The Use of Nasogastric Tube Bridle Kits in COVID-19 Intensive Care Unit Patients

Rajveer Atkar, MBBS, Bryce Clark, MB, ChB, Matthew Eskell, MB, ChB, and Mohammed Asif Arshad, MB, BChir

Objective: To ascertain the extent of nasogastric tube (NGT) dislodgment in COVID-19 intensive care unit (ICU) patients after the introduction of NGT bridle kits as a standard of practice, to see whether this would reduce the number of NGT insertions, patient irradiation, missed feeds, and overall cost.

Background: Nasogastric feeding is the mainstay of enteral feeding for ICU patients. The usual standard of practice is to secure the tube using adhesive tape. Studies show this method has a 40% to 48% dislodgment rate. The COVID-19 ICU patient population may be at even greater risk due to the need for proning, long duration of invasive ventilation, and emergence delirium.

Design: This was a 2-cycle quality improvement project. The first cycle was done retrospectively, looking at the contemporaneous standard of practice where bridle kits were not used. This gave an objective measure of the extent of NGT displacement, associated costs, and missed feeds. The second cycle was carried out prospectively, with the use of NGT bridle kits as the new standard of practice.

Setting: A large United Kingdom teaching hospital with a 100-bed, single-floor ICU.

Participants: Patients admitted to the ICU with COVID-19 who subsequently required sedation and invasive ventilation.

Measurements: Measurements included days of feeding required, hours of feeding missed due to NGT dislodgment, total number of nasogastric tubes required per ICU stay, and number of chest radiographs for NGT position confirmation. NGT-related pressure sores were also recorded.

Results: When compared to the bridled group, the unbridled group required a higher number of NGTs (2.5 vs 1.3; $P < .001$) and chest radiographs (3.4 vs 1.6; $P < .001$), had more hours of feeding missed (11.8 vs 5.0), and accumulated a slightly higher total cost (cost of NGT, chest radiographs +/- bridle kit: £211.67 vs £210, [US $284.25 vs US $282.01]).

Conclusions: The use of NGT bridle kits reduces the number of NGT insertions patients require and subsequently reduces the number of chest radiographs for each patient. These patients also miss fewer feeds, with no appreciable increase in cost.

Keywords: nasogastric, bridle, enteral, COVID-19, intensive care, quality improvement, safety.

The COVID-19 pandemic has led to a large influx of patients to critical care units in the United Kingdom (UK) and across the world. Figures from the Intensive Care National Audit & Research Centre in May 2020 show that the median length of stay for COVID-19 survivors requiring invasive ventilatory support while on the intensive care unit (ICU) was 15 days.[1] For these days at the very least, patients are completely reliant on enteral feeding in order to meet their nutritional requirements. The standard method of enteral feeding when a patient is sedated and ventilated is via a nasogastric tube (NGT). Incorrect placement of an NGT can have devastating consequences, including pneumothorax, fistula formation, ulceration, sepsis, and death. Between September 2011 and March 2016, the National Patient Safety Agency in the UK recorded 95 incidents of feeding into the respiratory tract as a result of incorrect NGT placement.[2] With the onset of the pandemic, the prevalence of NGT misplacement increased, with the NHS Improvement team reporting 7 cases of misplaced NGTs within just 3 months (April 1, 2020, through June 30, 2020).[3] With over 3 million nasogastric or orogastric tubes inserted each year in the UK, the risk of adverse events is very real.

From Queen Elizabeth Hospital Birmingham, Mindelsohn Way, Birmingham, United Kingdom.

NGT dislodgment is common, with 1 study putting this figure at 40%.[4] Recurrent dislodgment of NGTs disrupts nutrition and may lead to the patient missing a feed in a time where nutrition is vital during acute illness. Research has showed that NGT bridling reduces the rate of dislodgment significantly (from 40% to 14%).[5] Moreover, a 2018 systematic review looking specifically at NGT dislodgment found 10 out of 11 studies showed a significant reduction in dislodgment following use of a bridle kit.[6] Bridling an NGT has been shown to significantly reduce the need for percutaneous endoscopic gastrostomy insertion.[7] NGT bridle kits have already been used successfully in ICU burn patients, where sloughed skin makes securement particularly difficult with traditional methods.[8] With each repeated insertion comes the risk of incorrect placement. COVID-19 ICU patients had specific risk factors for their NGTs becoming dislodged: duration of NGT feeding (in the ICU and on the ward), requirement for proning and de-proning, and post-emergence confusion related to long duration of sedation. Repeated NGT insertion comes with potential risks to the patient and staff, as well as a financial cost. Patient-specific risks include potential for incorrect placement, missed feedings, irradiation (from the patient's own chest radiograph and from others), and discomfort from manual handling and repeat reinsertions. Staff risk factors include radiation scatter from portable radiographs (especially when dealing with more than 1 patient per bed space), manual handling, and increased pressure on radiographers. Finally, financial costs are related to the NGTs themselves as well as the portable chest radiograph, which our Superintendent Radiographer estimates to be £55 (US $73.86).

