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Home Nasogastric Tube Feeding in Patients with Traditional Indications for Gastrostomy Tube Placement

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Abstract: *Background*: Gastrostomy tube placement (GTP) has become standard of care in infants with esophageal atresia, severe neurologic impairment, evidence of severe dysphagia with aspiration, and tracheostomy; all other indications are considered non-traditional indications with little evidence of benefit. *Objective*: The aim of the study is to identify a select group of infants with non- traditional indications for GTP who may benefit from home nasogastric feeds (HNGF) with a pre-established protocol and algorithm. *Methods*: We performed a retrospective study of all infants who underwent GTP between January 2015 and December 2017. Infants were categorized as having traditional or non-traditional indications for GTP. Parents or designated caregivers were prospectively contacted by phone and interviewed to determine gastrostomy tube (GT) use status, time to full per oral (PO) feeds, and related complications after discharge. *Results*: 111 infants had GTP during the study period and 51 (46%) of these were classified as non-traditional indications: term infants with chronic oral aversion, preterm infants with mild to moderate dysphagia, infants of diabetic mothers with feeding problems, post-op cardiac patients with oral aversion, and patients with isolated Pierre Robin sequence. The average days of PO trial before GTP in this group was 41 (±30.5) days, average oral intake and average age at GTP was 32% and 75±42.4 days respectively. Average duration of GT use was 403.4±390.7 days. After discharge, 100% of preterm infants with oral aversion or dysphagia, 100% of infants with isolated Pierre Robin sequence, and 75% of infants of diabetic mothers reached full feeds by mouth in less than 90 days. Only 30% of infants with complex congenital heart defects met this goal. Thirty percent of infants with mild to moderate aspiration reached full PO feeds on average at 22.5 months post-conception age. All infants with neurodevelopmental abnormalities and feeding problems were still on GT feeds at the time of parental interview. *Conclusion*: We identified a cohort of infants with non-traditional indications for GTP who may benefit from HNGF. Future quality improvement initiatives and randomized controlled studies with HNGF should include infants with the probability of reaching full feeds before 6 months of life to avoid the complications and costs associated with GT placement.

Keywords: Gastrostomy Tube Placement, Home Nasogastric Feeds, Neonates

1. Introduction

Indications for gastrostomy tube placement in neonates vary depending on the underlying problem affecting normal per oral feeds. [1] Traditional indications include severe neurodevelopmental or neuromuscular impairment with inability to swallow, trachea-esophageal fistula/esophageal atresia, significant dysphagia and aspiration, syndromic Pierre Robin sequence, need for tracheostomy, and infants with short gut needing prolonged parenteral nutrition. [1, 2] Non-traditional indications for GTP include prolonged feeding problems in premature infants with oral aversion (in the absence of severe Intraventricular hemorrhage/white matter injury or Severe chronic lung disease), infants of diabetic mothers, genetic and syndromic infants, and post-operative cardiac surgery patients. [1-6] When indications are non-traditional, parents are generally hesitant to accept GTP for their infants, leading to prolonged hospitalization and associated complications. Although generally considered a relatively benign surgical intervention, complications can

occur related to general anesthesia with endotracheal intubation, leakage, malposition of the tube, peritonitis, sepsis, cellulitis, granulomas, and gastro-cutaneous fistula. [7-12] The majority of GT related emergency room visits has been reported to be for accidental GT dislodgement. [7] Fatal complications include tube erosion of the stomach and diaphragm and intraperitoneal leakage. [8, 9] Nasogastric (NG) tube feeds, a less invasive alternative, is used routinely in the neonatal intensive care unit; registered nurses are trained to place, administer feeds, and monitor NG tube position according to established protocols and policies. Home nasogastric tube feeds (HNGF), although a feasible alternative has not been very popular due to potential complications associated with inappropriate placement or dislodgement of the NG tube and increased risk of aspiration. [13, 14] Other possible limiting factors may include parental education, compliance, transportation, home health support and availability of outpatient clinics for evaluation of oral intake, nutrition, and need for subsequent GT placement. [15, 16] Studies have shown that both GTP and home HNGF reduce the length of hospital stay with beneficial effects on infant development and caregiver satisfaction. [4, 17-19] A recent study has shown that HNGF has similar or lesser complications compared to home GT feeding and may reduce total time of exposure to GT. [20] Absence of a well powered randomized control trial evaluating the efficacy and safety of these two interventions has led physicians to choose GT feeds as the default strategy. The aim of the study is to identify a select group of infants with non-traditional indications for GTP who may benefit from HNGF with a pre-established protocol and algorithm that will facilitate and enhance the safety of this intervention.

