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Original Article

The Outcome Of Laparoscopic Pyloromyotomy Using Electrocautery Hook For Treatment Of Infantile Hypertrophic Pyloric Stenosis

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Abstract

Background: Laparoscopic pyloromyotomy first described in 1991, has become an effective minimally invasive treatment for IHPS. Recently, in most of the paediatric surgery centers laparoscopic pyloromyotomy has become popular. We can use multiple techniques to perform laparoscopic pyloromyotomy such as-hook electrocautery, retractable pyloromyotomy knife, arthrotomy knife, ophthalmic knife, bovie blade. Among them in our study we have tried to evaluate the outcome of laparoscopic pyloromyotomy using electrocautery hook.

Objective: To evaluate the outcome of laparoscopic pyloromyotomy using electrocautery hook for treatment of infantile hypertrophic pyloric stenosis (IHPS).

Materials and Methods: This is a prospective type of observational study was conducted in the department of Paediatric surgery, Dhaka Medical College & Hospital, from September 2024 to December 2025. The study included infants of 2 weeks to 12 weeks of age, Documented pyloric stenosis proven by abdominal USG (Pyloric Canal length ≥ 15mm, Pyloric muscle thickness ≥ 3mm) &excludedinfants with previous abdominal surgery. Inflamed or unhealed umbilicus,associated with known case of congenital heart disease/severe congenital anomaly,redo cases. In this study, 24 patients was done by laparoscopic pyloromyotomy using electrocautery hook. Laparoscopic pyloromyotomy was done undergeneral endotracheal anesthesia. Per operative events and postoperative outcome were followed up after 1 weeks and 1 months. Data were analyses using descriptive statistics.

Results: In this study maximum number of patients 11(45.8%) were between 2- 5 weeks of age. Mean ± SD of age was 4.47 ± 2.01 weeks. Out of 24 cases, male and female were 19(79.1%) and 5(20.8%) respectively. Male: Female ratio was 3.8: 1.Ultrasound findings revealed that pyloric muscle thickness was 5.42±1.03 mm and pyloric canal length was 18.9±2.74 mm. Diameter of pylorus was 17.5± 1.56 mm. The mean operative time was 43.5±6.1 min with a range of 30-70 min. No bleeding, but 1(4.1%) case found mucosal perforation. Only 1 (4.16%) case developed postoperative complication like omental herniation. In this study complete recovery was found 23(95.8%) of patients.

Conclusion: This study revealed thatlaparoscopic pyloromyotomy using electrocautery hook is safe, technically feasible and effective with good postoperative outcomes.

Key Word: IHPS- Infantile hypertrophic pyloric stenosis, LP -Laparoscopic Pyloromyotomy

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BACKGROUND

Infantile Hypertrophic Pyloric Stenosis (IHPS) is a common cause of gastric outlet obstruction in infants, resulting from hypertrophy and hyperplasia of the pyloric muscle that lead to thickening and elongation of the

pyloric canal due to overgrowth of the circular and longitudinal muscle layers, results gastric outlet narrowing. It typically presents between 2–12 weeks of age, with an average onset around 5 weeks, and occurs more frequently in males (male-to-female ratio 5:1), especially among first-born infants.(Ibarra-Guerrero et al., 2023).

Clinically, affected infants present with progressive, projectile, forceful, non-bilious vomiting after feeding, while infants often remain hungry and active in the early phase. If untreated, prolonged vomiting can cause dehydration, electrolyte imbalance, and failure to thrive. (Garfield, 2023).

Diagnosis is mainly clinical and confirmed by ultrasonography. Diagnostic criteria include pyloric muscle thickness >3 mm, canal length >15 mm, and diameter >10–14 mm. Ultrasonography has about 95% sensitivity and specificity (CAHS, 2023). Occasionally, an “olive-shaped” mass may be palpable in the epigastrium. When findings are inconclusive, an upper GI contrast study may show narrow string.

