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Study to Evaluate how Different Parameters Affect Time to Full Enteral Feeding (TFEF) in Children Undergoing Pyloromyotomy

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ABSTRACT

The aim of the present study was to evaluate how different parameters in the preoperative, preoperative and postoperative period affect time to full enthral feeding (TFEF) in children undergoing pyloromyotomy. All children received treatment at a specialized center for paediatric surgery. Eligibility for inclusion was based on patients who had a diagnosis code of Q 40.0 in the International Classification of Diseases 10th Revision and underwent pyloromyotomy within a one-year period. A group of 50 children underwent diagnosis and surgery for infantile hypertrophic pyloric stenosis (IHPS). The cohort analyzed in this study comprised mostly male infants, with an average corrected age of 37 days and an average weight of 3932 g. A small percentage of the infants were born prematurely and a few had a serious underlying illness. The average duration of symptoms was 4 days, with a range of 7 days. A significant majority of patients, 72%, reported experiencing weight loss. Additionally, 6 patients, 12%, showed an increase in bilirubin levels. The average time to reach TFEF for the entire group was 48±32 hrs, while the average duration of hospitalization after surgery was 66±44 hrs. A large proportion of children (88%) followed a structured feeding routine. No child needed intravenous nutrition. Two children experienced postoperative complications, with one of them needing to undergo another operation. During the univariate analysis, certain factors were observed to have an impact on TFEF. These factors included age, weight, the presence of severe underlying disease, elevated bilirubin levels and the duration of symptoms. After conducting a thorough analysis, it was found that only age and the presence of a severe underlying disease had a significant impact on TFEF. The TFEF showed a decrease as individuals grew older, while it exhibited an increase in children who had a serious underlying illness. There is no evidence to suggest that symptoms such as duration of emesis, weight change, electrolyte abnormalities have any impact on TFEF. Enhancing parental knowledge regarding factors that impact the time to full feeds and length of postoperative hospital stay can lead to improved information.

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Key Words
Predictive factors, full enteral feeding, children, pyloromyotomy

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INTRODUCTION

Pyloric Stenosis, or infantile hypertrophic pyloric stenosis (IHPS), is a frequently occurring disorder that mostly affects children under the age of one year[1]. Infantile hypertrophic pyloric stenosis (IHPS) is a gastrointestinal disorder that affects newborns and young babies. It is clinically characterized by a gradual and forceful vomiting of stomach contents that does not include bile[2]. There are several underlying risk factors linked to the illness, however, its exact cause is still mostly unclear[3]. Usually, these newborns do not exhibit any symptoms initially, but they develop vomiting during the first several weeks after birth. IHPS hinders the passage of stomach contents from the pyloric canal into the duodenum, leading to insufficient food digestion and consequent buildup of stomach contents[4]. This illness is often seen, occurring in around 2-4 cases per 1000 live births in Western countries[3]. This is a frequently occurring disease in neonates that often necessitates surgical intervention[5]. Consequently, it is well recognised and often used by paediatric practitioners. Untreated gastric outlet blockage caused by IHPS may be perilous, since it can lead to severe weight loss and potentially fatal consequences. From the 20th century forward, a thorough comprehension of the ailment and advancements in therapy have significantly decreased the death rate of IHPS from over 50% to almost 0%[6]. Infantile hypertrophic pyloric stenosis (IHPS) does not need immediate surgery, since the first step involves administering intensive intravenous fluid therapy to rehydrate and stabilise metabolically imbalanced newborns[7]. Following fluid correction, the conventional treatment strategy is extramucosal pyloromyotomy, a surgical procedure that has remained mostly unchanged for more than a century.8 Minor improvements include less invasive access alterations, such as the circumbilical incision technique introduced by Tan and Bianchi in 1986 and the laparoscopic approach developed by Alain and Grousseau in 1991[9,10].

The postoperative outcome of infantile hypertrophic pyloric stenosis (IHPS) surgery may be evaluated based on two factors: the time it takes for the patient to achieve full enteral feeding (TFEF) and the duration of hospital stay. This evaluation can be focused on either the surgical approach used[11,12] or the manner of postoperative feeding[13,14]. The duration of hospitalisation will be compared between patients who had surgery and those who received medicinal treatment. Additionally, potential predicting indicators for the efficacy of medication therapy will be examined. An analysis of the individual traits of babies who experience unfavourable results from medical intervention may aid in making a well-informed choice when deciding on the most suitable treatment approach for newborns on a case-by-case basis in nations that may use pharmacological treatment. The objective of this research was to assess the impact of various factors during the preoperative, perioperative and postoperative phases on the duration required for children having pyloromyotomy to achieve complete enteral feeding.