2. Methods

This is a retrospective, descriptive study of all infants who had surgery for GTP prior to discharge from a 70-bed tertiary neonatal intensive care unit (NICU) at Valley Children's Hospital between January 1, 2017 and December 31, 2018. Institutional review board approval was granted for electronic chart review and phone contact of parents of eligible infants who were discharged home with GT. Infants who underwent GTP in the NICU were identified with CPT codes 43246, 49440, 43653, 43750, 43830, 43659, and ICD 10 code Z93.1. They were then classified as having traditional and non-traditional indications for GT placement. Traditional indications include in infants with esophageal atresia, severe neurologic impairment, evidence of severe dysphagia with aspiration, and tracheostomy. Non-traditional indications include term infants with chronic oral aversion, preterm infants with mild to moderate dysphagia, infants of diabetic mothers with feeding problems, post-op cardiac patients with oral aversion, and patients with isolated Pierre Robin sequence without associated nasal issues. Only infants with non-traditional indications for GT placement were included in the study. Clinically relevant data was collected including: gestational age, primary diagnosis, co-morbidities, age in days and percentage of feeds by mouth at the time of GT placement, amount of per oral (PO) feeds after GT placement, and any social issues that could affect successful implementation of this intervention. Legally authorized representatives (LAR) were contacted prospectively by phone and were asked three questions: 1. How long did they use the GT for feeds? 2. When was the GT removed? 3. Did your child have any GT related complications? All clinical and phone interview data was collected in a pre-designed data collection tool that was then deposited in a secure password protected web-based electronic database with de-identification capabilities to protect patients and families (REDCap, Vanderbilt University). [21] If a parent or LAR could not be reached for phone interview, the patient was excluded from the study. The summary of descriptive data presented as percentages, Mean±SD, and Median with range.

3. Results

A total of 111 infants with GT placement were identified during the study period. Of these, 60 (54%) had standard (hard) indications for GT placement and were excluded. The remaining 51 infants (46%) were categorized as having soft indications for GT placement. In this group, one infant died prior to discharge due to a cause unrelated to GT placement and was included in demographic data but excluded from final analysis. The remaining 50 infants were included in the study and their families were contacted by phone for interview. Mean gestational age of the cohort was 35.9±4.6 weeks. Median age at GT placement was 370 days (173-1180). The mean days of PO trial prior to GT placement was 41±30.2 days, average oral intake at the time of GT placement was 32%, and mean age at GT placement was 75±42 days in this cohort. Mean length of G-tube feeds was 403.4±390.7 days. Five infants died after discharge (10%) and of these, 4 died < 3 months after GTP, with no deaths related to GT placement.

Table 1 describes GT placement according to diagnosis, duration of PO trial prior to GT, and time to full feeds after GT placement. Two distinct groups were identified: the first, infants that reached full PO feeds at < 90 days after GT placement (average 48.4 days) and the second, those that reached this goal at > 400 days (average 530.3 days). The first group includes infants with isolated cardiac conditions, uncomplicated prematurity, gastroschisis, infants of diabetic mothers, and isolated Pierre Robin sequence with no associated nasal issues. The second group of infants represents a more complex cohort that requires prolonged use of GT and includes: infants with dysmorphology associated with genetic anomalies and syndromes, CHD with genetic anomalies, complicated prematurity, gastro-esophageal reflux disease (GERD), and aspiration. Table 2 depicts infants according to diagnosis that reached full PO feeds < 90 days after GTP. Infants diagnosed with complex CHD and an associated genetic diagnosis who developed post-operative oral aversion and those with moderate to severe neurologic impairment were the least likely to reach

this goal.

Table 1. *Gastric tube placement by diagnosis, per oral trial, and time to full per oral feeds.*

Diagnoses	Number of patients	Average days of PO trial prior to GT	Days of GT use until full PO feeds
CHD	17	77	414
Isolated cardiac conditions	5	55	67
CHD with gene defects	12	45	495
Dysmorphology	20	39	593
Syndromes	9	31	633
Gene defects	11	47	553
Isolated Prematurity	3	63	33
Complicated Prematurity	4	66	444
Infant of diabetic mother	4	56	48
Gastroschisis	3	26	43
GERD	10	26	428
Aspiration only	5	27	629
Isolated PRS	4	29	51

CHD, congenital heart disease; GERD, gastro-esophageal reflux disease, PRS, Pierre Robin Sequence.