The definitive management of IHPS is laparoscopic or open pyloromyotomyCAHS, 2023. Which was first described by Fredet 1907 and Ramstedt 1912. The circumumbilical incision described by Tan and Bianchi in 1986 became a new alternative to the standard right upper quadrant incision. Laparoscopic pyloromyotomy was first described by Alain in 1991. The laparoscopic approach can result in good postoperative outcomes and satisfying cosmesis (Kabaet al, 2020).

Most recently use of a hook with electrocautery reported instead of the use of a retractable pyloromyotomy knife with excellent outcomes Pogoreli´c et al, 2021. Jain et al. 2012 reported usage of an electrocautery hook in a cohort of 15 patients, as a valuable alternative to a retractable pyloromyotomy knife. They reported that pyloromyotomy using an electrocautery hook is as safe and effective as the usage of a retractable pyloromyotomy knife. Moreover, usage of electrocautery hook results in a bloodless operative field, which is very important to pediatric laparoscopic surgeons who work in very limited space in infants Jain et al, 2012.The use of electrocautery hook may also lead to complications such as thermal damage and opening of the pyloric mucosa but as the 3-mm hook reduced the risk of mucosal injury, due to the thickness of the hypertrophic pyloric muscle is greater than 4 mm. The hook could therefore be inserted liberally in the pylorus to divide the muscle at depth. Hence electrocautery book could be used as an effective alternative for the laparoscopic pyloromyotomy

Materials And Methods

The study was approved by the Research Ethics Committee of Dhaka Medical College in August 2024. This prospective type of observational study was carried out on 24 patients presented to the Paediatric Surgery Unit of Dhaka Medical College Hospital with proved diagnosis of IHPS during form period from January 2024 to December 2025.

Diagnosis

Ultrasound diagnosis of IHPS is confirmed when the pyloric muscle thickness (PMT) exceeds 3 mm and the pyloric canal length is greater than 15 mm. Real-time imaging shows failure of pyloric relaxation and abnormal gastric emptying or peristalsis (Ibarra-Guerrero et al., 2023).

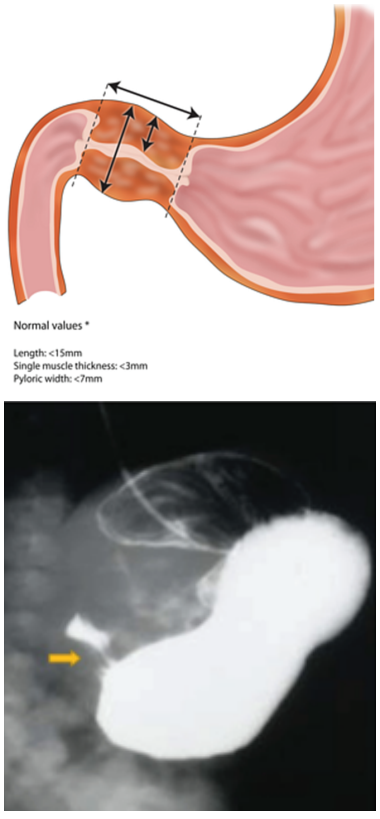


Figure: Pyloric stenosis: imaging findings

Study Procedure

Laparoscopic pyloromyotomy: The patient kept placed supine at the end of the operating table. Stomach was emptied with nasogastric tube suction immediately before induction of anesthesia to avoid the risk of perioperative aspiration. General endotracheal anesthesia was done.

The surgeon stands to the left and the monitor was placed on the right side of the patient opposite the surgeon. Carbon-di-oxide pneumoperitoneum was created using supra umbilical port at a pressure between 6-8 mmhg and flow rate around 1-2 L/min.