The objective of this study was to ascertain the extent of NGT dislodgment in COVID-19 ICU patients after the introduction of NGT bridle kits as a standard of practice and to determine whether this would reduce the number of NGT insertions, patient irradiation, missed feedings, and overall costs. With the introduction of bridle kits, incidence of pressure sores related to the bridle kit were also recorded.

Methods

Data were collected over 2 cycles, the first retrospectively and the second prospectively, once NGT bridle kits were introduced as an intervention.

Cycle 1. Analyzing the current standard of practice: regular NGT insertion with no use of bridle kit

Cycle 1 was done retrospectively, looking at 30 patient notes of COVID-19 patients admitted to the critical care unit (CCU) between March 11, 2020, and April 20, 2020, at Queen Elizabeth Hospital Birmingham, Birmingham, UK. All patients admitted to the ICU with COVID-19 requiring invasive ventilation were eligible for inclusion in the study. A total of 32 patients were admitted during this time; however, 2 patients were excluded due to NGTs being inserted prior to ICU admission.

Individual patient notes were searched for:

- days of feeding required during their inpatient stay (this included NGT feeding on the ward post-ICU discharge).
- hours of feeding missed while waiting for NGT reinsertion or chest radiograph due to dislodged or displaced NGTs (during the entire period of enteral feeding, ICU, and ward).
- number of NGT insertions.
- number of chest radiographs purely for NGT position.

Each patient's first day of feeding and NGT insertion were noted. Following that, the patient electronic note system, the Prescribing Information and Communication System, was used to look for any further chest radiograph requests, which were primarily for NGT position. Using the date and time, the "critical care observations" tab was used to look at fluids and to calculate how long NGT feeding was stopped while NGT position-check x-rays were being awaited. The notes were also checked at this date and time to work out whether a new NGT was inserted or whether an existing tube had been dislodged (if not evident from the x-ray request). Data collection was stopped once either of the following occurred:

- patient no longer required NGT feeding.
- patient was transferred to another hospital.
- death.

The cost of the NGT was averaged between the cost of size 8 and 12, which worked out to be £10 (US $13.43). As mentioned earlier, each radiograph cost was determined by the Superintendent Radiographer (£55).

Table. **NGTs and CXRs Required Before and After Introduction of Bridle Kit**

	Cycle 1 NGT, no bridle[a] (n=30)		Cycle 2 NGT + bridle kit[b] (n=31)		*P* value[c]
	Mean	SD	Mean	SD	
Days of NGT feeding required	23.4	10.8	17.5	12.0	
No. of NGTs required	2.5	1.6	1.3	0.5	<.01
No. of CXRs required for NGT position	3.4	2.5	1.6	0.6	<.01
Hours of feeding missed due to NGT displacement/ reinsertion	11.8	10.9	5.0	14.5	
Total cost (includes cost of radiographs[d] + NGT[e] +/- bridle kit[f])	£211.7 (US $284.29)	£147.7 (US $198.35)	£210 (US $282.01)	£40.8 (US $54.79)	

[a]Documented pressure sores in nonbridle group: 2.
[b]Documented pressure sores in bridle group: 1.
[c]Calculated using *t*-test.
[d]Cost of portable chest radiograph: £55 (US $73.86).
[e]Cost of NGT: £10 (US $13.43).
[f]Cost of bridle kit: £109 (US $146.38).
CXR, chest x-ray; NGT, nasogastric tube.

Cycle 2. Implementing a change: introduction of NGT bridle kit (Applied Medical Technology Bridle) as standard of practice

The case notes of 54 patients admitted to the COVID-19 CCU at the Queen Elizabeth Hospital Birmingham, Birmingham, UK, were retrospectively reviewed between February 8, 2021, and April 17, 2021. The inclusion criteria consisted of: admitted to the CCU due to COVID-19, required NGT feeding, and was bridled on admission. Case notes were retrospectively reviewed for:

- Length of CCU stay
- Days of feeding required during the hospital stay
- Hours of feeding missed while waiting for a chest radiograph due to displaced NGTs
- Number of NGT insertions
- Number of chest radiographs to confirm NGT position
- Bridling of NGTs
- Documented pressure sores related to the bridle or NGT, or referrals for wound management advice (Tissue Viability Team) as a consequence of the NGT bridle

Results

Of the 54 patients admitted, 31 had their NGTs bridled. Data were collected as in the first cycle, with individual notes analyzed on the online system (**Table**). Additionally, notes were reviewed for documentation of pressure sores related to NGT bridling, and the "requests" tab as well as the "noting" function were used to identify referrals for "Wound Management Advice" (Tissue Viability Review).

