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Infantile Hypertrophic Pyeloric Stenosis- Laparoscopic Management

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Abstract

Background: The gold standard of treatment for infants with hypertrophic pyloric stenosis is still pyloromyotomy. Recently, in most of the pediatric surgical hospitals laparoscopic pyloromyotomy has become popular. The aim of the present study is performing laparoscopic pyloromyotomy using standard 3-mm laparoscopic instruments and to document and manage the challenges in laparoscopic surgery in neonates. Methods: A total of 22 neonates age 14 days to 27 days 19 (86.4%) males, 3 females (13.6%) underwent pyloromyotomy because of hypertrophic pyloric stenosis, between April 2017 and March 2021 were included. Exclusion criteria : patients age more than 28 days were done open surgery instead of laparoscopy. The neonates were studied in regards to time to oral intake, duration of surgery, the type and rate of complications, rate of reoperations, frequency of vomiting after surgery, and the length of hospital stay. Results: Laparoscopic approach was associated with shorter duration of surgery 25 minutes to 70 minutes (median 35 min),shorter time to oral intake and shorter length of postoperative hospital stay 2 days. In regards to complications post operative vomiting in 1(4.5%) and delayed recovery in 3 cases(13.6%).No cases of wound infection were recorded in the laparoscopic group. Conclusion: Laparoscopic pyloromyotomy gives very good result at par with open pyloromyotomy. Cosmetically it is superior to open procedure and wound related complications like infections, dehiscence etc are avoided. Laparoscopic technique is associated with faster recovery, shorter duration of surgery and shorter duration of hospital stay with experience and expertise.

Keywords: hypertrophic pyloric stenosis, pyloromyotomy, laparoscopic pyloromyotomy, open pyloromyotomy,laparoscopic instruments,infantile hypertrophic pyeloric stenosis

Introduction

Pyloric stenosis is also known as IHPS the most common cause of gastric outlet obstruction in infants . Circular and longitudinal muscular fibers of the pylorus and the distal antrum of the stomach undergoes hypertrophy and hyperplasia causing thickening of the pylorus and gradual narrowing of the pyloric canal [1].

Incidence of hypertrophic pyloric stenosis is 2–4 infants per 1000 live births yearly. It is more common in male than female newborns(4:1). It is more prevalent in white population,and is rare in Black and Asian populations. [1,4].

Age: At birth newborns are well and usually tolerate meals properly for the first two weeks. This condition, in most of the cases, occurs between the second to eight weeks of life [1,4]. Rarely late presentation of hypertrophic pyloric stenosis has been described(3-5 months of age) [5].

Symptoms- In the beginning, infants usually vomit after the meal, vomiting is non bilious and projectile.

Signs- As the disease advances the infants present with of hypertrophic pyloric stenosis, projectile vomiting after each meal ,if left untreated may lead to dehydration, electrolyte imbalance and weight loss. Babies seem to be always hungry especially after an episode of vomiting, sometimes there may be aspiration pneumonia. [1,2,3,4,6]. In some of infants, a hard, non-tender pylorus (called olive) palpated near the epigastrium. At times peristaltic waves the from left to right is visible.

Metabolic abnormalities- Frequent vomiting leads to metabolic alkalosis (blood pH more than 7.45) which in late presented cases associated with hypochloremia (serum chloride level less than 96 mEq/L) and hypokalemia (serum potassium level <3.5 mEq/L) and paradoxical aciduria [7,8]

Pathology- Exact cause is unknown .Multiple possible causes and factors have been suggested such as antibiotics (macrolides, erythromycin), C- section, bottle feeding, premature newborns,first born infants especially male baby and maternal smoking during the pregnancy but none of them have been proven [1,2,3]. Circular and longitudinal muscular fibers of the pylorus and the distal antrum of the stomach undergoes hypertrophy and hyperplasia causing thickening of the pylorus and gradual narrowing of the pyloric canal [1].

