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Pyloromyotomy Surgery in Hypertrophic Pyloric Stenosis – A Comparative Study with or without Antibiotics

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Abstract **Original Research Article**

***Introduction*:** Infantile hypertrophic pyloric stenosis (IHPS) is one of the most common surgical conditions of infancy. It`s prevalence ranges from 1.5 to 4 per 1000 live births. Different treatment modalities and procedures have been tried for the management of this common condition. Many innovations and approaches have been carried out for surgical management of IHPS. Open extramucosal pyloromyotomy, the original operation used to correct IHPS. ***Aim of the Study*:** The aim of this study was to evaluate and compare the outcome of Pyloromyotomy surgery among children with antibiotics or no antibiotics. ***Methods*:** This was a comparative study and was conducted in the Faculty of Pediatric Surgery of Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh during the period from January, 2020 to December, 2022. In our study we took 120 cases of Pyloromyotomy. All patients were randomized into two groups – Group A (Patients with antibiotics Ceftazidime) and Group B (Patients with no antibiotics). Periumbilical semicircular incision was made in all patients. ***Result*:** In total 120 patients from both the groups completed the study. In our study we found majority (67.5%) were less than 1 month & majority of our patients were male (75%) compared to female (25%). The Mean Age of group A & B was 33.5 ±11.2 & 32.1 ± 12.4 days respectively. Mean weight was 3.97 ± 0.8 & 4.02 ± 0.7 kg in group A & B respectively. Majority (13.33% & 10%) of patients had vomiting in group A & B respectively. Wound infection was 5% in group A & 6.67% in group B, stitch abscess was found 1.67% &1.67%, suture granuloma 5% & 1.67% in patients with antibiotics & no antibiotics respectively. Skin dehiscence was 6.67% in antibiotic group & 5% in no antibiotic group. ***Conclusion*:** In this study, we found major complications like wound infection, stitch abscess &skin dehiscence was present in our patients. However, there were no significant differences of these complications between antibiotic or no antibiotic group. So, we don't feel any necessity to use the prophylactic antibiotics regarding the reduction of wound infection in patients undergoing pyloromyotomy and also in those children with periumbilical incisions for any abdominal operative approach.

Keywords: Infantile hypertrophic pyloric stenosis (IHPS), Pyloromyotomy surgery, Antibiotics, Neonates.

INTRODUCTION

Infantile hypertrophic pyloric stenosis (IHPS) is one of the most common surgical conditions of infancy. The first anatomical description of the hypertrophied pyloric muscle was made by Blair in 1717 [1]. It`s prevalence ranges from 1.5 to 4 per 1000 live births [2]. Different treatment modalities and procedures have been tried for the management of this common condition. Simple observation to surgery have all been tried and tested. Pharmacological interventions have been used in a few centres. However, for practical purposes, surgery remains the mainstay for management of IHPS. Many innovations and approaches have been carried out for surgical management of IHPS. First successful surgery was performed by Dufour and Fredet which was longitudinally splitting of hypertrophic pyloric muscle and transversely closing [3]. But Ramstedt stated that no need of muscle closure and from that period it was known as Ramstedt's pyloromyotomy. Ramstedt's

pyloromyotomy was remained the surgical treatment of choice for about a hundred years. Open extramucosal pyloromyotomy, the original operation used to correct IHPS, was first performed by Ramstedt in 1912 [4]. With this technique, the division of the hypertrophic pyloric muscle fibers is completed through a transverse right upper quadrant incision. However, this operation leaves a conspicuous scar that often increases in length as a child grows. Therefore, in 1986, some pediatric surgeons began to perform the operation via an open periumbilical incision to improve cosmesis [5]. However, debris and bacteria located in the moist folds of the umbilicus led to increased wound infection rates, often greater than the 1% to 5% that is predicted for a clean case, which pyloromyotomy is considered to be [6]. Because of this, some surgeons began to administer prophylactic preoperative antibiotics before performing an umbilical fold pyloromyotomy, resulting in a significant decrease in the wound infection rate [7]. Within the past decade, laparoscopic pyloromyotomy has become a standard of care for the treatment of IHPS [8-10]. Because an umbilical trocar is required to accommodate the laparoscope, prophylactic antibiotics are often administered before the procedure. The umbilical fold incision provides a convenient exposure of the pylorus and results in a cosmetically appealing scar. Conflicting evidence is present in the literature concerning the possible increased rate of wound infection with this newer approach when compared with the classic right upper quadrant (RUQ) incision [5, 11-15].

