https://doi.org/10.29309/TPMJ/2023.30.06.7468

The Professional Medical Journal
www.theprofesional.com
2023, Volume, 30 Issue, 06

ORIGINAL ARTICLE

Comparison of post-operative complications, operative time and hospital stay between laparoscopic and open pyloromyotomy.

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Article Citation: Dar OA, Ahmed N, Afzal T, Aziz M, Javed-Ur-Rehman, Habib-Ur-Rehman. Comparison of post-operative complications, operative time and hospital stay between laparoscopic and open pyloromyotomy. Professional Med J 2023; 30(06):689-694. https://doi.org/10.29309/TPMJ/2023.30.06.7468

ABSTRACT… Objective: To compare operative time, hospital stay and post-operative complications between laparoscopic and open pyloromyotomy. **Study Design:** Randomized Prospective study. **Setting:** Department of Paediatric Surgery, Pak Emirates Military Hospital, Rawalpindi. **Period:** 7th May 2022 to 7th November 2022. **Material & Methods:** This study included 20 patients each in the two groups. Group A underwent laparoscopic whereas group B underwent open pyloromyotomy. Both groups were compared regarding operative time (OT), hospital stay (HS) and post-operative complications. **Results:** OT ranged from 20 to 70 min with a mean of 15.4 min in group A. In group B, the mean OT was 25.6 min (range, 25–60 min). HS ranged from 14 to 58 hours with a mean of 16.8 hours in group A. In group B, it ranged from 19 to 30 hours, and the mean was 24.2 hours. One case in group A was converted to open approach (conversion rate 5%) because of mucosal perforation while one case of incomplete pyloromyotomy was found. **Conclusion:** Laparoscopic technique has shorter operative time and hospital stay than open surgery. Complication like mucosal perforation were seen in laparoscopy group, however, it was not found statistically significant.

Key words: IHPS, Pyloromyotomy.

INTRODUCTION

Infantile hypertrophic pyloric stenosis (IHPS) is a common cause of non-bilious vomiting in the early infantile period, with a prevalence range of 1.5 to 4.0 per 1000 live births.[1] It is the most common cause of vomiting in infants that requires surgical correction.[2] The exact cause of IHPS is not known. There are various risk factors which have been described in literature like use of macrolide antibiotics like erythromycin during pregnancy, male gender, 1st born child, pre-term birth, bottle feeding, Caesarean section delivery and maternal heavy smoking.[3]

In pyloric canal there are longitudinal and circular muscle layers. The hyperplasia and hypertrophy of these muscle layers leads to stenosis of the canal that causes the symptoms.[4] Infants are well at birth but develop projectile vomiting at 3 to 6 weeks of age which can lead to dehydration, weight loss and electrolyte abnormalities.[3] On examination, there can be features of dehydration like lethargy, dry mucous membranes, depressed fontanelle, decreased skin turgor and sunken eyes. On abdominal examination, a firm, non-tender, hard mass ("olive") measuring 1 to 2 cm in diameter, may be present in the right upper quadrant. The classic electrolyte imbalance of pyloric stenosis is hypochloremic, hypokalaemic metabolic alkalosis which is present up to some extent in most patients.[5] Other than the clinical findings, the sonographic diagnostic criterion for pyloric stenosis is finding of muscle thickness of 4 mm or more and a length of 16 mm or more.[6] For infants up to 30 days of age, muscle thickness of 3 mm is considered diagnostic.[7]

Treatment for pyloric stenosis is mainly surgical but electrolyte and fluid balance should be achieved prior to that. Initial 10 to 20ml/kg IV

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Article received on: 20/02/2023
Accepted for publication: 26/04/2023

bolus of normal saline is given followed by infusion of 0.45% normal saline and 5 % dextrose with 20-30mEq/L of Potassium Chloride at 1.25 to 2 times the rate of maintenance. Electrolytes are checked 06 hourly until they reach normal levels.[8] IHPS is corrected by a procedure known as pyloromyotomy, as described by Ramstedt in 1912 and procedure is also named after him.[9] Open surgery (OS) can be done via a transverse right upper quadrant incision, or a circum-umbilical incision as described by Bianchi.[10] Since the inception of minimal access surgery, laparoscopic procedure (LP) also gained popularity and was first described in 1990.[11] This technique has gained popularity worldwide. Various studies have shown comparable results of LP with OS in terms of complication rates, operative time, and length of hospital stay.

We report the results of a prospective randomized study comparing LP to OS for IHPS in a single institution.

MATERIAL & METHODS

This was a prospective randomized study conducted from 7th May 2022 to 7th November 2022 in Paediatric surgery department Pak Emirates Military Hospital, Rawalpindi after getting approval from ethical committee (A/28/EC/489/2022). It included 20 patients each in the two groups allocated randomly. In group A, laparoscopic pyloromyotomy was performed whereas in group B open surgery was performed. Both groups were compared regarding operative time, hospital stay and complications: mucosal perforation and inadequate pyloromyotomy.