Diagnosis- Previously barium enema with upper gastrointestinal series was the standard diagnostic method for diagnosing hypertrophic pyloric stenosis. Nowadays, abdominal ultrasound has become the standard diagnostic tool method [9]. The ultrasound criteria for the hypertrophic pyloric stenosis include muscle wall thickness > 3 mm, length of pyloric canal >15-17 mm and pyloric volume more than 1.5cc. Antral nipple sign/Cervix sign/ Target signs are visible[9,10].

Treatment Initial treatment is placement of a nasogastric tube, stoppage of feeding and maintain hydration and correction of electrolyte and metabolic imbalances [11].Although there are reports in literature of treatment of hypertrophic pyloric stenosis with atropine-sulfate, in a patient contraindication for surgery. Most centers the standard approach to treatment of this condition is surgery, i.e., Ramstedt pyloromyotomy which is gold standard of treatment was introduced in 1911. The success rates of conservative treatment with atropine-sulfate varies between 68 and 87% [11,12]. Pyloromyotomy may be performed either through open or laparoscopic approach [6,11]. The traditional open technique is well-known with adequate postoperative effects but recovery after surgery lasts a little longer due to slower oral intake and a higher level of pain due to abdominal incision, cosmetic effects are poor as well [6,11].

Recently, with breakthrough of laparoscopic surgery which was first reported in 1990 more frequently used due to its benefits, such as significantly lesser duration of surgery, faster oral intake, faster recovery, lesser pain and tissue trauma, and excellent cosmetic effects [6,11]. In regards to efficacy of the procedure a meta-analysis confirmed that laparoscopic approach had the same safety and efficacy as open surgery [11].

In the majority of the centers traditional laparoscopic pyloromyotomy is performed using a retractable pyloromyotomy knife for incision of the hypertrophied pylorus [5,6]. However, in all centers, especially in countries with lower socio-economic status, such an instrument is not always available, so pediatric surgeons used various modifications of this knife to perform the procedure by laparoscopic approach

Aim And Objectives

The aim of the present study is performing laparoscopic pyloromyotomy in neonates using standard 3-mm laparoscopic instruments and monopolar energy source. Also to document and manage the challenges in laparoscopic surgery in neonates.

Materials And Methods

A total of 22 neonates age 14 days to 27 days 19 males, 3 females underwent pyloromyotomy because of hypertrophic pyloric stenosis, between April 2017 and March 2021 were included. Patients age more than 28 days and cases where Laparoscopy converted to open procedure were excluded from this study. Standard laparoscopic equipments used are HD camera with monitor, CO2 insufflator at 6mm of Hg pressure setting. Monopolar energy source was used. Standard 3mm instruments used are Bowel grasper,

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Maryland dissector and Monopolar hook.All ethical guidelines as per Helsinki declaration have been adhered to while undertaking surgeries.

Surgical Technique

A stab incision is performed in the supraumbilical region. Pneumoperitoneum is established through the Veress needle. A level of pneumoperitoneum is set at 6 mmHg. A 5-mm trocar is inserted through previous supraumbilical incision. A 5-mm laparoscope is used to inspect the abdominal cavity. After the hypertrophied pylorus is identified, left working port (3 mm) is placed at left subcostal region 1 cm medially to the midclavicular line and right working port is placed at midclavicular line at the level of umbilicus[Fig-1]. Pylorus is grasped using bowel grasper. Pyloromyotomy is performed using a 3-mm monopolar diathermy hook from the prepyloric vein of Mayo to the antrum of the stomach[Fig.2]. The muscle edges of hypertrophied pylorus are dissected using Maryland dissector. The procedure is terminated when the mucosa protrudes through the incision[fig.3] .At the end of the procedure an air insufflation through nasogastric tube into stomach for testing seromucosal integrity was performed. After the hemostasis is secured, ports are removed and skin incisions are closed using braided adhesive skin closures or closed with Monocryl 5-0.