MATERIALS AND METHODS

All children were treated at a tertiary center for pediatric surgery. All patients with an International Classification of Diseases 10th Revision diagnosis code of Q 40.0 who underwent pyloromyotomy for the period of one year were eligible for inclusion. A total of 50 children were diagnosed and operated on for infantile hypertrophic pyloric stenosis (IHPS). Inclusion criteria were diagnosis of isolated IHPS and isolated pyloromyotomy operation. Children with insufficient data for retrieving TFEF were excluded. Laparoscopic pylo- romyotomy was not used at our department during the study period. The diagnosis of IHPS was based on clinical symptoms and ultrasound findings. The postoperative feeding was initiated by the operating surgeon and started 3-4 hrs after surgery with either free feeding or according to a schedule. The specific feeding schedule started with 20% of the full amount (150 mL^{-1} kg) and increases with 20% for every meal; if significant vomiting occurred, the same amount would be given again at the next meal.

Study design: This study is an institution-based retrospective study. Primary outcome was duration (hours) to full enteral feeding. This was defined by the time from operation to journal notes either stated ‘fully fed’ or describing correct amount of food intake without emesis. Inde-pendent variables were preoperative parameters such as demographical data, type of feeding (breast-milk/ formula), symptoms and blood tests, surgical data such as method of operation; and postoperative parameters including method of feeding and complications. Prema-turity was defined as a gestational age shorter than 37 weeks. Age at operation was corrected for prematurity. Small for gestational age was defined as a weight below the 10th percentile for the gestational age. Children with congenital heart disease (CHD) requiring surgery and syndromes were included in the ‘severe underlying disease’ group. The cut-offs used for ultrasound were pyloric muscle thickness of 4 mm or more and pyloric channel length of 16 mm or more[15]. In infants small than 3 weeks the cut-off for thickness was 3.5 mm[16]. Blood samples were taken from venous blood to perform analysis of sodium, potassium, chloride, base excess, pH, pCO_2, pO_2, hemoglobin and liver function tests including alanine transaminase, aspartate transaminase, alkaline phosphatase, gamma-glutamyl and bilirubin (total). Reference intervals for all analyses were age specific and followed international

standards[17]. The reference intervals for (total) bilirubin were: <2 days of age:<100 µmol/L, 2-6 days of age: <200 µmol L^{-1}, 7-20 days of age: <100 µmol L^{-1}, 21–29 days:<50 µmol L^{-1} and >1 month of age: <22 µmol L^{-1}. Complications included were postoperative infection and reoperation. Length of postoperative hospital stay (hours) was counted from operation until discharge.

Statistical analyses: Statistical analyses were performed using IBM SPSS Statistics for Mac, V.24 (IBM). Continuous variables were presented as median or interquartile range (IQR) (no normal distribution) or mean±SD (normal distribution). A $p<0.05$ was considered to be statistically significant.

RESULTS

The included cohort consisted of 43 (86%) boys, with a mean corrected age of 37 days, a mean weight of 3932 g, 30 (15%) of which were premature and 3 (6%) of which had a severe underlying disease. Median duration of symptoms was 4 days (IQR: 7), 36 patients (72%) experienced weight loss and increased bilirubin was seen in 6 patients (12%). Mean TFEF for the whole cohort was 48±32 hours and mean length of postoperative hospital stay was 66±44 hours. The majority of children (88%) were fed according to a feeding schedule. No child required intravenous nutrition. There were 2 children (4%) presented with postoperative complications, of which one required reparation. In the univariate analysis, age, weight, severe underlying disease increased bilirubin level and duration of symptoms were found to affect TFEF.

In multi variate analysis, only age and severe underlying disease remained as variables significantly affecting TFEF. Hence, for every day of age, the time to fully fed decreased with 0.6 hour and the presence of an underlying disease increased the time to fully fed with over 1 day. TFEF did not seem to be affected by prematurity, preoperative weight loss, symptom duration, preoperative acid/base balance or electrolyte values, surgical method, or method of postoperative feeding.

