MonashHealth

Clinicians, Consumers, Evidence
Centre for Clinical Effectiveness

Abstract

Preventing pressure injuries in intubated patients in ICU

Citation Garrubba M. 2017. Preventing pressure injuries in intubated patients in ICU: Systematic Review. Centre for Clinical Effectiveness, Monash Innovation and Quality, Monash Health, Melbourne, Australia.

Background

Monash Health Intensive Care Unit have requested a review of the literature to determine best practice for preventing facial, tongue and oral pressure injuries in intubated patients.

Question

What is best practice for preventing facial, tongue and oral pressure injuries in intubated patients in the intensive care setting?

- What is the incidence of pressure injuries in intubated patients in ICU/PICU?
- What is best practice for securing endotracheal tubes (ETT) or nasogastric tubes for airway security, ease of use, infection control and skin integrity?

Methods

A systematic search of papers in English from 2010 to present was undertaken in Medline, CINAHL, All EBM, EMBASE databases and Google.

Results

One clinical practice guideline [1], one systematic review [2] and two observational studies [3, 4] were found. These resources provided results and recommendations for the prevention and reduction in incidence of facial, tongue and oral pressure injuries in ICU patients with a medical device in situ.

The literature reports the incidence of hospital acquired pressure injuries ranges from 12.4% to 18.7%. There is a greater incidence of grade 1 – 2 than Grade 3 – 4 pressure injuries [1]. Where a pressure injury was reported, 29% were attributed to a medical device. The most common devices that related to this review of evidence were ETT tapes (21-29%), nasogastric tubes (14-16%) [1].

From the identified literature, four interventions reduced the incidence of pressure injuries in ICU patients with a medical device.

- Non-invasive ventilation masks
- Protective dressings (hydrocolloid and transparent film)
- Silicon pressure reducing strips
- Repositioning ETT every 72 hours if no risk factors were present.

Conclusion

The evidence for preventing facial, tongue and oral pressure injuries in intubated patients in intensive care units is limited. Non-invasive ventilation masks, protective dressings (hydrocolloid and transparent film), silicon pressure reducing strips and repositioning ETT every 72 hours all reported reduction in incidence of facial, tongue and oral pressure injuries. However, these results should be interpreted with caution due to small underpowered sample sizes.

Full Review

Background

Monash Health Intensive Care Unit have requested a review of the literature to determine best practice for preventing facial, tongue and oral pressure injuries in intubated patients.

Question

What is best practice for preventing facial, tongue and oral pressure injuries in intubated patients in the intensive care setting?

- What is the incidence of pressure injuries in intubated patients in ICU/PICU?
- What is best practice for securing endotracheal tubes (ETT) or nasogastric tubes for airway security, ease of use, infection control and skin integrity?

Inclusion Criteria

Population	Adult and Paediatric intubated patients (endotracheal tubes or nasogastric tubes)
Intervention	Methods for securing endotracheal tubes (ETT) • Tape: Adhesive and non-adhesive twill product • Commercial devices – manufactured e.g. Hollister Anchor-Fast and Thomas tube holders Strategies to prevent or reduce incidence of facial, tongue and oral pressure injuries
Outcomes	Prevention of facial, tongue and oral pressure injuries Reduced incidence of pressure injuries Improved airway security, ease of use of securing method, infection control, skin integrity
Setting	Hospital ICU, PICU, NICU

*Search terms and study selection presented in Appendix 1

Results

One clinical practice guideline [1], one systematic review [2] and two observational studies [3, 4] were found. These provided results and recommendations for prevention and reduction in incidence of facial, tongue and oral pressure injuries in ICU patients. No evidence was identified that reported on airway security, ease of use of securing method, infection control and skin integrity outcomes. Detailed results by included papers is provided in Table 1.

Synthesis of Results

The current evidence addressing the epidemiology of pressure injuries in the critically ill adult patient is limited by the poor quality of the literature, with a reported moderate to high level of bias associated with most studies [1]. Prevalence of pressure injuries in the critically ill adult in the literature ranges from 4% to 53.4%. Pressure injury incidence ranges from 12.4% to 18.7%. There is a greater incidence of grade 1 – 2 than Grade 3 – 4 pressure injuries [1]. Where a pressure injury was reported, 29% were attributed to a medical device. The most common devices that related to this review of evidence were ETT tapes (21-29%), nasogastric tubes (14-16%) [1].

From the identified literature four interventions were described that were specific to device related pressure injuries.

1. *Prototype face masks Vs Conventional face masks*

One study investigated the effectiveness of prototype face masks (disposable, single size mask specifically designed for non-invasive ventilation to allow a more comfortable patient-mask interface where the mask is in contact with the nasal bridge) compared to a conventional face mask and found a significant improvement in device related pressure ulcers using prototype face mask ($P<0.001$) [2]. Specific number of patients or percentage improvements for this result were not provided.