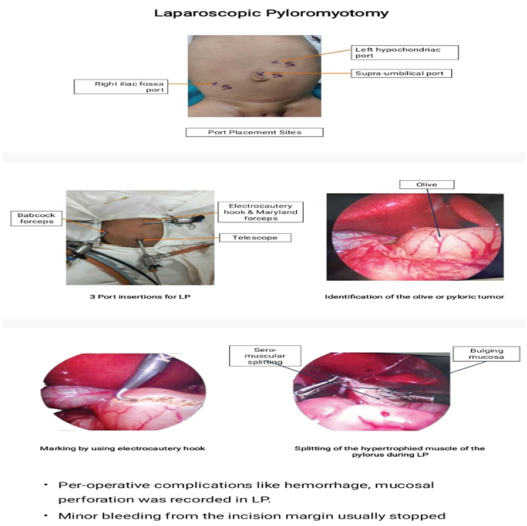
After establishing pneumoperitoneum, a 5-mm trocar was introduced through the supra umbilical port and then 30 degree, 5mm Laparoscope was introduced through it. Two other 5 mm trocars then placed in right & Left hypochondrium.

Operation table was tilted in right side up and head end up position to displace the bowel loops from the operative field. A general abdominal inspection was done and thickened pylorus visualized. The pylorus was stabilized with Babcock forceps as grasper placed through theright hypochondriac trocar. An electrocautery hook instrument was inserted through the left hypochondrium trocar.

A seromuscular incision was placed antero-superior surface of the pyloric tumor in its avascular place from the prepyloric vein well into the gastric antrum using the electrocautery hook in coagulation mode for scoring and deepening the incision. When it will accommodate the hook instrument from heel to the tip, the depth of the incision considered adequate. Once the adequate depth of the incision achieved, then Maryland dissector used to split the muscle.

Gentle but persistent spreading force used at the mid portion of the incision for the easier accomplishment of the desired pyloromyotomy with the bulging of the gastric mucosa throughout the length of incision.

A satisfactory pyloromyotomy was evidenced by a ballooning of the intact mucosa and two independently moving pyloric edges. 1 or 2 mL of saline was poured through the left trocar over the pyloromyotomy incision. 30-60 ml of air injected by the anesthetist through the feeding tube placed into the stomach to rule out any inadvertent mucosal perforation. After completion, instruments were removed and pneumoperitoneum exsufflated. The skin incisions was closed with subcuticular 5/0 vicryl and three dressings was applied.



Peroperative complications like hemorrhage, mucosal perforation was recorded in LP. In LP minor bleeding from the incision margin usually stopped spontaneously. Mucosal perforation occur during LP and repaired with 5/0 vicryl and covered with omental patch via open approach.

Postoperative outcome: After completion of operation, the patient was return to the postoperative ward. Patient was kept NPO for 6 hours. 5% dextrose in 0.225% normal saline was administered as intravenous fluid. The feeding tube removed 6 hours after operation and the child allowed to feed, normally with low-volume dextrose solution initially and rapidly advanced to full feeds of breast milk/ formula over the next 12 to 24 hours' period. Breastfed infants were fed with the same volume of expressed breast milk as formula fed infants.

If the patient vomits, which is common after this procedure, the same volume feed that caused the emesis repeated after 1 hour. If the patient vomits more than 2 times, then domperidone drop given, 1 mg 8 hourly. The IV fluid was discontinued when the infant tolerated 2 times feeding.

Postpyloromyotomy feeding was started 6 hours after operation. The feeding schedule was Dextrose, 15-30 ml orally once (Body weight if < 2 kg start with 15 ml, if> 2 kg start with 30 ml).

- Breast milk! Full strength formula, 30 ml orally every 3 hr x 1.

- Breast milk! Full strength formula, 45 ml orally every 3 hr x 2.

- Breast milk! Full strength formula, 60 ml orally every 3 hr x 2.

- Breast milk! Full strength formula, as desired.
(Schwartz, 2006).