Table 1: Demographics, preoperative data and surgical method with infantile hypertrophic pyloric stenosis

Gender (male)	43 (86%)	
Age (days)	41±19	
Breast feeding	37 (74%)	
Gestational age	39+4 (27+4 to 42+1)	
Premature	30 (15%)	
Corrected age (days)	36±16	
SGA	16 (8%)	
Weight (g)	3932±854	
Weight loss	36 (72%)	
Severe underlying disease	3 (6%)	
Increased bilirubin	6 (12%)	
Bilirubin (µmol/L)	46 (174)	
Duration of symptoms (d)	3 (6)	
Acid base balance	First	Last
Metabolic acidosis	2 (1%)	2 (1%)
Metabolic alkalosis	14 (28%)	0
Base excess	4.7 (-8.0 to 22.7)	0.7 (-7.4 to 9.0)
CO2	5.8 (1.3)	5.4 (1)
Electrolyte balance	First	Last
Hyponatremia	5 (10%)	3 (6%)
Chloride	102 (8)	108 (4)
Lactate	2.1 (1.3)‡‡‡	1.9 (1)§§§
Preoperative LOH (days)	2 (1)	
Operation		
Umbilical incision	28 (56%)	
Right upper quadrant incision	22 (44%)	

Table 2: Postoperative data and outcome in children operated for infantile hypertrophic pyloric stenosis

Method of feeding	
Ad libitum	24 (12%)
Scheduled	44 (88%)
Time fully fed (hours)	48±32
Complications	2 (4%)
Reoperation	1 (2%)
Postoperative LOH (hours)	66±44
Readmission (<30 days)	2 (4%)

Table 3: Univariate regression of demographics, preoperative and postoperative data and the effect on time in hours to full enteral feeding

Variable	B (95% CI)	p-value
Gender (male)	-12.8 (-26.37 to 1.36)	0.081
Corrected age (days)	-0.66 (-0.91 to -0.36)	<0.001
Breast feeding (yes)	-2.7 (-14.1 to 8.54)	0.614
Premature (yes)	7.4 (-7.35 to 21.95)	0.314
SGA (yes)	15.4 (-4.5 to 35.15)	0.134
Weight (kg)	-4.8 (-9.47 to -0.53)	0.004
Weight loss (yes)	-1.8 (-13.16 to 9.77)	0.780
Severe underlying disease (yes)	34.4 (14.88 to 53.5)	0.001
Increased bilirubin (yes)	20.8 (7.28 to 35.54)	0.007
Bilirubin (µmol/L)	-0.04 (-0.172 to 0.121)	0.713
Duration of symptoms	-0.78 (-1.53 to -0.042)	0.036
First acid balance		
pH	-5.6 (-79.9 to 68.69)	0.890
Base excess	0.58 (-0.66 to 1.83)	0.360
pCO2	4.6 (-0.43 to 9.27)	0.072
First electrolyte balance		
Sodium (mmol L^{-1})	0.94 (-1.05 to 2.91)	0.324
Chloride (mmol L^{-1})	0.36 (-0.55 to 1.25)	0.460
Lactate (mmol L^{-1})	-1.8 (-6.48 to 3.04)	0.440
Operation (umbilical)	-1.5 (-11.70 to 8.85)	0.740
Method of feeding	14.6 (-1.28 to 30.28)	0.076
Reoperation (yes)	0.12 (-33.1 to 33.15)	0.984
Complication (yes)	2.16 (-22.1 to 26.3)	0.832

DISCUSSIONS

Infantile hypertrophic pyloric stenosis (IHPS) is a gastrointestinal disorder affecting newborns and young babies, clinically characterized by gradual “projectile” non-bilious vomiting[18]. The majority of the time, these infants are born without any symptoms and the onset of emesis typically occurs within the first few weeks of their lives. IHPS limits the flow of stomach contents via the pyloric canal into the duodenum, which causes the poor digestion of meals and as a consequence, the buildup of stomach contents[19]. Infantile hypertrophic pyloric stenosis (IHPS) is one of the most prevalent diseases needing surgery in neonates[20]. A significant number of paediatric practitioners are therefore very familiar with it. Gastric outlet obstruction from IHPS is dangerous as it leads to emaciation may result in death if it is left untreated[21]. The evaluation of preoperative factors as potential predictors of a poorer postoperative outcome is of significant value. Such assessments provide beforehand and postoperative information to care-givers, they also offer a means to improve

Table 4: Multivariate linear regression of variables predicting longer time in hours to full enteral feeding in children operated for infantile hypertrophic pyloric stenosis

