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Stabilization of Nasoenteric Feeding Tubes Using Nasal Bridles In Paediatric Patients

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Abstract

Purpose: To determine if routine bridling of nasoenteric feeding tubes is a low-morbidity method of decreasing unintended tube dislodgement in pediatric patients.

Methods: From November 2012 to June 2015, bridle systems were implemented in 30 pediatric patients with nasoenteric feeding tubes in place for an extended period of time, and data was prospectively collected. Historical cohort controls were 33 tracheoesophageal fistula (TEF) repair patients with taped nasoenteric tubes from 2001 to 2012. A second control group was 20 patients with nasoenteric tubes placed under fluoroscopy from February 2012 to July 2013. Analysis compared bridled children with these 2 groups to look at differences in total number tube dislodgements and tube dislodgements per 100 days. Complications related to bridle use were noted.

Results: Among the 30 bridled patients, only 4 tube dislodgements were recorded in 1553 total days a tube was in place. During each of these instances, the bridle remained in place. There was a significant association between experimental group and total number tube dislodgements: only 3 of 30 bridled patients experienced tube dislodgements, compared to 18 of 33 TEF patients ($p=0.0006$) and 9 of 20 patients with fluoroscopically placed tubes ($p=0.021$). Children with bridled tubes experienced a lower rate of tube dislodgements per 100 days than TEF children with taped tubes ($p<0.0001$) and children with fluoroscopically placed taped tubes ($p<0.0001$). Aside from one child presenting with septum erosion and one report of patient fussiness, no complications related to bridle use were identified.

Conclusion: We conclude that bridling of nasoenteric feeding tubes provides a safe and effective method of decreasing unintended tube dislodgement and optimizing nutritional delivery in pediatric patients.

Keywords: Bridle; Nasoenteric; Feeding tube

Introduction

Accidental removal of nasoenteric feeding tubes leads to delays in nutritional support and to multiple tube replacements which put patients at risk for aspiration, radiation exposure, and complications such as inadvertent tracheal intubation, intestinal perforation, or pneumothorax. Feeding tube dislodgement also consumes hospital resources through the added cost of time replacing tubes, the cost of the feeding tube itself, and radiographic confirmation studies [1-3]. The traditional method of securing feeding tubes to the patient's face with adhesive tape is relatively ineffective, with an incidence of unintended tube removal as high as 62% [4-6]. One previously reported alternative technique for securing nasoenteric feeding tubes uses a nasal bridle involving an anchor placed around the vomer bone or nasal septum with both ends secured to the nasoenteric tube near the nares [7-10]. Various methods of bridling exist. The Applied Medical Technology (AMT) Nasal Bridle System innovatively uses a magnetic retrieval system attached to umbilical tape as an anchor, which is then clipped to the feeding tube [11] (Figure 1).

Previous studies suggest that, when compared to the traditional method of adhesive tape, bridling nasoenteric feeding tubes reduces tube dislodgements, thereby optimizing nutrition through improved caloric intake and reducing cost of nasal tube replacement [11-25]. While these studies show effectiveness of bridle use in adults, little current literature addresses their use in children [26]. The purpose of this study is to determine if routine bridling of nasoenteric feeding tubes is a safe and effective method of decreasing unintended nasoenteric tube dislodgement in paediatric patients.

Material and Methods

This study was approved by University of Nebraska Medical Center Institutional Review Board for the Protection of Human Subjects (IRB 257-13-EP). Informed consent was obtained for prospective data collection on bridled patients. Informed consent was waived for historical cohort controls given the retrospective nature of the data collection. Research was funded solely by University of Nebraska Medical Center. Bridles were provided free of charge by AMT, Inc.

Patient population and data collection

Research design involved a prospective implementation study with retrospective cohort data collection conducted at Children's Hospital and Medical Center and University of Nebraska Medical Center, as a single pediatric surgical practice provides care to both neonatal intensive care units (NICUs). From November 2012 to June 2015, AMT Nasal Bridle Systems were implemented in 30 pediatric patients with nasoenteric feeding tubes in place for an extended period of time. The charts of these patients were reviewed and data was prospectively

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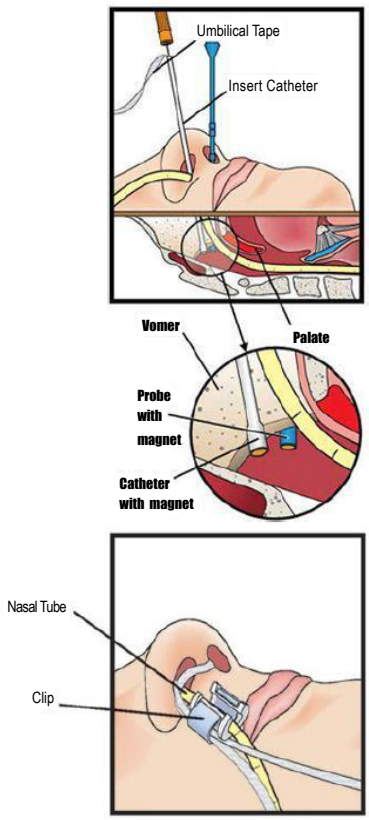