All the patients diagnosed to have IHPS were considered to be included in the study. The patients having associated anomalies like complex congenital cardiac diseases were excluded from the study. Diagnosis was established by taking a detailed history from the parents followed by a thorough clinical examination and investigations like ultrasonography (US). Details like age of the patient, gender and sonographic measures of the pylorus were documented in a specified proforma at time of operation. Initial 10 to 20ml/kg IV bolus of normal saline was given followed by infusion of 0.45% normal saline and 5 % dextrose with 20-30mEq/L of Potassium Chloride at 1.25 to 2 times the rate of maintenance. An informed consent was signed after full counselling of baby's parents.

Group A cases underwent LP with the baby under general anaesthesia in supine position with nasogastric tube inserted at the time of induction. Patient was positioned in a way that feet were brought at the edge of the table and the monitor was placed at the baby's head facing the surgeon. Optical port (5mm) was placed below the umbilicus through a small stab incision. A pneumoperitoneum of 8 to 10 mmHg was established through the optical port followed by a 5mm port placement in right subcostal region in the midclavicular line. A grasper was introduced to hold the duodenum. Another port was placed on the left side in mid-clavicular line halfway from xiphisternum to umbilicus. Pyloromyotomy was done in the avascular plane using the belly of a diathermy hook. The cut extends proximally from the anterior aspect of the antrum to the vein of Mayo distally. The pyloric incision was deepened, and muscle edges were spread to expose the mucosa using Maryland. Adequacy of pyloromyotomy confirmed by separately moving edges of incision and ballooning of mucosa. Perforation test was done by injection of 30 mL air via the Ryle tube and passing it gently through the pyloric canal. At the end, haemostasis was secured; removal of ports and closure of stab incisions was performed. Nasogastric tube was also removed.

On the other hand, group B cases underwent OP through a supra-umbilical incision. The baby operated under general anaesthesia in supine position with nasogastric tube inserted at the time of induction. The stomach was visualized, and the pyloric tumour identified and delivered through the incision. By using a no. 15 knife, a seromuscular incision was made in the avascular plane extending from antrum of the stomach proximally to the vein of Mayo distally. In order to split the muscle edges, the belly of the blunt artery forceps was used cautiously. As a result of that, mucosa bulged through the cut edges

after splitting up the muscle fibres. The remaining strands were also freed by independently moving the two cut edges of the pyloric canal. Bulging of the mucosa and independent movement of the cut edges of the pyloric canal marked the satisfactory pyloromyotomy. In order to rule out the perforation of the mucosa, air was injected in the nasogastric tube and was milked through the pyloric canal while at the same time saline was poured at operative site and observed for bubbles indicating the mucosal injury. After that, haemostasis was secured, and the wound was closed in layers. Both groups were compared in terms of operative time that was calculated from incision to dressing, and intraoperative complications like mucosal injury. In patients operated laparoscopically (Group A), further details were recorded like those converted to open approach and what was the underlying reason for that. Similarly, both the groups were compared in terms of time duration starting from operation to discharge. All cases were followed up for 1 month for post-operative complications.

RESULTS

Both groups were matched regarding the age at time of operation, gender, body weight and sonographic dimensions of the pyloric muscle. The mean age was 33.0 ± 5.8 days in group A while 35.0 ± 5.9 in group B. Similarly, the mean weight was 3.7 ± 0.5 kg in Group A while 3.8 ± 0.5 kg in Group B. Gender was equally distributed in the study too. There was no statistically significant difference that may affect the comparative study. (Table-I)

Operative time ranged from 20 to 70 min with a mean of 15.4 min in group A. In group B, the mean operative time was 25.6 min (range, 25–60 min). Using Mann-Whitney U test, the statistical difference between the two was significant (p-value=0.006). The time from operation to discharge ranged from 14 to 58 h with a mean of 16.8 h in group A. In group B, it ranged from 19 to 30 h, and the mean was 24.2 h. Comparing the two groups revealed a statistically significant difference in favour for the LP (p-value = 0.04). (Table-II)

One case in group A was converted to open approach (conversion rate 5%) because of mucosal perforation while one case of inadequate pyloromyotomy was found. Although no mucosal perforation was reported in group B, there was proportionate difference but no statistically significant difference in comparison (p-value=0.26). (Figure-1)

	Laparoscopic Technique (n=20)	Open Surgery (n=20)	P-Value
Age (years)			
Mean ± SD	33.0 ± 5.8	35.0 ± 5.9	0.29
Gender			
Male	6 (30.0%)	6 (30.0%)	1.0
Female	14 (70.0%)	14 (70.0%)	
Weight (kg)			
Mean ± SD	3.7 ± 0.5	3.8 ± 0.5	0.54

