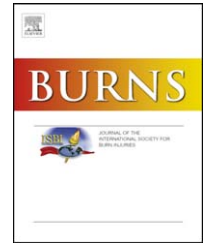


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Intra-operative endotracheal tube stabilisation for facial burns

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ABSTRACT

Endotracheal tube stabilisation for the debridement and grafting of facial burns is challenging. Traditional securing methods using adhesive tapes or ties are unsuitable. Presented here is a method utilizing a nasogastric tube looped around the hard palate for oral intubation or the nasal septum for nasal intubation and attached to the endotracheal tube using a plastic cable tie. This non-invasive method was used on 12 patients undergoing debridement and grafting of facial burns at The Red Cross War Memorial Children's Hospital without complication.

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1. Introduction

A patient with facial burns for debridement and skin grafting in theatre poses an airway management challenge to the anaesthetist. Whether a supra- (e.g. Laryngeal Mask Airway) or subglottic (e.g. endotracheal tube (ETT)) device is used, securing the device reliably while allowing the surgeons adequate access to their operative field is difficult.

Traditionally adhesive fabric tape has been used to secure the ETT but this will not adhere to freshly burnt tissue and may interfere with the surgical site. We have developed a technique to secure the ETT in instances of facial burns. This technique allows the surgeon full access to the face for debridement, grafting and dressing. It is easily performed and reversed at the conclusion of the case. It uses standard airway management equipment with the addition of a plastic cable tie.

This paper details a series of 12 paediatric cases in which this technique has been used. The technique has subsequently been used in over 50 cases in theatre without incident.

2. Method

Over a 3-month period the technique described below was employed in cases of facial burns at the discretion of the anaesthetist. All cases in which the technique was used in the 3-month period were included in the series.

Intubation is performed either nasally or orally (Fig. 1). ETT position is confirmed by standard tests.

A wide-bore nasogastric tube (NGT) is passed nasally into the oropharynx. Using Magill's forceps under direct vision the tip of the NGT is withdrawn from the mouth looping the NGT around the hard palate (Fig. 2).

The two ends of the NGT are then pulled firmly so that there is no slack on the tube around the hard palate and then attached to the ETT using a cable tie (Fig. 3). The cable tie should be secured firmly but without excessive pressure at the lip or nose. It should be tightened sufficiently to hold the two ends of the NGT and ETT together firmly but without kinking the ETT or obstructing the lumen.

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Fig. 1 – Intubation.



Fig. 3 – Cable Tie.



Fig. 2 – Nasogastric tube.



Fig. 4 – All in place.

The free ends of the cable tie and NGT are then cut no less than 2 cm from the “noose” of the cable tie to prevent slippage (Fig. 4).

At the end of anaesthesia the loop of nasogastric tube is cut and the ETT removed bringing with it the cable tie and NGT.

If nasal intubation is performed a second wide-bore NGT is passed through the adjacent nostril (that through which the ETT has been passed) and the tip extricated from the mouth in the manner described above. The oral ends of each NGT are sutured together as shown (Fig. 5). The first NGT is then pulled via the nostril, resulting in the sutured ends and other NGT being pulled upwards out of that nostril looping the first NGT around the nasal septum posteriorly. The tie and second nasogastric tube can then be cut off and the ETT secured to the NGT using the cable tie as described.

3. Results

The technique described was employed in 12 patients ranging from 9 months to 10 years of age. Procedures took

from 48 to 180 min (Table 1). Both oral and nasal routes of intubation were used and in two cases the patients were turned prone intra-operatively. Anaesthetic techniques varied from volatile and opiate based techniques to

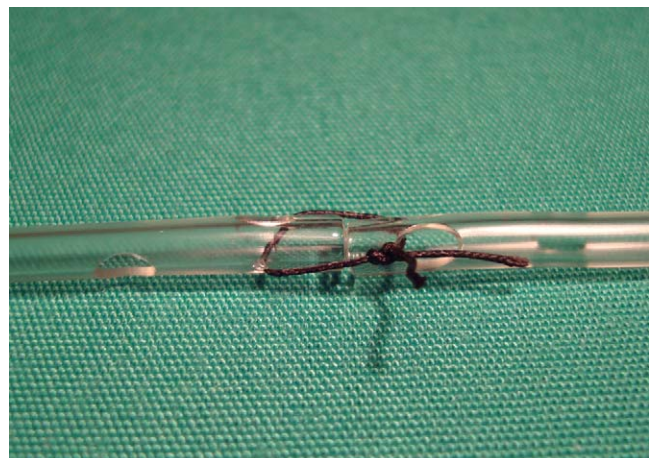


Fig. 5 – End-to-end suture of NGTs.