Figure 1: Birdle Insertion.

collected. Explanatory variables include method used to secure feeding tube, weight and age at tube placement, and demographic information. Response variables include number of tube placements, duration each tube stayed in place, number of unintended tube dislodgements, days on total parenteral nutrition, and number of x-ray and fluoroscopy studies required for tube placement. Complications related to bridle use were noted.

Case-control selection

Children with bridle systems in place to secure nasoenteric feeding tubes were compared with a historical cohort control group of 33 tracheoesophageal fistula (TEF) repair patients with taped nasoenteric tubes from 2001 to 2012. A second control group was 20 patients with taped nasoenteric tubes placed under fluoroscopy from February 2012 to July 2013.

Statistical analysis

Analysis compared bridled children with each group of patients with taped nasoenteric tubes to look at differences in total number tube dislodgements and rate of tube dislodgements per 100 days. Fisher's exact test was used to compare the distribution of tube dislodgement between the 3 groups and then used for pairwise comparisons (i.e., Bridled group versus TEF group, Bridle group versus fluoroscopy group). P-values were adjusted for the pairwise comparisons using the Bonferroni method. Poisson regression model was used to determine the rate of tube pulls per day as a function of group. Tukey's method was used to conduct pairwise comparisons of the mean rate of tube pulls per day between groups. A p-value<0.05 was considered statistically significant.

Results

Demographics

Bridle systems were implemented in 19 male and 11 female children. Average weight at bridle placement was 8.1 kg (median: 4.0 kg, range: 1.2 kg-108.2 kg), and average age at placement was 121 days (median: 57 days, range: 1 day-18 years). Bridles were placed on children with a range of diagnoses including poor oral skills/feeding difficulties, TEFs, omphaloceles, gastroesophageal reflux, esophageal atresia, gastroschisis, and abdominal ascites. Gender distribution and average weight and age at placement did not vary significantly between the bridled group and either nonbridled group.

Bridle complications

One child with a bridled tube in place at home for an extended period of time presented at a monthly follow-up appointment with a dislodged tube due to movement of the bridle clip farther from the nares than at original placement. Upon further inspection, the umbilical tape of the bridle had eroded one centimeter of the posterior septum. Aside from this incident and one report of fussiness which improved after bridle removal, no other bridle complications were identified.

Tube dislodgements

Among the 30 bridled patients, only 4 tube dislodgements were recorded in 1553 total days, with 2 of these instances occurring in the same child. During each of these instances, the tube came out the mouth after retching but the bridle remained in place. Thus, 3 of 30 bridled patients experienced tube dislodgements. Eighteen of 33 TEF patients and 9 of 20 patients with fluoroscopically placed tubes experienced dislodgements. Statistical analysis shows a significant association between bridle use and decreased incidents of tube dislodgement ($p=0.0004$). Specifically, fewer tube dislodgements occurred among children with bridled tubes when compared to TEF children with taped tubes ($p=0.0006$) and to children with fluoroscopically placed taped tubes ($p=0.021$).

Comparison between groups of number of tube dislodgements per 100 days showed statistically significant differences between bridled children versus children in each control group. The estimated rate of tube dislodgements per 100 days is 0.26 for the bridle group (95%CI: 0.005, 0.51). This differs significantly from an estimated rate of 2.62 dislodgements per 100 days in the group with fluoroscopically placed taped tubes ($p<0.0001$) and 5.12 dislodgments per 100 days in the TEF group with taped tubes ($p<0.0001$). We also noted the duration each individual tube remained in place until an unintended dislodgement. For the bridled group, the average duration was 41.9 days (median: 35 days). For the group with fluoroscopically placed taped tubes, the average duration was 11.4 days (median: 6). For the TEF group with taped tubes, the average duration was 10.6 days (median: 8).

Discussion

Our results support existing literature in adults which suggests that securing nasoenteric feeding tubes with bridles instead of traditional adhesive tape significantly reduces unintended tube dislodgement [11-25]. Various techniques and materials exist for placing and securing nasal bridles. In 2009, the new AMT Nasal Bridle System first appeared in the medical literature presenting an innovative method using magnets passed within the nasopharynx to loop umbilical tape around the vomer bone [5,22]. This novel technique offers relatively easy and quick placement without needing patient sedation [11]. Although

many studies show bridles effectively secure feeding tubes in adults, few investigators have looked at use of bridles in children. In a case study of one child with facial blistering secondary to toxic epidermal necrolysis, Rooney found that, of several techniques, nasal bridling was the simplest and safest for effectively securing a feeding tube in the child [26].