Paracetamol suppository 15 mg/kg/dose will be given per-rectally 6-hourly as postoperative analgesia up to 2 POD. Ceftazidime in injectable form, 0.5ml/kg/day in 2 divided doses for first two POD, then orally for next 5 days.Following postoperative outcomes were evaluated: Postoperative emesis, late complications like port site infection and omental herniation.

Data analysis

Were compiled collected data from predesigned data sheet, the data had been presented in the form of tables, figures, and graphs, as necessary.

Statistical analysis of the results were done by using computer based statistical software, SPSS windows software, version 22.0 (SPSS Inc. Illinois, USA).

Quantitative data were expressed as mean and standard deviation and qualitative data as percentage and frequency.

Results

We included 24 patients by purposive sampling technique. Results and observations given below,

Table I: Demographic profile of the patients with IHPS (n=24)

Variables	Frequency	Percentage
Age (weeks)		
2- 5	11	45.8
6- 9	8	33.4
12	5	20.8
Mean ±SD	4.47 ± 2.01	
Gender		
Male	19	79.1
Female	5	20.8
Body weight (Kg)		
<3	17	70.8
3-5	7	29.2

Figure- 1: Socioeconomic status of the study population (n=24)

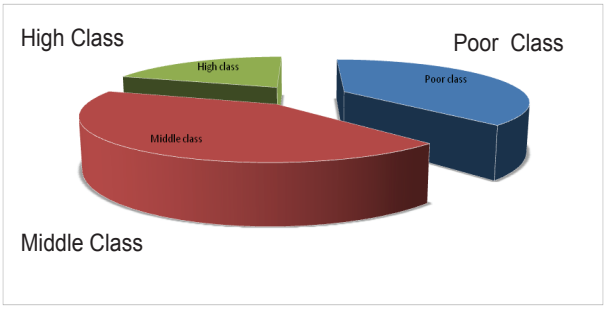


Table II: USGfindings of the respondents (n=24)

USG findings	Mean±SD
Pyloric canal length (mm)	18.9±2.74
Muscle thickness (mm)	5.42±1.03
Diameter of the pylorus (mm)	17.5±1.56

Table III: Per-operative data of the respondents (n=24)

Per operative data	Frequency	Percentage
Operating time (min)		
30- 45	12	50.0
46- 60	9	37.5
≥60	3	12.5
Mean ±SD	43.5±6.1	-
Complications		
Haemorrhage	0	0
Mucosal perforation	1	4.1

Table IV: Postoperative outcome of the respondents (n=24)

Postoperative outcome	After 1 week	After 1 month
Complete recovery	24 (100.0)	23 (100.0)
Postoperative emesis	0	0
Late complication		
Port site infection	0	0
Omental herniation	0	1 (4.16)

Data were expressed as frequency and percentage

Discussion

We included 24 infants of 2 to 12 weeks of age with the diagnosis of IHPS. In this study maximum number of patients 11(45.8%) were between 2- 5 weeks of age. Mean ± SD of age was 4.47 ± 2.01 weeks. Out of 24 cases, male and female were 19(79.1%) and 5(20.8%) respectively. Male: Female ratio was 3.8: 1. Body weight shows that <3 kg was found in 17 (70.8%) cases.

Findings consistent with result of other studies. Pogorelić et al (2021) reported that 83.2% were males, with median age 33 (IQR 24, 40) days. Kaba et al (2020) reported that male-female ratio was 2.7: 1, and the age at the admission of the patients was 36.5 (25-110) days. Elnaggar et al (2018) noted that sixteen (80%) infants were males and four (20%) infants were females with a mean age at presentation of 7±2.59 weeks.

Ultrasonography is the diagnostic modality of choice, and it shows hypertrophied and elongated pylorus. Ultrasound findings revealed that pyloric muscle thickness was 5.42±1.03 mm and pyloric canal length was 18.9±2.74 mm.

The mean operative time was 43.5±6.1 min with a range of 30-70 min. No bleeding, but 1(4.1%) case found mucosal perforation.