The average length of stay for this ICU cohort was 17.6 days. This reiterates the reliance on NGT feeding of patients admitted to the CCU. The results from this project can be summarized as follows: The use of NGT bridle kits leads to a significant reduction in the total number of NGTs a patient requires during intensive care. As a result, there is a significant reduction in the number of chest radiographs required to confirm NGT position. Feedings missed can also be reduced by using a bridle kit. These advantages all come with no additional cost.

On average, bridled patients required 1.3 NGTs, compared to 2.5 before bridles were introduced. The fewer NGTs inserted, the less chance of an NGT-associated injury occurring.

The number of chest radiographs required to confirm NGT position after resiting also fell, from 3.4 to 1.6. This has numerous advantages. There is a financial savings of £99 (US $133.04) per patient from the reduced number of chest x-rays. Although this does not offset the price of the bridle kit itself, there are other less easily quantifiable costs that are reduced. For instance, patients are highly catabolic during severe infection, and their predominant energy source comes from their feedings. Missed feedings are associated with longer length of stay in the ICU and in the hospital in general.[9] Bridle kits have the potential to reduce the number of missed feedings by ensuring the NGT remains in the correct position.

Discussion

Many of the results are aligned with what is already known in the literature. A meta-analysis from 2014 concluded that dislodgment is reduced with the use of a bridle kit.[6] This change is what underpins many of the advantages seen, as an NGT that stays in place means additional radiographs are not required and feeding is not delayed.

COVID-19 critical care patients are very fragile and are dependent on ventilators for the majority of their stay. They are often on very high levels of ventilator support and moving the patient can lead to desaturation or difficulties in ventilation. Therefore, reduction in any manual handling occurring as a result of the need for portable chest radiographs minimizes the chances of further negative events. Furthermore, nursing staff, along with the radiographers, are often the ones who must move these patients in order for the x-ray film to be placed behind the patient. This task is not easy, especially with limited personnel, and has the potential to cause injuries to both patients and staff members.

The knock-on effect of reduced NGTs and x-rays is also a reduction of work for the portable radiography team, in what is a very time- and resource-consuming process of coming onto the COVID-19 CCU. Not only does the machine itself need to be wiped down thoroughly after use, but also the individual must use personal protective equipment (PPE) each time. There is a cost associated with PPE itself, as well as the time it takes to don and doff appropriately.

A reduction in chest radiographs reduces the irradiation of the patient and the potential irradiation of staff members. With bridling of the NGT, the radiation exposure is more than halved for the patient. Because the COVID ICU is often very busy, with patients in some cases being doubled up in a bed space, the scatter radiation is high. This can be reduced if fewer chest radiographs are required.

An additional benefit of a reduction in the mean number of NGT insertions per patient is also illustrated by anecdotal evidence. Over the studied period, we identified 2 traumatic pneumothoraces related to NGT insertion on the COVID-19 CCU, highlighting the potential risks of NGT insertion and the need to reduce its frequency, if possible.

One concern noted was that bridles could cause increased incidence of pressure sores. In the patients represented in this study, only 1 suffered a pressure sore (grade 2) directly related to the bridle. A subpopulation of patients not bridled was also noted. This was significantly smaller than the main group; however, we had noted 2 incidences of pressure sores from their standard NGT and securement devices. Some studies have alluded to the potential for increased skin complications with bridle kits; however, studies looking specifically at kits using umbilical tape (as in this study) show no significant increase in skin damage.[10] This leaves us confident that there is no increased risk of pressure sores related to the bridling of patients when umbilical tape is used with the bridle kit.

NGT bridles require training to insert safely. With the introduction of bridling, our hospital's nursing staff underwent training in order to be proficient with the bridle kits. This comes with a time commitment, and, like other equipment usage, it takes time to build confidence. However, in this study, there were no concerns raised from nursing staff regarding difficulty of insertion or the time taken to do so.

Our study adds an objective measure of the benefits provided by bridle kits. Not only was there a reduction in the number of NGT insertions required, but we were also able to show a significant reduction in the number of chest radiographs required as well in the amount of time feeding is missed. While apprehension regarding bridle kits may be focused on cost, this study has shown that the savings more than make up for the initial cost of the kit itself.

Although the patient demographics, systemic effects, and treatment of COVID-19 are similar between different ICUs, a single-center study does have limitations. One of these is the potential for an intervention in a single-center study to lead to a larger effect than that of multicenter studies.[11] But as seen in previous studies, the dislodgment of NGTs is not just an issue in this ICU.[12] COVID-19–specific risk factors for NGT dislodgment also apply to all patients requiring invasive ventilation and proning.