Variable B (95% CI)	p-value	
Gender (male)	-9.84 (-26.12 to 6.44)	0.220
Corrected age (days)	-0.62 (-1.05 to -0.19)	0.007
Breast feeding (yes)	-2.29 (-15.06 to 10.46)	0.750
Premature (yes)	12.08 (-10.08 to 34.24)	0.275
SGA (yes)	4.26 (-23.53 to 32.05)	0.750
Weight (kg)	-2.1 (-3.4 to 0.56)	0.812
Weight loss (yes)	-1.12 (-14.35 to 12.12)	0.855
Severe underlying disease (yes)	26.49 (3.29 to 49.71)	0.024
Increased bilirubin (yes)	4.31 (-11.71 to 20.32)	0.512
Duration of symptoms (hours)	-0.10 (-1.07 to 0.87)	0.850
First acid base balance		
pH 36.48 (-151.39 to 224.35)	0.708	
Base excess	0.43 (-2.17 to 3.04)	0.753
pCO2 2.78 (-6.85 to 12.41)	0.554	
First electrolyte balance		
Sodium (mmol L^{-1})	1.14 (-1.22 to 3.51)	0.346
Chloride (mmol L^{-1})	-0.58 (-5.99 to 4.83)	0.845
Lactate (mmol L^{-1})	-1.02 (-5.73 to 2.51)	0.660
Operation (umbilical incision)	-2.39 (-13.51 to 8.72)	0.677
Method of feeding (schedule)	7.41 (-9.66 to 24.47)	0.394
Reoperation (yes)	-15.15 (-39.16 to 40.2)	0.594
Complication (yes)	0.835 (-39.1 to 40.8)	0.944

preoperative and postoperative treatment. Further, being able to stratify patients in distinct risk categories would be of considerable relevance in future studies comparing alternative surgical procedures or different postoperative feeding regimes, as discussed before[13]. The included cohort comprised of 43 (86%) boys, with a mean corrected age of 37 days, a mean weight of 3932 g, 30 (15%) of which were preterm and 3 (6%) of which had a serious underlying condition. Median duration of symptoms was 4 days (IQR: 7); 36 patients (72%) had weight loss and elevated bilirubin was found in 6 individuals (12%). A few studies before the current one has sought to analyse how various preoperative factors impact postoperative outcome, either defined as nemesis, time to target intake, or duration of postoperative hospital stay. Prospective research demonstrated that the degree of hypokalemic, hypochloremic and metabolic alkalosis linked with the frequency of postoperative emesis episodes and TFEF. The authors also concluded that the duration of dehy-dration and failure to thrive was correlated with poor outcome since there were inverse correlations between the number of episodes of postoperative emesis and time to goal intakes with weight at admission. Results from a randomized experiment indicated that low chloride levels boosted TFEF.

Mean TFEF for the overall group was 48±32 hours and mean duration of postoperative hospital stay was 66±44 hours. Eighty-eight percent of the children were fed in accordance with a predetermined feeding schedule. No youngster needed feeding via intravenous means. Two children, representing four percent of the total, presented with postoperative complications, with one of them requiring additional surgery. In the univariate study, age, weight, severe underlying illness elevated bilirubin level and duration of symptoms were shown to impact TFEF. According to the results of the multivariate analysis, the only variables that continued to have a significant impact on TFEF were age and severe underlying disease. Hence, for every day of age, the time to completely fed reduced with 0.6 hour and the existence of an underlying condition increased the time to fully fed with almost 1 day. TFEF did not seem to be influenced by factors such as preterm, preoperative weight loss, symptom duration, preoperative acid/base balance or electrolyte levels, surgical procedure, or type of postoperative feeding. A severe underlying condition, defined in our research as CHD needing surgery, or a syndrome, was also related with greater risk of prolonged TFEF. A study of IHPS comparing surgical outcomes between patients with and without CHD found that a comorbidity extended hospital stay.24 In isolated instances of IHPS, duration to complete feed frequently matches length of hospital stay, however it is difficult to separate the two when a comorbidity is the examined component. We feel that this is related to various therapeutic needs which may postpone or impair the development of obtaining target feeds. Children who have coronary heart disease might also require additional calories.

CONCLUSION

The Total Functional Efficiency (TFEF) declined with advancing age and shown an elevation in youngsters afflicted with a severe underlying ailment. There is little evidence to suggest that preoperative emesis measures such as symptom duration, weight change and electrolyte imbalances have any impact on TFEF. Enhancing parental information may be achieved by acquiring a greater understanding of the factors that influence the duration of time required for complete feeds and the length of postoperative hospital stay. We recommend that future research focuses on investigating preoperative, perioperative and postoperative factors, as well as conducting studies that compare various surgical procedures and postoperative food plans. It is important to account for the corrected age at the time of surgery and the existence of any underlying medical conditions.