We specifically examined the use of the AMT Nasal Bridle System in children, comparing them with two different cohorts of controls with taped tubes. We used children who underwent TEF repair as one control group because these patients have a nasoenteric feeding tube placed during surgical repair. It is especially important that this tube remain in place because it cannot be replaced if inadvertently removed. Despite being in the closely monitored environment of the Neonatal Intensive Care Unit, there was still a high rate of tube dislodgement among this group. We used children with fluoroscopically placed nasoenteric tubes as a second control group because fluoroscopy studies are expensive and increase the patient's risk of radiation exposure, making multiple tube placements costly and undesirable.

The control group of TEF patients likely provides an underestimate of the difference in tube dislodgements between taped versus bridled feeding tubes. The TEF control group patients were monitored closely by nurses and trained staff in a hospital setting. In contrast, many patients in the bridled group were monitored by parents at home for long periods of time. Since use of the bridle was associated with a significant reduction in tube dislodgement when compared to taped tubes used only in closely monitored patients, the difference in tube dislodgement is likely more pronounced if compared to the total population of patients with taped nasoenteric feeding tubes.

While both control groups showed a significant decrease in tube dislodgements per 100 days, the tube dislodgement rate varied between control groups (2.62 per 100 days in TEF group with taped tubes versus 5.12 per 100 days in group with fluoroscopically placed taped tubes). We suspect this variance is due to the majority of patients in the group with fluoroscopically placed taped tubes who went home with nasoenteric tubes and experienced dislodgements while outpatient. As previously stated, patients in the TEF group had taped nasoenteric tubes in place while inpatient in a closely monitored environment following their TEF repair. Therefore, we believe the greater reduction in tube dislodgements evident when comparing the bridled group to the control group with fluoroscopically placed taped tubes suggests the bridle may provide the most beneficial effect for patients in need of nasoenteric feeding tubes while outpatient. The results of our study showing the bridle's effectiveness at securing feeding tubes in the home environment supports bridling as a solution for concerns related to at-home placement of feeding tubes. As placement of nasoenteric feeding tubes can be both challenging and time-consuming, in-hospital placement procedures generally require x-ray confirmation of correct positioning and often involve expensive endoscopic or fluoroscopic guidance. Misplacement of nasoenteric feeding tubes may result in increased risk of aspiration or inadvertent administration of formula into the lung [18,27,28]. Consequently, dislodgement of feeding tubes in patients at home often requires additional trips to the hospital to obtain abdominal radiographs for tube placement verification, resulting in an increased burden on families and invariable gaps in nutritional support [27,28]. Additionally, with the current strong effort in pediatrics to avoid radiation exposure in children, bridling nasoenteric feeding tubes has the potential to reduce the number of repeated radiographic confirmation studies often required to verify proper placement after unintended tube dislodgement [11,21,27].

Based on our experience with this study, we suggest that bridles are particularly beneficial for patients sent home with nasoenteric tubes, especially with standardized monitoring practices in place. In light of the patient in our study who presented with an eroded septum from the bridle tape, we recommend that patients sent home with bridled tubes attend a monthly hospital visit to check position of the clip and to ensure there has been no tube dislodgement or erosion of the septum. We also recommend changing the tube every other month and changing the bridle at 3 months, at this point discussing the option of a permanent tube.

Other than the eroded septum incident and the one report of patient fussiness which improved upon bridle removal, we found no complications related to bridle use and observed no increase in patient discomfort. However, other studies suggest a higher rate of skin complications, such as erythema or ulcerations, associated with bridle use when compared to traditional adhesive tape [4,6,18,22,23]. Additionally, two studies report cases of an avulsed bridle system insertion stylet or magnet presenting as an intranasal foreign body [29,30]. Incidence of sinusitis has not been found to differ between bridled and taped tubes [4,18,23]. Limitations to this study include small sample size and comparison to cohort groups containing different numbers of patients.

Conclusion

We report the first study of bridle use to secure nasoenteric feeding tubes in children. Our results corroborate existing literature related to bridle use in adults by showing that bridles reduce the total number of tube dislodgements and the rate of tube dislodgements per 100 days. We conclude that bridling of nasoenteric feeding tubes provides a safe and effective method of decreasing unintended tube dislodgement and optimizing nutritional delivery in paediatric patients.

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