Table 2. *Duration of Gavage Feeds by Diagnosis.*

Diagnosis	Gavage feeds <90 days
All	15/50 (30%)
Uncomplicated Prematurity + oral aversion	2/2 (100%)
Non-syndromic PRS	4/4/ (100%)
Infant of Diabetic Mother	3/4 (75%)
Gastrointestinal conditions	3/4 (75%)
Complex CHD with post-op oral aversion	3/10 (30%)
Moderate to severe Neurological conditions	0/13 (0%)

PRS, Pierre Robin Sequence; CHD, congenital heart disease; post-op, post-operation.

At the time of phone interview, only 16/50 (32%) of infants in the cohort had their GT removed and only 27/50 (54%) had reached full PO feeds. Infants diagnosed with variable degrees of aspiration by video-fluoroscopic swallow study were gavage fed for prolonged periods of time with only 1/5 (20%) reaching full oral feeds at 24 months after discharge. Only 1/8 (12.5%) with confirmed genetic conditions reached full oral feeds less than 150 days after discharge. Two infants with a diagnosis of congenital diaphragmatic hernia and one patient with end stage renal disease (ESRD) continued to need GT for nutrition at the time of parental interview. The average time of GT removal was 208 days after reaching full oral feeds. Overall, 72.5% of the cohort developed complications with the majority occurring post-discharge (56%). Infection and leakage accounted for 53% of all complications. A significant drop in percentage of PO feeds was observed in these infants after GTP. The number of infants tolerating 50-75% of PO feeds prior to GTP was 11/50 [22%] as compared to 4/50 [8%] after GTP. Variables identified that may affect compliance with HNGF include: parental education, willingness to participate, distance from home to hospital (median of 52 miles [5-160]), difficulties with transport 3/50 (6%), substance abuse 5/51 (9.8%), and low income 23/51 (45%).

4. Discussion

To our knowledge, this is the first study to explore the potential use of HNGF in a selected group of infants with non-traditional indications for GT placement. This study identified a select cohort of patients with variable diagnoses who were submitted to GTP but could have been considered potential candidates for home NG feeds due to the relatively short interval of time between GT placement and reaching full PO feeds. GT placement has been associated with both fatal and non-fatal complications, need for corrective surgeries, including removal of GT after full oral feeds are established which as shown in this study may be as long as 7 months. [8-13] Pediatric surgeons by protocol leave GTs in place for 3-6 months after the infant has reached full per oral feeds potentially increasing the risk of complications. Our study identified a significant number of both inpatient and outpatient complications associated with prolonged GT placement, although none were considered fatal. We also observed a drop in PO feeds after GT placement that may be explained in part by the ease of administration of GT feeds versus PO feeds.

Concerns with the possibility of aspiration at home due to inadequate NG tube management by the parent or LAR has been a major factor limiting research and use of HNGF as a reasonable alternative to GTP. Non-availability of quality improvement or randomized controlled studies with standardized parental education and training protocols for the administration of HNGF versus GT feeds have been conducted to date. Separating GTP infants into traditional and non-traditional indications for GT placement allowed us to determine a subcategory of infants that with appropriate education and training may avoid the more invasive GTP while decreasing the risk of aspiration. Other variables of importance to be considered are the willingness of parents to participate in administering HNGF and barriers to health access. This may include transportation issues, and social concerns that may affect compliance such as drug abuse and physical abuse. From an institutional perspective, administrators need to support the development of an outpatient clinic that maintains ongoing contact with the families of infants on HNGF, and schedules regular appointments to verify adequate growth and development.

Based on the objective data obtained in this study, we have designed an algorithm for the administration of HNGF (Figure 1). Infants identified as potential candidates for this intervention will be enrolled in a quality improvement initiative and followed prospectively in a 'HNGF' clinic where the gastroenterologist, speech and occupational therapists, and nutrition specialists work together to coordinate and manage the care of these infants and support their families until full PO feeds are reached. A strong educational component, enhanced training of the parents, and availability of a 'feeding clinic' is considered key to the success of HNGF. Future randomized controlled trials may use this algorithm to compare the use of HNGF to GT feeds to determine efficacy and safety of these interventions. An important limitation of our study is the single center design, but this study was done in a level 4-referral neonatal intensive care unit with a spectrum of complex patients and disease seen in neonatal units of similar characteristics, which supports the generalizability of our observations.