Identification of whether a new NGT was inserted, or whether the existing NGT was replaced following dislodging of an NGT, relied on accurate documentation by the relevant staff. The case notes did not always make this explicitly clear. Unlike other procedures commonly performed, documentation of NGT insertion is not formally done under the procedures heading, and, on occasion is not done at all. We recognize that manually searching notes only yields NGT insertions that have been formally documented. There is a potential for the number recorded to be lower than the actual number of NGTs inserted. However, when x-ray requests are cross-referenced with the notes, there is a significant degree of confidence that the vast majority of insertions are picked up.

One patient identified in the study required a Ryle's tube as part of their critical care treatment. While similar in nature to an NGT, these are unable to fit into a bridle and are at increased risk of dislodging during the patient's critical care stay. The intended benefit of the bridle kit does not therefore extend to patients with Ryle's tubes.

Conclusion

The COVID-19 critical care population requires significant time on invasive ventilation and remains dependent on NGT feeding during this process. The risk of NGT dislodgment can be mitigated by using a bridle kit, as the number of NGT insertions a patient requires is significantly reduced. Not only does this reduce the risk of inadvertent misplacement but also has a cost savings, as well as increasing safety for staff and patients. From this study, the risk of pressure injuries is not significant. The benefit of NGT bridling may be extended to other non-COVID long-stay ICU patients.

Future research looking at the efficacy of bridle kits in larger patient groups will help confirm the benefits seen in this study and will also provide better information with regard to any long-term complications associated with bridles.

Corresponding author: Rajveer Atkar, MBBS, Queen Elizabeth Hospital Birmingham, Mindelsohn Way, Birmingham B15 2GW, United Kingdom; r.atkar@nhs.net.

Financial disclosures: None.

doi:10.12788/jcom.0072

References

1. Intensive Care National Audit & Research Centre. ICNARC report on COVID-19 in critical care 15 May 2020. https://www.icnarc.org/DataServices/Attachments/Download/cbcb6217-f698-ea11-9125-00505601089b
2. NHS. Nasogastric tube misplacement: continuing risk of death and severe harm. July 22, 2016. https://www.england.nhs.uk/2016/07/nasogastric-tube-misplacement-continuing-risk-of-death-severe-harm/
3. NHS. Provisional publication of never events reported as occurring between 1 April and 30 June 2020. https://www.england.nhs.uk/wp-content/uploads/2020/08/Provisional_publication_-_NE_1_April_-_30_June_2020.pdf
4. Meer JA. Inadvertent dislodgement of nasoenteral feeding tubes: incidence and prevention. *JPEN J Parenter Enteral Nutr*. 1987;11(2):187- 189. doi:10.1177/0148607187011002187
5. Bechtold ML, Nguyen DL, Palmer L, et al. Nasal bridles for securing nasoenteric tubes: a meta-analysis. *Nutr Clin Pract*. 2014;29(5):667-671. doi:10.1177/0884533614536737
6. Lynch A, Tang CS, Jeganathan LS, Rockey JG. A systematic review of the effectiveness and complications of using nasal bridles to secure nasoenteral feeding tubes. *Aust J Otolaryngol*. 2018;1:8. doi:10.21037/ajo.2018.01.01
7. Johnston R, O'Dell L, Patrick M, Cole OT, Cunliffe N. Outcome of patients fed via a nasogastric tube retained with a bridle loop: Do bridle loops reduce the requirement for percutaneous endoscopic gastrostomy insertion and 30-day mortality? *Proc Nutr Soc*. 2008;67:E116. doi:10.1017/S0029665108007489
8. Li AY, Rustad KC, Long C, et al. Reduced incidence of feeding tube dislodgement and missed feeds in burn patients with nasal bridle securement. *Burns*. 2018;44(5):1203-1209. doi:10.1016/j.burns.2017.05.025
9. Peev MP, Yeh DD, Quraishi SA, et al. Causes and consequences of interrupted enteral nutrition: a prospective observational study in critically ill surgical patients. *JPEN J Parenter Enteral Nutr*. 2015;39(1):21-27. doi:10.1177/0148607114526887
10. Seder CW, Janczyk R. The routine bridling of nasjejunal tubes is a safe and effective method of reducing dislodgement in the intensive care unit. *Nutr Clin Pract*. 2008;23(6):651-654. doi:10.1177/0148607114526887
11. Dechartres A, Boutron I, Trinquart L, Charles P, Ravaud P. Single-center trials show larger treatment effects than multicenter trials: evidence from a meta-epidemiologic study. *Ann Intern Med*. 2011;155:39-51. doi:10.7326/0003-4819-155-1-201107050-00006
12. Morton B, Hall R, Ridgway T, Al-Rawi O. Nasogastric tube dislodgement: a problem on our ICU. *Crit Care*. 2013;17(suppl 2):P242. doi:10.1186/cc12180