Postoperative Protocol And Follow-Up

After surgical procedure, the patients were observed in the intensive care unit for several hours until they were fully awake. An intravenous fluid (5% glucose + 0.45% NaCl) was started as per the standard protocol. Oral feeding was started with 5–10 mL of 5% glucose 2–24 h after the surgery, depending on the operating surgeon decision. If the patient tolerated glucose well, breast milk or adapted milk formula was started. The amount of milk was increased with each meal until an age-appropriate meal was achieved. In case of vomiting, the infusion was continued and after a few hours the oral milk was started again according to the same scheme in smaller meals. Paracetamol in dose of 10–15 mg/kg was used for analgesia. Afebrile patients with no vomiting within 24 h and complete tolerance of oral meals were discharged from the hospital. The children were followed-up at 7 and 30 days after discharge at outpatient clinic.

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Figure 1

Figure2

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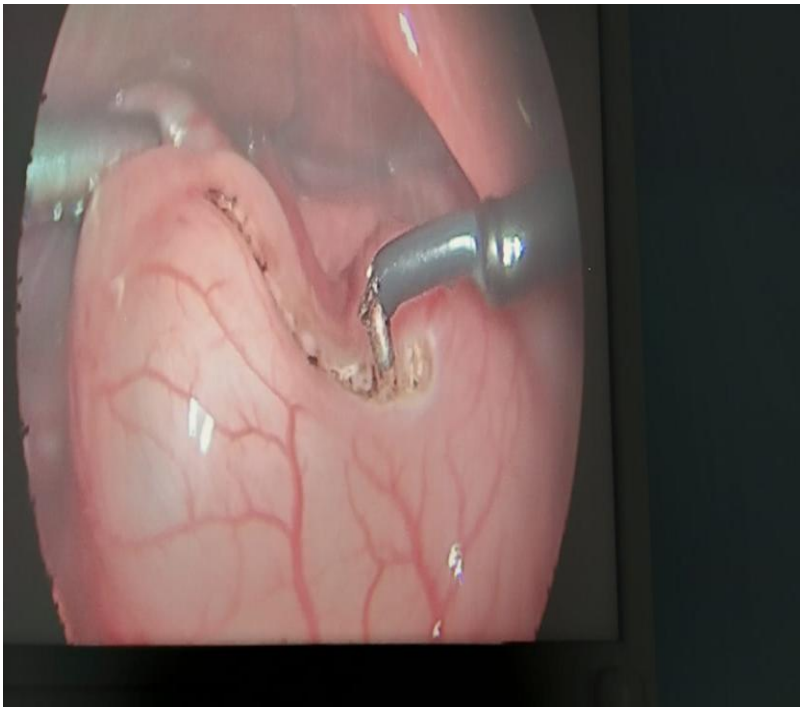
Figure 3



Results

Laparoscopic approach was associated with shorter duration of surgery 25 minutes to 70 minutes (median 35 min),shorter time to oral intake and shorter length of postoperative hospital stay 2 days. In regards to complications post operative vomiting in 1(4.5%) and delayed recovery in 3 cases(13.6%).No cases of wound infection were recorded in the laparoscopic group.

Discussion

In majority of cases pyloric cutting knife is used for incision of the hypertrophied pylorus in laparoscopic pyloromyotomies.The present study confirms that laparoscopic pyloromyotomy using 3-mm electrocautery hook, is feasible, safe and effective. This study also confirmed that surgical time, length of hospital stay, and time to initiate oral feeding are significantly shorter compared to open surgery. Postoperative vomiting,complications and reoperations less in laparoscopic approach, but without statistical significance.