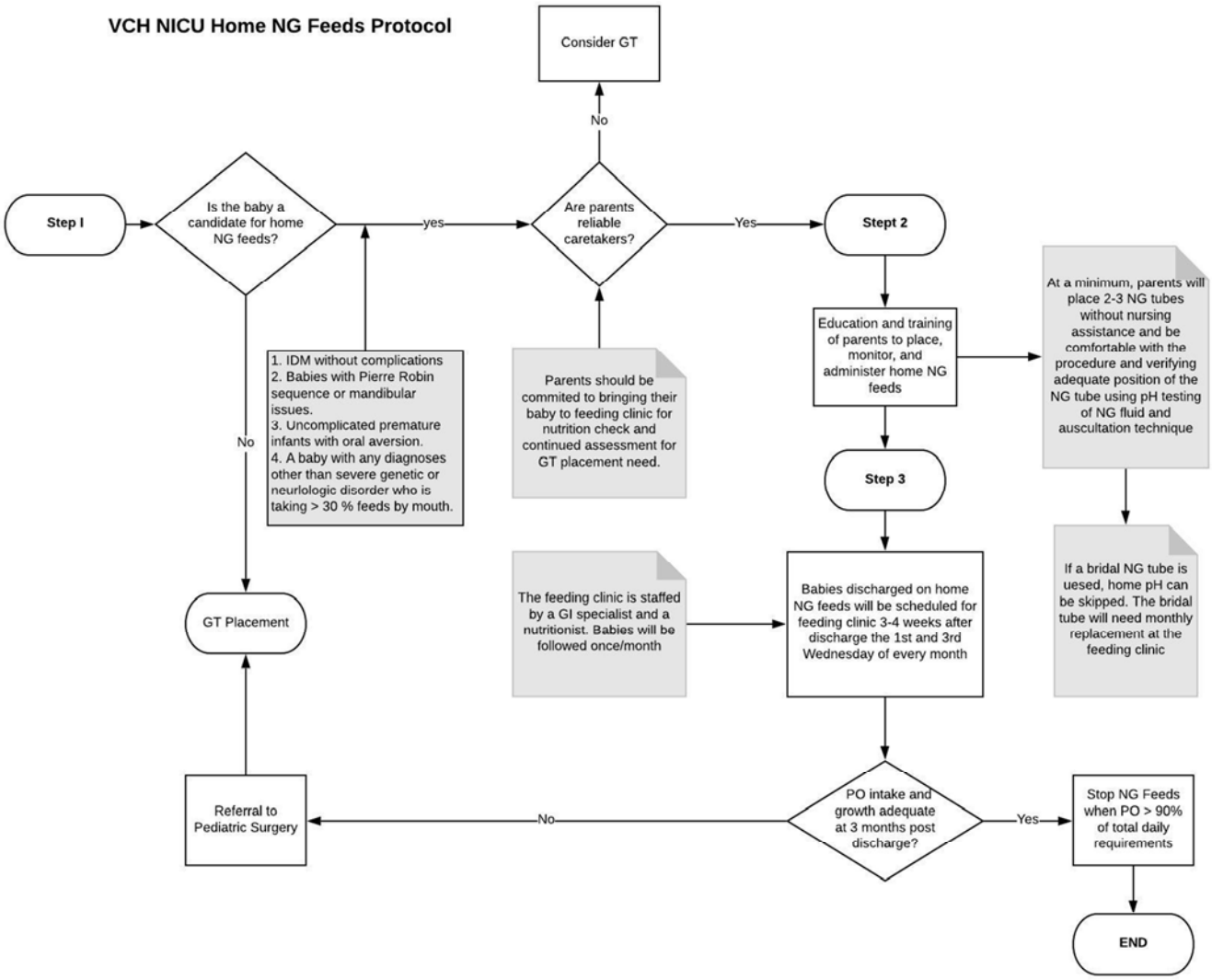

Figure 1. *VCH Home NG feeding protocol.*

5. Conclusion

This study identifies a select group of infants with feeding problems that may benefit from HNGF by decreasing hospitalization time, GT exposure, and GT related complications. HNGF has the potential to promote more parental engagement with PO feeds, shorten time to home NG tube removal while decreasing the risk of aspiration. Well designed and powered randomized controlled trials controlled trials comparing these two modes of feeding infants are required to determine efficacy and safe.

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