2. Protective Dressings

Another study [2] investigated the effectiveness of using two different protective dressings (hydrocolloid and transparent film) with conventional masks to prevent device-related pressure ulcers [2]. The findings showed that 53.3% of patients in the transparent film group developed a pressure ulcer, 40% in the hydrocolloid group and 96.7% in the conventional mask group (total of 30 patients in each group). This shows a significant difference in the incidence of device-related pressure ulcers between groups (. No significant difference was seen in the occurrence duration time of pressure ulcers using different types of protective dressings [2].

3. Methods for securing ETT

A quality improvement observational study published in 2017 [3] showed an improvement when using twill tie compared to silicone pressure reducing strips. This study compared the use of twill tie to secure ETT,wrapped around the circumference of the head (pre-intervention) to the use of silicone pressure-reducing strips applied under the twill tie in facial burns patients in ICU (post-intervention) [3]. In the pre-intervention group, a total of 25 pressure ulcers in 16 patients, or 21% of patients having at least one pressure ulcer related to securing their endotracheal tube were reported. In the post-intervention group, a total of two pressure ulcers in two patients, or 5% of patients with at least one pressure ulcer related to securing their endotracheal tube were reported. [3].

4. Repositioning ETT

The effectiveness of repositioning the ETT every 72 hours if no risk factors are present is effective in patients primarily in post-operative care. This study was conducted in patients after heart surgery who were on mechanical ventilation and orally intubated with an ETT [4]. Of the patients who were orally intubated for 53 days and were repositioned every third day, 71% showed no signs of pressure ulcers caused by ETT. Six patients (15.8%) who were orally intubated for less than three days showed no signs of pressure ulcers [4]. There was a significant difference ($P<0.001$) in 'study days/intubated' between patients with ETT-induced damage compared to those with undamaged mucosa [4].

The results from this study show that the routine repositioning of the ETT every third day in most patients can be adopted in other intensive care units. There is an increased risk for the development of ETT-induced pressure ulcers in patients with bleeding problems and clotting disorders, and the risk increased with the number of ETT days. An individually-tailored care plan with the aim of preventing pressure damage should be implemented to reduce suffering in this group of patients [4].

Clinical Guideline recommendations

The following recommendations specific to medical devices and pressure injuries were presented by the Agency for Clinical Innovation (2014).

Pressure Injury Risk Assessment:

Inspect all of the skin and devices attached to the patient within two hours of admission, at each repositioning and each shift change to identify indications of pressure injury including:

- for fair skin races – erythema and for darker pigmented skin – persistent blue or purple hue
- blanching response
- localised heat
- oedema
- induration
- skin breakdown

The skin and mucosa impacted by invasive medical devices (including but not limited to nasogastric tubes, tracheal tubes, urinary catheter, faecal management devices, nasopharyngeal airway and intravascular devices) should be inspected:

- at the beginning of the shift
- each time the patient is repositioned or adjusted
- where applicable when dressings are changed.

Repositioning:

Reposition patients to reduce duration and magnitude of pressure over vulnerable areas, including under medical devices, bony prominences and heels.

Practice Point: When repositioning a critically ill adult, staff should ensure that:

- all medical devices, especially tracheal tubes and central lines, are being monitored to ensure accidental dislodgment does not occur and the tubing and lines are not left where they can lead to pressure or mucosal injury.
- an experienced clinician is holding the tracheal tube to ensure it remains within the trachea. This is especially important for patients where re-intubation is difficult, such as those with tracheostomy tubes in situ for less than 72 hours and/or obese patients with adjustable flange tubes.

Quality assessment of included reviews, studies and guidelines

The included papers in this review were appraised using standardised quality appraisal checklists. The clinical practice guideline [1] and systematic review [2] were of high quality and documented robust methodology. The studies relevant to our questions, included in the systematic review, were observational studies and are considered low level evidence. Although explicit in their methodology the two observational studies [3, 4] included are also considered to be low levels of evidence which inherently have methodological limitations that generate bias and confounding meaning that causal inferences cannot reliably be drawn.

Conclusion

The evidence for preventing facial, tongue and oral pressure injuries in intubated patients in intensive care units is limited. Non-invasive ventilation masks, protective dressings (hydrocolloid and transparent film), silicon pressure reducing strips and repositioning ETT every 72 hours all reported reduction in incidence of facial, tongue and oral pressure injuries. However, these results should be interpreted with caution due to small underpowered sample sizes.