REFERENCES

1. .Corner, B.D., 1955. Hypertrophic pyloric stenosis in infancy treated with methyl scopolamine nitrate. Arch. Dis. Child., 30: 377-386.
2. Hussain, M., 2008. Sonographic diagnosis of infantile hypertrophic pyloric stenosis-use of simultaneous grey-scale & colour doppler examination. Int. J. health. sci., Vol. 134.
3. To, T., A. Wajja, P.W. Wales and J.C. Langer, 2005. Population demographic indicators associated with incidence of pyloric stenosis. Arch. Pediatr. Adolesc. Med., 159: 520-525.

4. Galea, R. and E. Said, 2018. Infantile hypertrophic pyloric stenosis: An epidemiological review. Neonatal. Net., 37: 197-204.
5. Ross, A., and P.R.V. Johnson, 2016. Infantile hypertrophic pyloric stenosis. Surg. Oxf., 34: 609-611.
6. Hernanz-Schulman, M., 2003. Infantile hypertrophic pyloric stenosis. Radiology., 227: 319-331.
7. Ranells, J.D., J.D. Carver and R.S. Kirby, 2011. Infantile hypertrophic pyloric stenosis: Epidemiology, genetics and clinical update. Adv. Pediatr., 58: 195-206.
8. Bertozzi, M.,E. Magrini. and A. Appignani, 2019. Hypertrophic Pyloric Stenosis and Other Pyloric Affections. In: Neonatal Surgery, Lima, M.,O. Reinberg, (Ed.)., Neonatal Surgery, Cham: Springer International Publishing, pp: 225-238.
9. Tan, K.C. and A. Bianchi, 1986. Circumumbilical incision for pyloromyotomy. Br. J. Surg., 73: 399-399.
10. MacKinlay, G.A. and D.C. Barnhart, 2008. Laparoscopic pyloromyotomy. Endosco. Surg. Inf. Child., Vol. 6. 10.1007/978-3-540-49910-7-37
11. Sola, J.E. and H.L. Neville, 2009. Laparoscopic vs open pyloromyotomy: A systematic review and meta-analysis. J. Pediatr. Surg., 44: 1631-1637.
12. Hall, N.J., M. Pacilli, S. Eaton, K. Reblock and B.A. Gaines et al., 2009. Recovery after open versus laparoscopic pyloromyotomy for pyloric stenosis: A double-blind multicentre randomised controlled trial. Lancet., 373: 390-398.
13. Graham, K.A., C.A. Laituri, T.A. Markel and A.P. Ladd, 2013. A review of postoperative feeding regimens in infantile hypertrophic pyloric stenosis. J. Pediatr. Surg., 48: 2175-2179.
14. Carpenter, R.O., R.L. Schaffer, C.E. Maeso, F. Sasan and J.G. Nuchtern et al., 1999. Postoperative ad lib feeding for hypertrophic pyloric stenosis. J. Pediatr. Surg., 34: 959-961.
15. Leaphart, C.L., K. Borland, T.D. Kane and D.J. Hackam, 2008. Hypertrophic pyloric stenosis in newborns younger than 21 days: Remodeling the path of surgical intervention. J. Pediatr. Surg., 43: 998-1001.
16. Colantonio, D.A., L. Kyriakopoulou, M.K. Chan, C.H. Daly and D. Brinc et al., 2012. Closing the gaps in pediatric laboratory reference intervals: A caliper database of 40 biochemical markers in a healthy and multiethnic population of children. Clin. Chem., 58: 854-868.
17. Hussain, M., 2008. Sonographic diagnosis of infantile hypertrophic pyloric stenosis- use of simultaneous grey-scale and colour doppler examination. Dopp. Exam., Vol. 2.
18. Ross, A. and P.R.V. Johnson, 2016. Infantile hypertrophic pyloric stenosis. Surg. Oxf., 227: 609-611.
19. Peter, S.D.S., K. Tsao, S.W. Sharp, G.W. Holcomb and D.J. Ostlie, 2008. Predictors of emesis and time to goal intake after pyloromyotomy: Analysis from a prospective trial. J. Pediatr. Surg., 43: 2038-2041.
20. Markel, T.A., M.R. Scott, S.M. Stokes and A.P. Ladd, 2017. A randomized trial to assess advancement of enteral feedings following surgery for hypertrophic pyloric stenosis. J. Pediatr. Surg., 52: 534-539.
21. Miyata, S., J. Cho, K. Matsushima, A. Fowler and D.W. Bliss, 2016. Operative outcomes of infantile hypertrophic pyloric stenosis in patients with congenital heart disease. J. Pediatr. Surg., 51: 1755-1758.