The treatment of choice in IHPS is still pyloromyotomy, even though medical management with atropine has been reported. [11,12]. Open pyloromyotomy was advocated by German surgeon Ramstedt, who reported it for the first time . Since then, hypertrophic pyloric stenosis cases were successfully managed with traditional open approach till laparoscopic surgery gained popularity in last 2-3 decades. The development of newer small size instruments helped neonatal laparoscopy surgery feasible. Laparoscopic pyloromyotomy resulted in faster recovery, initiation of early feeding in postoperative period,lesser pain, shorter surgical and hospitalization time and also less wound related complications [6,11]. The cosmetic results of laparoscopy surgery were superior in comparison to open surgey. [6,11]. . Most of the studies have confirmed the advantage of laparoscopy over open surgery.

Huang et al.in 2020,published a paper comparing open and laparoscopic surgery in 233 infants with infantile hypertrophic pyloric stenosis. They also reported shorter operative time, shorter time to start oral feeding after surgery, and shorter length of stay in laparoscopic group of the patients [15].Our finding was consist with them.

Ismail et al. did a prospective randomized clinical trial in 80 infants comparing clinical outcomes of open versus laparoscopic approach for the treatment of hypertrophic pyloric stenosis. Their results were

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also similar in regard to surgical time, hospital stay, and early resumption of feeding post operatively. Need of analgesia after surgery was less had better parents' compliance in the laparoscopic group of the infants. They also reported incomplete pyloromyotomy in two cases and wound infection in one case of laparoscopic group [29].

Zampieri et al.in 2021, studied 60 infants and did not find statistically significant difference in outcome in both the open and laparoscopic group.ques and concluded that laparoscopy an alternative to the open surgery [29]. Similar results were found by Shawn et al. who reported only lesser pain and fewer complication rates in the laparoscopic group [30]. Kim et al. concluded that laparoscopic approach is safe and effective with the shortest operative time in comparison to open techniques [31].

Costanzo et al. analysed complications of procedure and duration of hospital stay between the open and laparoscopic groups in 3256 infants with hypertrophic pyloric stenosis. Their findings showed a significant fall in overall morbidity rates in infants who underwent laparoscopic surgery and concluded that laparoscopic approach may be better than open surgery [17].

Shorter surgical time and length of hospitalization in laparoscopic approach has also been described by Mahida et al. In 2016 [32].

Although the most of the published papers reported advantage of laparoscopic approach in the treatment of hypertrophic pyloric stenosis, recent systematic reviews and meta-analyses, did not find significant evidence to support laparoscopic procedure over the open approach ,probably due to small sample size. There is slightly higher incidence of mucosal perforation and incomplete pyloromyotomies. There is also no statistical significance in favour of advantages of laparoscopy surgery [16].

Most of the paediatric surgeons use a pyloric cutting knife for pyloromyotomy,which is reported as safe but there are reports of accidental injury to the adjacent organs or structures further complicating the procedure. Electrocautery hook for incision of the pylorus was used by Jain etal in 27 infants. They compared both the procedures of using cutting knife and electro cautery hook in performing pyloromyotomy . They concluded both the methods are safe and effective and not associated with complications [22]. Our results were similar. The main advantage of this technique is bloodless operative filed, which is very essential for laparoscopic surgery in very small spaces in infants and children [22]. One should be very careful to avoid thermal damage or injury of the pyloric mucosa as there is chance of delayed complications due to thermal burns [22].

The retrospective character of the study as well as the limited number of the patients is the most important limitation of the present study. Moreover, it was not possible to compare the treatment outcomes of electrocautery hook over pyloric cutting knife among our patients, because in all patients 3-mm electrocautery hook was used for pyloromyotomy. Multicenter randomized studies on larger cohorts of the patients should be performed to confirm our findings and determine whether changing these parameters affect the outcomes of the study.

Conclusions

Laparoscopic pyloromyotomy in neonates gives excellent result as par with open pyloromyotomy. Cosmetically it is superior to open procedure and wound related complications like infections, dehiscence etc are avoided. Laparoscopic technique is associated with faster recovery, shorter duration of surgery and shorter duration of hospital stay with experience and expertise. Laparoscopic pyloromyotomy can also be done effectively with standard instruments and monopolar energy source.

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