Table-I. Baseline characteristics in the two groups

	Laparoscopic Technique (n=20)	Open Surgery (n=20)	P-Value
Operative time (min)			
Mean	15.40	25.60	0.006
Range (min – max)	20 to 70	25 to 60	
Hospital Stay (hours)			
Mean	16.80	24.20	0.04
Range (min – max)	14 to 58	19 to 30	

Table-II. Comparison of OT, HS and complications between study groups

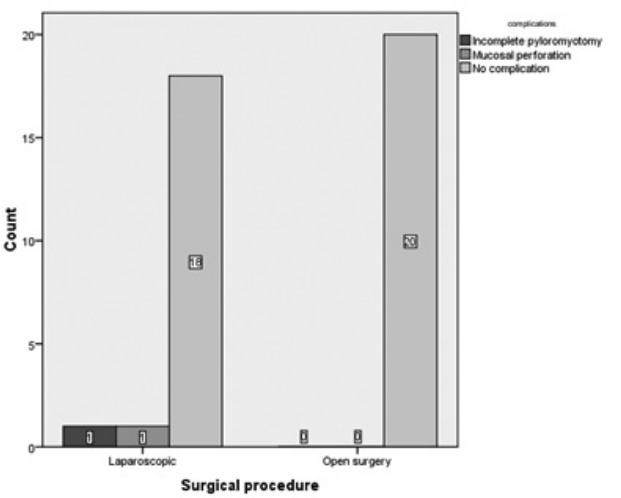

Figure-1. Comparison of complications between two procedures

DISCUSSION

Although OS remained the standard procedure for IHPS for many years, LP is widely accepting

the popularity competing with the traditional technique. In the present study, the laparoscopic approach was found significantly better than the OS in terms of operative time (mins) and hospital stay (hours).

Many researchers have compared the two approaches of LP and OS like we did but if we compare different studies and analyses, the results are contradictory in terms of advantages and disadvantages of each approach. A study conducted in 2009 compared both techniques and concluded that statistically no significant differences were noted in terms of wound infection, postoperative vomiting, rates of mucosal perforation or operating time.[12] Another study, although favoured LP but strongly recommended that it should only be done only in specialised centres with adequate expertise available as in inexperienced hands, complications rate might be higher so standard OS is advised. The study also concluded that the time to full feed and hospital stay were shorter after LP than after OS hence, they suggested that laparoscopic technique should preferably be performed in centres with experienced paediatric surgeons.[13,14] We had similar results in our study.

A meta-analysis was performed by Hall et al that included eight studies and 595 cases. It was concluded that there was no significant difference regarding the operative time between open and laparoscopic techniques. However, they witnessed a significantly shorter HS with laparoscopy technique post operatively.[15] Comparing to our study, we had significantly lesser OT and HS in our study in LP group as compared to OS.

St. Peter et al also noted a significantly lesser HS in their study.[16] On the other hand there is also evidence which suggests no difference in the operative time and hospital stay post operatively between laparoscopic procedure and open surgery.[17]

In the current study incomplete pyloromyotomy was observed in one case in the LP group, which was managed by redo OS, however, this difference was not statistically significant between the groups. St. Peters et al also witnessed fewer complications post laparoscopy.[16] Although there was no statistically significant difference in complications in between the two groups in our study but we did observe two complications in LP as compared to none in OS.

Literature also exists where some series have found mixed results, including longer operative times and increased complication rates with the laparoscopic approach. A study conducted in 1998 stated that although LP is definitely associated with better cosmetic outcome, causes less postoperative pain and discomfort and results in a shorter hospital stay. But the operative time was significantly longer in LP compared to OS i.e. 32 versus 18 minutes respectively. LP was also associated with more complications in the form of more mucosal perforations and rate of reoperations.[18]

A study compared the LP and OS and concluded that both the approaches had similar outcomes. However, LP was associated with increased complication rates and higher hospital charges.[19]

In brief, for the management of IHPS, there are no clear evidence-based recommendations, and the selection between both laparoscopic and open surgery is still under debate and directed by the surgeon's preference and experience. Overall, the laparoscopic procedure is preferred over the open technique due to its better cosmetic effects and otherwise a similar efficacy.

The advantages of this study lies in the fact that very few trials have so far been done on this topic in the local healthcare settings. Secondly, this prospective study used simple randomization which revealed equally distributed baseline characteristics of child population.

CONCLUSION

Based on the results of current study, it is concluded that laparoscopic technique has significantly shorter OT and HS than OS in children with IHPS. Minor complications like mucosal perforation were seen in one case in the laparoscopy group,

however, it was not found statistically significant among groups. Further large scale trials using rigorous research methods are recommended before generalization of these findings.

LIMITATIONS

The limitations were mainly in terms of small sample size and short duration of study. Another limitation was lack of long-term outcome of these cases.

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