Table 1: Summary of included papers

Ref	Study Design	Population/ Setting	Intervention	Outcomes	Results
[3]	Quality Improvement study Retrospective analysis	Patients with facial burns and ETT	**I:** Silicone pressure-reducing strips applied under the twill tie in facial burned patients where traditional methods of securing endotracheal tubes were not indicated due to lack of adhesion of other commercially available devices Skin inspection was performed per protocol by nursing and respiratory therapists during the time of use **C:** twill tie to secure tube and wrapped around the circumference of the head	Rate of pressure-related complications from securing endotracheal tubes before and after a practice change incorporating the use of SPRS.	In the pre-intervention group, there were a total of 25 pressure ulcers in 16 patients, or 21% of patients having at least one pressure ulcer related to securing their endotracheal tube. In the post-intervention group, there were a total of two pressure ulcers in two patients, or 5% of patients with at least one pressure ulcer related to securing their endotracheal tube. This was a statistically significant difference (P value = .032)
[4]	Observational Study	Thoracic ICU in Sweden for patients primarily in post-op care after heart surgery on mechanical ventilation and orally intubated with an ETT	**I:** Oral status of each patient was assessed by Intensive care nurse and one colleague. Assessment conducted once a day starting at 24hrs after intubation when changing the tape fixation of the tube on the patient's skin and/or repositioning the tube	Occurrence of pressure damage caused by endotracheal tubes (ETT).	Of the patients who were orally intubated for 53 days and were repositioned every third day, 71% showed no signs of pressure ulcers caused by ETT. Six patients (15.8%) who were orally intubated for less than three days showed no signs of pressure ulcers. In one of the five patients, the damage was caused by an armoured ETT that led to a crush injury to the oral mucosa. One patient with a bleeding disorder was intubated for 21 days. In this patient, the tube was repositioned every third day, and the patient subsequently developed a pressure ulcer. In the other four patients with pressure damage, the ETT was repositioned sometimes more often than every third day due to signs of damage. In one of the four patients, the tube was repositioned for the first time on the fourth day. There was a significant difference (P<0.001) in 'study days/intubated' between patients with ETT-induced damage compared to those with undamaged mucosa. The results from this study show that the routine repositioning the ETT every third day in most patients can be adopted in other intensive care units. We found an increased risk for the development of ETT-induced pressure ulcers in patients with bleeding problems and clotting disorders, and the risk increased with the number of ETT days. An individually-tailored care plan with the aim of preventing pressure damage should be implemented to reduce suffering in this group of patients.
[2]	Systematic Review 2 of 24 included studies relevant to facial, tongue and oral PUs	ICU	Effectiveness of prototype face masks compared with conventional face masks. Prototype face mask: is a disposable, single size mask specifically designed for non-invasive ventilation to allow a more comfortable patient-mask interface where the mask is in contact with the nasal bridge	Prevention of device related pressure ulcers	Found significant improvement in device related pressure ulcers using prototype face masks.
			Effectiveness of using different protective dressings (hydrocolloid, and transparent film) with conventional face masks.		Findings showed a significant difference in the incidence of device related pressure ulcers between groups. No significant difference in occurrence duration time.

References

1. Agency for Clinical Innovation, *Pressure Injury Prevention for Critically Ill Adults*. 2014: Chatswood NSW.
2. Tayyib, N. and F. Coyer, *Effectiveness of Pressure Ulcer Prevention Strategies for Adult Patients in Intensive Care Units: A Systematic Review.* Worldviews on Evidence-Based Nursing, 2016. **13**(6): p. 432-444.
3. Whitley, A.B., R.M. Nygaard, and M.D. Endorf, *Reduction of Pressure-Related Complications With an Improved Method of Securing Endotracheal Tubes in Burn Patients With Facial Burns.* J Burn Care Res, 2017. **Online Edition**.
4. Wickberg, M. and A.-C. Falk, *The occurrence of pressure damage in the oral cavity caused by endotracheal tubes.* Nordic Journal of Nursing Research, 2017. **37**(1): p. 2-6.

Appendix 1

Search terms

Ovid Medline 1946 to Present with Daily Update*			
1	exp Pressure Ulcer/	10	endotracheal tube.mp.
2	exp Skin Ulcer/	11	nasogastric tube.mp.
3	(skin adj3 breakdown$).mp.	12	8 or 9 or 10 or 11
4	(pressure$ adj (wound$ or sore$ or ulcer$ or injur$ or damag$)).mp.	13	exp Intensive Care Units/
5	1 or 2 or 3 or 4	14	exp Intensive Care Units, Pediatric/
6	(face or facial or tongue or mouth or oral).mp.	15	exp Intensive Care Units, Neonatal/
7	5 AND 6	16	13 or 14 or 15
8	exp Intubation, Intratracheal/	17	limit 17 to (english language and humans and yr="2010 - Current")
9	exp Intubation, Gastrointestinal/		

*Search terms were adapted for All EBM, EMBASE, CINAHL and Google.

Study Selection

Publication details	Include: All study designs Exclude: editorials, opinion papers, conference abstracts
Limitations	2010-2017; English, Humans
Databases	Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily, Ovid MEDLINE and Versions(R);CINAHL Plus; All EBM; EMBASE; Google

Titles and abstracts identified were exported to EndNote X7 (Thompson, Reuters, Carlsbad, California, USA). Papers identified were screened using inclusion and exclusion criteria established *a priori.* Searches of Medline, CINAHL, All EBM, EMBASE and the internet were screened by one reviewer in consultation with colleagues as necessary. Literature was included based on the above criteria.