy incision with saline solution. The fascia of the umbilical wound and ports is closed with 4/0 absorbable sutures & the skin is closed with 5/0 subcuticular sutures or Steristrips™.

Oral feeding was started 2 hours postoperatively and gradually increased according to the patient tolerance; at first with distilled water and then with milk either breast or formula feeding.

Postoperative pain was assessed using NIPS (Neonatal Infant Pain Scale). The parents were asked in the outpatient clinic to express their satisfaction with cosmetic appearance as excellent, good, fair or poor, where excellent was expressed as 4/4 and poor as 1/4.

3. RESULTS

This study included 15 infants with IHPS during a period of 1 year. Twelve (80%) patients were males and 3 (20%) patients were females. The mean age at the time of presentation was 34.46 ± 8.7 days with a range of 19 - 57 days. The mean weight at time of presentation was 3.04 ± 0.26 kg (range 2.4 - 3.4 kg).

The duration of vomiting before presentation ranged from 4 to 30 days with a mean of 11.26 ± 7.13 days.

U/S was enough to confirm diagnosis in 100% of cases and upper GIT contrast wasn't needed. The pyloric muscle thickness ranged from 4.4 to 7 mm with a mean of 5.21 ± 0.87 mm, while pyloric canal length ranged from 17.5 to 21 mm with a mean of 19.16 ± 1.18 mm.

Mucosal perforation occurred in one case (6.67%) at the gastric end of the pyloromyotomy incision during the spreading which was converted to open surgery. The operative time from skin incision to skin closure ranged from 33 to 80 minutes. The mean operative time without the perforated case was 44.5 ± 12.6 minutes while the operative time of the perforated case was 80 minutes.

Oral feeding was started 2 hours postoperatively except the perforated case and the mean time to full oral feeding was 9.8 hours. For the perforated case, oral feeding was started after 2 days and tolerated full oral feeding after 12 h. we had no persistent postoperative vomiting and no incomplete pyloromyotomy.

Postoperative pain was assessed using Neonatal Infant Pain Scale (NIPS) during 1st 24 hours; 4 cases (26.67%) had mild pain and 10 cases (66.67%) had moderate pain. The pain was controlled by paracetamol and non-pharmacological therapy. Only one case (6.67%) had severe pain. This was the converted case and the pain improved by adding a dose of ibuprofen to the previous measures.

Fourteen (93.33%) cases stayed for 1 day postoperatively, while the perforated case stayed for 3 days. The parents expressed their satisfaction with cosmetic appearance; 12 cases were described as excellent, 2 cases were described as good, and 1 case (the perforated case) was described as poor.

4. DISCUSSION

Laparoscopic pyloromyotomy has been adopted by many centers as a standard technique for treatment of IHPS, but limited resources were an obstacle for providing the specialized laparoscopic instruments. So many modifications have been introduced, according to the available laparoscopic instruments for making the pyloromyotomy incision and spreading [5].

The pyloromyotomy incision was done in our study by 3 mm hook using the high cutting mode (ERBE VIO 300S®) with a power of 30-40 watts. Trials of using lower cutting power were associated with burning the tissues without making an incision. These burns made next spreading more difficult. Parelkar et al, 2013, used the hook with coagulating mode to perform the incision of LP (n= 16) at a power of 30 watts [6]. Sometimes the coagulating current was not enough and they used the cutting mode with a power of 30 watts to complete the incision [6]. Pathak et al, 2019, initially used the coagulation mode then shifted to use the cutting mode [7]. Salmai et al, 2011, performed micro-laparoscopic pyloromyotomy using the monopolar electrocautery knife and described also difficulty in making the incision. They overcame this difficulty by increasing the diathermy power [8].

Early in the study, there was difficulty in making the incision due to hesitancy to deepen the incision for fear of thermal mucosal perforation. Tang et al described a similar hesitancy in their analysis of technical surgical errors during an initial experience of laparoscopic pyloromyotomy using the retractable blade [9]. They stated that "in their attempt to avoid perforation, surgeons

performed shallow or even deviated cut movements instead of one incision of adequate depth and length [9]. Later, the hook was used to deepen the incision using the back of the cold hook.

In our study, spreading was done using 3 mm grasper or Maryland dissector instead of specialized pyloric spreader. Early in the study, there was difficulty in spreading mainly due to the shallow incisions, in addition to the toughened tissues from the effect of the heat and the lack of laparoscopic pyloric spreader. With advancement of the learning curve, incisions were made with less trials of cautery, with less hesitancy and were made deep enough which made spreading easier. Pathak et al, 2019, reported also a similar difficulty in splitting which he overcame by using cutting mode of electrocautery and adequate deepening of the incision. They concluded that adequate depth of the incision can be obtained by deepening until it accommodates the hook from the heel to the tip. As the depth of a 3 mm hook is 2.5 mm, which is less than the thickness of hypertrophic pyloric muscle (more than 4 mm). So, it is safe to get enough depth [7].