However, not all of the surgeons use preoperative prophylactic antibiotics, citing that the operation is a clean case and that antibiotics are not indicated. Inappropriate antibiotic use often leads to the proliferation of multidrug- resistant pathogens and is also associated with adverse antibiotic-related events, such as Clostridium difficile infection and allergic reactions, which result in patient morbidity and high health care costs [16]. The majority of hospitalized children receive antibiotics and, of these, more than 40% are for surgical indications with significant variation in administration among US children's hospitals [17, 18]. Antibiotics are administered in more than 50% of surgical procedures performed at children's hospitals but are only considered appropriate in 65% of cases, according to one study [19]. Moreover, the variation among children's hospitals by procedure ranges from 11 to 100%, and antibiotics are given in 48% of cases in which they are not indicated. In other pediatric subspecialties, the variation in practice is comparable. For example, the variation in antibiotic prophylaxis for clean outpatient pediatric urological procedures for which antibiotics are not indicated ranges from 35 to 98% [20]. For those procedures in which prophylaxis is indicated, there is similar variation in the choice, timing, and duration of antibiotic administration. Pyloromyotomy, for congenital hypertrophic pyloric stenosis, is one of the most common pediatric surgical procedures. According to the conventional wound classification system, pyloromyotomy is considered a ''clean'' procedure, given the absence of entry into a hollow viscus. There is a small risk of iatrogenic perforation, with an estimated incidence of 2%, for which antibiotics would theoretically reduce the risk of a subsequent surgical site infection (SSI). However, such a low incidence of perforation for this procedure would not seem to justify routine antibiotic prophylaxis in every case. For uneventful cases, studies have demonstrated a very low rate of SSI after this procedure of 1–2%, a rate that is not lowered by the administration of antibiotic prophylaxis [21, 22].

OBJECTIVE OF THE STUDY

The main objective of the study was to evaluate and compare the outcome of Pyloromyotomy surgery among children with or without antibiotics.

METHODOLOGY & MATERIALS

This was a comparative study and was conducted in the Faculty of Pediatric Surgery of Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh during the period from January, 2020 to December, 2022.

In our study we took 180 patients of Pyloromyotomy surgery. Because of inclusion& exclusion criteria, 120 patients were included and 60 patients were excluded from our study. All patients were randomized into two groups – Group A (Patients with antibiotics Ceftazidime) and Group B (Patients with no antibiotics). Periumbilical semicircular incision was made in all patients.

These are the following criteria to be eligible for the enrollment as our study participants: a) Patients aged up to 2 months; b) Patients with Infantile hypertrophic pyloric stenosis; c) Patients who underwent pyloromyotomy for IHPS at our institution; d) Patients who were given consent by their guardians to participate were included in the study And a) Patients with severe infection, b) Patients with Coagulopathy; c) Patients with previous history of surgical complications; d) Patients with known allergy to study drugs; e) Patients having gross congenital anomalies were excluded from our study.

STATISTICAL ANALYSIS

All data were recorded systematically in preformed data collection form and quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. Statistical analysis was performed by using SPSS (Statistical Package for Social Sciences) for windows version 10. Probability value <0.05 was considered as level of significance. The study was approved by Ethical Review Committee of Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh.