Elnaggar et al (2018) noted that mean operative time was 35.55±16.52 min with a range of 20–60 min. No bleeding, mucosal perforation, or incomplete pyloromyotomy occurred. Three (15%) cases had superficial gastric and duodenal serosal injuries. The mean length of pyloromyotomy was 2.2±0.22 cm.

Nowadays, despite several reports of conservative treatment with different medication, surgical treatment (pyloromyotomy) is still the method of choice for infants suffering from hypertrophic pyloric stenosis. Traditional open pyloromyotomy was initially introduced by German surgeon Ramstedt who described the first successful cases of pyloromyotomy. Since then, hypertrophic pyloric stenosis was successfully treated using a traditional open approach for many years. Last two to three decades

laparoscopic surgery gained popularity among pediatric surgeons, especially after development of instruments suitable for the pediatric population.

Parelkar and colleagues in India used a 3-mm hook with low power monopolar electrocautery as an alternative to the pyloromyotomy knife. This technique was effective and resulted in a bloodless operative field, thus facilitating complete spreading of the pyloric muscle by a Maryland dissector. Judicious use of an insulated hook minimizes the risk of mucosal perforation (Parelkaret al, 2013; Jain et al, 2012).

In this study complete recovery was found 23(95.8%) of patients. There was a little incidence of postoperative complications after laparoscopic pyloromyotomy using electrocautery hook. Post-operatively, test feeds were started within 6 h of surgery in 19 (79.1%) of the infants and within 12–24 h in 4(16.7%) participants. Only 1(4.16%)patient developed complications like omental herniation. The mean postoperative hospital stay was 4.2 ± 1.6 days with a range of 3–12 days.

The results of the study confirmed that laparoscopic pyloromyotomy using electrocautery hook, in a hand of experienced laparoscopic surgeon, is a safe and effective method for treatment of infants with hypertrophic pyloric stenosis. This study confirmed also that surgical time, and overall outcome were better. In this study we found that, 95.8 % patients recovered without any significant complication following laparoscopic pyloromyotomy using electrocautery hook.

Jain et al. in their study on 27 infants introduced the use of electrocautery hook for incision of the pylorus. They compared infants in whom pyloromyotomy was performed using a pyloric cutting knife with infants who received laparoscopic pyloromyotomy using electrocautery hook. They found both methods as safe and effective without complications (Jain et al, 2012). The same results were recorded in our study. One of the main advantages of this technique is bloodless operative filed, which is very important to pediatric laparoscopic surgeons who work in very small spaces in infants and children(Jain et al, 2012). Pediatric surgeon should always be careful because every surgical technique, in addition to having advantages, also has disadvantages. The main possible disadvantage is thermal damage or opening of the pyloric mucosa, if the electrocautery hook is inserted too deep, or lateral thermal damage to surrounding organs. Care should be taken to avoid thermal damage as it does not have to be seen immediately, and delayed complications develop(-Jain et al, 2012).

Laparoscopic exploration provides good imaging, good determination of the pyloric borders and detailed evaluation of vascular structures. In laparoscopy, manipulation of the stomach, pylorus and duodenum is less; less surgical trauma occurs with appropriate material and experience. Laparoscopic pyloromyotomy is a technically easier, less traumatic method, which gives surgical satisfaction and high motivation in experienced hands for minimally invasive surgery, compared to pyloromyotomy with a circum-umbilical incision (Kabaet al, 2020). Similar study confirms that laparoscopic pyloromyotomy using 3-mm electrocautery hook, is feasible, safe and effective (Patra et al, 2022).

Conclusion

This study concluded that laparoscopic pyloromyotomy using an electrocautery hook is a safe, feasible and effective procedure that can be used routinely in the treatment of IHPS.

Limitations

1. Lack of appropriately sized laparoscopic instruments for neonates
2. Involvement of multiple surgeons.

Recommendations

Further study including a larger sample size and involving multiple center for a longer period should be conducted.

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