In our study the mean operative time without the perforated case was 44.5 ± 12.6 minutes, while the operative time of the perforated case was 80 minutes. In early cases the operative time was longer due to delay for establishing the incision with the hook and hesitancy for fear of perforation. It lessened with advancement of the learning curve.

Jain et al, 2012, reported a mean operative time of 38 (± 6.9) minutes using the hook electrocautery [5]. Parelkar et al, 2013, also reported an average operative time of 28 minutes using the hook [6]. Pathak et al, 2019, reported - in a study done on 2 cohorts using the hook - a mean operative time of 64 ± 6 min and 45 ± 7.2 min [7].

The operative time in our study was calculated from skin incision to skin closure including port placement & port site closure. In other studies, it is not clear whether the mentioned operative time is the laparoscopic operative time or the total time [5,6,7].

Mucosal perforation occurred in the first case (6.67%) during the spreading at the gastric end of the pyloromyotomy incision, which was noticed by the operator. Conversion to open was decided, then primary repair of the

pyloromyotomy incision and another pyloromyotomy incision was done after rotation of the pylorus 90 degrees. Parelkar et al 2013, also reported mucosal perforation at the gastric end in one case (6.25%) during a study on 16 cases using hook in performing LP [6]. The duodenal side is the most common site of mucosal perforation [10], however the perforation occurred at the gastric end possibly due to overspreading and difficulty in spreading using the Maryland or the grasper may also contribute to this complication. Use of specialized spreader may lessen this complication. It is also unclear if the thermal effect of the cautery has any role in this complication. Jain et al 2012 & Pathak et al 2019 have reported no incidence of perforation with using hook electrocautery for performing of LP [5,7].

Feeding was started in all infants (except the perforated case) 2 hours postoperatively with distilled water, then milk and increased ad libitum. Gollin et al, 2004, found no difference in the frequency or number of emesis when comparing infants who initiated feeding one hour postoperatively versus six hours postoperatively, and therefore advocating rapid and early feeding regimen for earlier discharge [10]. St Peter et al, 2006, started feeding after 2 hours and reported few episodes of emesis [11].

The mean time to full oral feeding was 9.8 hours. St Peter et al, 2006, started feeding after 2 hours and reported a mean time to full feeding of 19.5 hours in the laparoscopic group of their study [11]. Jain et al 2012, started feeding after 10 hours and reported mean time to full feeding of 24.5 hours in knife group and 23.8 hours in hook group [5]. Parelkar et al 2013, also started feeding after 12-18 hours and reached the full oral feeding in a mean time of 27 hours [6]. While Pathak et al reported significant difference in the mean time to full oral feeding when compared use of coagulation mode in cohort A with a mean time of 18 hours versus use of cutting mode in cohort B with a mean time of 11 hours [7].

The postoperative pain was assessed by NIPS; 4 cases had mild pain, 10 cases had moderate pain while the converted case had severe postoperative pain. Ismail et al, 2020, used PAIN scale to assess postoperative pain in a comparative study between laparoscopic and open pyloromyotomy and found that the open group had higher score of postoperative pain and needed higher doses of analgesia [12]. St Peter et al, 2006, and Binet et al, 2018, also reported

that lower doses of analgesics were required after laparoscopic pyloromyotomy [11,13]. This was evident in our study when the converted case to open had severe pain and needed additional analgesia to control pain.

In this study, we subjectively evaluated the cosmetic result by asking the parents to express their satisfaction with cosmetic appearance; 12 (80%) cases were described as excellent, 2 (13.3%) were described as good while the converted case was described as poor. This is congruent with St Peter et al, 2016, who evaluated the cosmetic outcome in more objective manner by asking the parents to complete a validated Patient Scar Assessment Questionnaire with photos [14]. They noted that scars after laparoscopic pyloromyotomy are less obvious than scars of open pyloromyotomy and also that laparoscopy has better parental satisfaction and aesthetic results [14].

5. CONCLUSION

Laparoscopic pyloromyotomy can be done using the hook and has a good outcome and excellent cosmesis. Hook is used for making the incision of pyloromyotomy by using the high cutting mode in continuous incision without hesitancy. Adequate depth of the incision –by the back of cold hook- is essential for easy spreading.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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