RESULTS

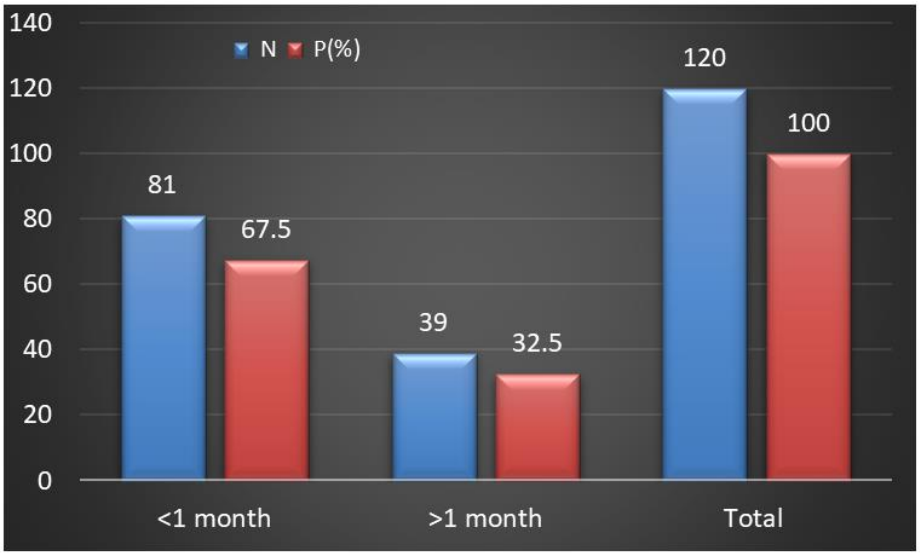

Figure 1: Age distribution of our study subjects

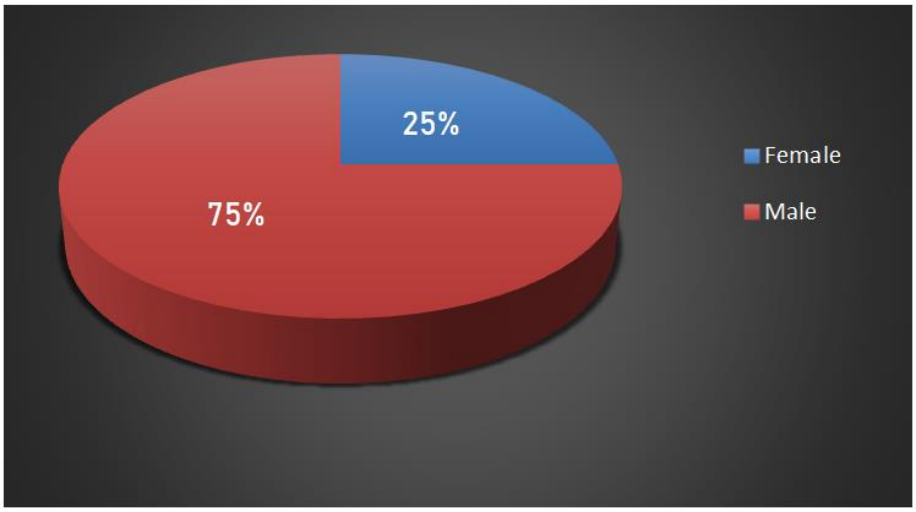

Figure 2: Gender distribution of our study participants

Table 1: Baseline characteristics of our study patients

Baseline Characteristics	Group A (antibiotics)		Group B (no antibiotics)		P value
	N=60	P(%)	N=60	P(%)	
Mean Age (days)	33.5 ±11.2		32.1 ± 12.4		0.829
Mean weight (kg)	3.97 ± 0.8		4.02 ± 0.7		0.521
Gender					
Male	50	83.33	40	66.67	0.599
Female	10	16.67	20	33.33	
Mean admission serum HCO_3	27.6 ± 5.8		26.8 ± 6.5		0.741
Mean operation serum HCO_3	24.1 ± 3.9		24.5 ± 4.0		0.474
Total Length of Stay (days)	2.23±1.49		2.32±1.57		0.020
Preoperative LOS (days)	0.75±0.79		0.76±0.62		0.308
Postoperative LOS (days)	1.48±1.49		1.56±1.37		0.010
Time to first feed (hours)	8.3		8.7		0.521

Table 2: Post-operative complications among our study subjects

Complications	Group A (antibiotics)		Group B (no antibiotics)		P-value
	N=60	P(%)	N=60	P(%)	
Vomiting	8	13.33	6	10.00	0.517
Wound infection	3	5.00	4	6.67	0.214
Stitch abscess	3	5.00	2	3.33	0.424
Suture granuloma	3	5.00	1	1.67	0.185
Skin dehiscence	4	6.67	3	5.00	0.532

In figure 1 we showed age distribution of our study patients. Majority (67.5%) patients were less than 1 month, followed by 32.5% was aged more than 1 month.

Figure 2 shows the gender distribution of study subjects. Majority of our patients were male (75%) compared to female (25%).

Table 1 summarized the baseline characteristics of study patients. The Mean Age of group A & B was 33.5 ±11.2&32.1 ± 12.4days respectively. Mean weight was 3.97 ± 0.8 & 4.02 ± 0.7 kg in group A & B respectively. There were 83.33% male & 16.67% female in group A whereas 66.67% male & 33.33% female in group B. The mean of admission serum $HCO_3$was 27.6 ± 5.8 & 26.8 ± 6.5; operation serum was 24.1 ± 3.9 & 24.5 ± 4.0 in patients with antibiotics & no antibiotics respectively. We found total length of stay in group A & B was 2.23±1.49 & 2.32 ±1.57 days respectively. During preoperative mean LOS was 0.75±0.79 & 0.76 ±0.62 days and during postoperative mean LOS was 1.48±1.49 & 1.56 ±1.37 days in group A & B respectively.

Table 2 showed the complications developed in patients after pyloromyotomy. Majority (13.33% &10%) of patients had vomiting in group A & B respectively. Wound infection was 5% in group A &6.67% in group B, stitch abscess was found 1.67% &1.67%, suture granuloma 5% &1.67% in patients with antibiotics & no antibiotics respectively. Skin dehiscence was 6.67% in antibiotic group & 5% in no antibiotic group. There were no significant changes in post-operative complications between these groups.