Table 1 – Cases in which the described technique was employed (D = debridement; B = biological dressing; A = autograft; S = supine; P = prone).

No.	Age (months)	% Burn	Type of burn	Operative time (min)	Surgical procedure	Intubation	Position (supine/prone)	Type of anaesthetic
1	29	5	Fire	65	B	Oral	S	Gas/opiate
2	18	25	Water	87	B	Oral	S	Gas/opiate
3	14	10	Water	70	B	Oral	S	Gas/opiate
4	46	36	Water	82	D	Oral	S	Ketamine
5	49	40	Fire	130	A	Nasal	S	Ketamine
6	9	10	Water	90	B	Oral	S	Gas/opiate
7	15	40	Fire	48	D	Oral	S	Gas/opiate
8	51	16	Fire	70	A	Oral	S	Ketamine
9	65	50	Fire	135	A	Nasal	S & P	Gas/opiate
10	102	22	Fire	75	A	Oral	S	Ketamine
11	45	36	Water	50	B	Oral	S	Ketamine
12	130	60	Fire	180	D	Oral	S & P	Ketamine

ketamine infusions. In all cases debridement and cleaning took place unhindered and skin grafts or biological dressings were successfully applied. No accidental extubations occurred despite frequent changes in head position as the surgical procedure demanded.

4. Discussion

For many years we have struggled with securing airway devices for facial burn surgery, often resorting to manually holding an ETT in place throughout a case. Traditional techniques such as fabric tape ties are commonly recommended [1] but are more useful in the Intensive Care Unit (ICU) than in theatre where the tapes are likely to get in the way of surgery.

Novel techniques reported in the literature include the placement of interdental wires to secure the ETT [2], tying the ETT to the teeth using a surgical suture [3] and placement of a circummandibular suture or wire (for oral intubation) or a transcartilagenous septal suture (for nasal intubation) [4,5]. Techniques described, but probably better suited to the ICU, include application of an external cranial fixation apparatus to which the ETT can be stabilised [6] and arch bar stabilisation of the ETT [7].

In many instances these techniques rely on the presence of teeth in the patient (not guaranteed in infants or the elderly). The described techniques are invasive and the potential for tissue trauma, in addition to that induced by the burn, is present.

The technique described in this paper is atraumatic and uses low cost equipment. It allows excellent surgical access to the face for debridement, grafting (Fig. 6) and the application of dressings (Fig. 7) while providing reliable anchoring of the ETT. It has revolutionized our anaesthetic management for facial burns.

This technique has not been tested in adults but there is no reason that there should be any significant differences in the performance and result of the technique.

The technique has certain limitations and potential problems.

Post-operative swelling and haemodynamic instability in the critically ill patient could predispose to the development of

pressure sores on the lip or nose or necrosis of the nasal septum if the NGT and cable tie are left in place. This technique is, therefore, not recommended for long-term use in the ICU.



Fig. 6 – Grafts applied.



Fig. 7 – Dressings.

If a patient with facial burns comes from the ICU already intubated, an NGT can be passed and the ETT secured as described for the case. Once the dressings have been applied the cable tie should be cut from the ETT and the loop of NGT removed. The ETT will then have to be secured over the dressings using ties.

If the filtrum or skin on the nasal septum requires surgical attention this may be difficult as the NGT will be in the way. Fortunately the filtrum is relatively spared in many facial burns, protected by the protrusion of the nose. In our series we have not encountered this problem.

If the cable tie is secured too tightly the ETT lumen will be partially or completely occluded. In such cases there may be difficulty achieving adequate ventilation. It will also be difficult to pass a suction catheter to aspirate airway secretions. Care must be taken at the time of tightening the cable tie to ensure that it is tight enough to secure the NGT to the ETT without allowing any movement of one on the other while not tightening it to the point of ETT occlusion (partial or complete). One way to avoid this situation is to pre-cut the ETT to the exact length required so that the hub is at the lips or nare. The cable tie can then be tightened around the rigid hub preventing collapse of the ETT walls.

5. Conclusion

Securing the ETT in the manner described is reliable, allows excellent operative access and mobility of the head without the possibility of inadvertently dislodging the ETT. It is a suitable method for the operating theatre but is not recommended for long-term use.

Disclosure statement

Informed consent for use of photographs was obtained from the parents of the two children photographed as well as from the older child herself.

Conflict of interest statement

The authors have no conflict of interest to declare in relation to this paper.

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