DISCUSSION

Infantile hypertrophic pyloric stenosis (IHPS) is a common cause of gastric outlet obstruction in infants and the prevalence ranges from 1.5-4.0/1000 live births among whites though the incidence is lower in black Americans and Asians [23]. The male to female ratio is ranges between 2:1 and 5:1 [24]. The majority of cases present between the 3rd and 5th week of age, although some cases are diagnosed at birth and some have even been diagnosed in utero [23, 25]. Persons with a positive familial history and certain ABO blood groups show a higher incidence [26]. Prenatal prescription of macrolides has been implicated in the pathophysiology of IHPS [27]. Decreased numbers of interstitial cells of Cajal and heme oxygenase- 2 have been found in the smooth muscle of IHPS [28]. Increased vascularity has been shown to be an integral component of the pylorus in IHPS [29].

Historically, there have been several approaches, both operative and nonoperative, to the treatment of IHPS [4, 30, 31]. However, surgical division of the hypertrophied pylorus using a transperitoneal approach has proven to be the only reliable modality to treat this common condition in infants. Initially, a pyloromyotomy was performed via an open incision using a transverse right upper quadrant incision (the Ramstedt pyloromyotomy), resulting in a noticeable scar that often elongated as the child grew [32, 33]. Recent advancements in the management of IHPS have focused on improving the surgical approach. To improve cosmesis, some surgeons began to perform the pyloromyotomy using a semicircular periumbilical incision [5]. However, it soon became evident that the umbilical fold approach was associated with a novel set of complications, such as prolonged gastroparesis and a higher rate of wound infections, as compared with the transverse right upper quadrant approach [34]. The increased wound infection rate, assumed to be due to the inability to effectively prep the umbilicus, was found to exceed the 1% to 5% expected for a clean case [6]. For this reason, many surgeons began to routinely administer prophylactic antibiotics before making the skin incision for the pyloromyotomy. Subsequent studies investigating the efficacy of preoperative antibiotics in preventing wound infections after an open umbilical approach demonstrated that their routine use reverted the wound infection rate back to that which would be expected for a clean case [7].

Several single-institution studies have demonstrated SSI rates after pyloromyotomy less than 3%, which are not significantly lowered by the administration of antibiotic prophylaxis. Katz *et al.*, found no difference in wound infection rates in a 7-year review of 299 patients who had a laparoscopic pyloromyotomy between those who received antibiotic prophylaxis and those who did not [21].

Not surprisingly, surgical antibiotic prophylaxis in children has been associated with higher odds of developing Clostridium difficile infection [19, 35]. Surgical antibiotic prophylaxis has also been linked to greater odds of receiving treatment for an allergic

reaction in both outpatient and inpatient pediatric surgical procedures [35, 36].

In regard to surgical antibiotic prophylaxis for this procedure, we have shown significant variation across hospitals in antibiotic use. Other investigators have also demonstrated significant inter-hospital variation, and there is no consensus in the pediatric surgical community around prophylaxis for common procedures [19, 35]. There is also often a lack of consensus in pediatric surgery around appropriate wound classification, particularly for neonatal operations. Further, the role of the traditional wound classification system in directing antibiotic prophylaxis has been questioned for pediatric surgical procedures, which are often done using a minimally invasive approach and for which the SSI rates can be very low, in the range of 1–3% [22, 37].

Our study included 120 patients (90 male and 30 female) diagnosed with IHPS [Figure 2]. The gender distribution found in our study is similar to others [38, 39]. As regards the age distribution, the mean age at presentation in this study was higher than the mean age in the study by Ordorica-Flores *et al.*, in which it was 30 ± 9 days and lower than the mean age of the study by Eltayeb *et al.*, in which the mean age was 65.1 ± 19.8 days [40, 41]. In our study majority (13.33% & 10%) of patients had vomiting in group A & B respectively. Wound infection was 5% in group A & 6.67% in group B, stitch abscess was found 1.67% &1.67%, suture granuloma 5% & 1.67% in patients with antibiotics & no antibiotics respectively. Skin dehiscence was 6.67% in antibiotic group & 5% in no antibiotic group. There were no significant changes in post-operative complications between these groups [Table 2].

Limitations of the Study

Our study was a single centre study. We took a small sample size because of our short study period& limited resources. We found some wound complications such as wound infection, stitch abscess, suture granuloma, but there are more complications like fatigue, nausea, constipation needs to be evaluated. After evaluating once those patients we did not follow-up them for a long term and have not known other possible interference that may happen in the long term with these patients.

CONCLUSION AND RECOMMENDATIONS

In this study, we found major complications like wound infection, stitch abscess & skin dehiscence was present in our patients. However, there were no significant differences of these complications between antibiotic or no antibiotic group. That's why we don't feel any necessity to use the prophylactic antibiotics regarding the reduction of wound infection in patients undergoing pyloromyotomy and also in those children with periumbilical incisions for any abdominal operative approach. So, further study with a prospective and longitudinal study design including larger sample size needs to be done to identify & compare the post-operative complications of Pyloromyotomy surgery between children administered with antibiotics or no antibiotics.

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