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Complications from submental endotracheal intubation: a prospective study and literature review

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Current techniques for the surgical management of midfacial or panfacial fractures commonly lead to specific problems for airway management. Surgeons must have access to an unobstructed field, and, in most cases, maxillomandibular fixation is required intraoperatively to achieve an adequate reconstruction of facial fractures (1, 2). Therefore, patients who sustain these fractures often cannot be managed with standard orotracheal intubation. Nasotracheal intubation represents an alternative for airway management. However, this procedure is frequently contraindicated due to concurrent skull base fractures, bearing the risk of the tube entering the anterior cranial fossa (3). In addition, the presence of a nasotracheal tube can interfere with the surgical reconstruction of fractures of the naso-orbito-ethmoid (NOE) complex (4). Another technique for airway control is the tracheotomy, which is considered by

Abstract – Submental endotracheal intubation, as compared to the use of tracheotomy, is an alternative for the surgical management of maxillofacial trauma, as described by Altemir FH (The submental route for endotracheal intubation: a new technique. J Maxillofac Surg 1986; 14: 64). Although the submental endotracheal intubation is a useful technique, a wide range of complications have been reported in the literature. The core aim of this article is to present additional data from 17 patients who have undergone submental endotracheal intubation and who have received at least 6 months of postoperative follow up. A prospective study was carried out on patients who suffered maxillofacial trauma between 2008 and 2011. Age, gender, etiology of trauma, fracture type, complications, and follow up were evaluated. Case series, as well as retrospective and prospective studies regarding submental endotracheal intubation in maxillofacial trauma, were also reviewed. This study demonstrated a low rate of complications in submental endotracheal intubation and no increase in operative time within the evaluated sample. The submental endotracheal intubation may be considered a simple, secure, and effective technique for operative airway control in major maxillofacial traumas.

many as the preferred route for airway management in patients with complex maxillofacial fractures (4–7). On the other hand, tracheotomy is associated with a significant number of perioperative and postoperative complications, including tracheal stenosis, subcutaneous emphysema, pneumothorax, damage to laryngeal nerves, tracheomalacia, tracheoesophageal fistula, and scarring (8–12).

Submental endotracheal intubation (SEI) is an alternative form of intubation through the submental route. Altemir (13) (1986) first described this procedure as an alternate technique of airway management in patients with maxillofacial trauma. Since then, this technique has been modified. The most substantial change was actually described by Green and Moore (14) (1996): it involves the use of 2 endotracheal tubes, where the first oral tube is replaced by a second one introduced through the submental dissection channel. Other modifications included the use of either the midline or submandibular approach, rather than the latero-submental approach (6,15), using a nasal speculum with long flanges (16) a nylon guiding tube (17) or covering the proximal end of the endotracheal tube with a blue cup of thoracic catheter to facilitate the externalization of the orotracheal tube (18).

Complications from SEI have been described by some authors since 1986. These complications have included the following: 1) damage to the lingual nerve, 2) damage to the marginal mandibular branch of the facial nerve, 3) damage to the duct of the submandibular gland, 4) damage to the sublingual gland, 4) salivary fistulae, 5) skin infections, 6) accidents related with the tube, 7) bleeding, and 8) unesthetic scars (7, 12, 19, 20).

The core aim of this prospective study is to review literature and to present additional data on complications in patients who underwent the SEI within a period of 4 years. A review of case series, as well as retrospective and prospective studies found in Englishlanguage literature from 1986 to 2011 concerning SEI in maxillofacial trauma, will also be presented.

Patients and methods

PubMed search of English-language literature between 1986 and 2011 was performed using the following keywords: complications, submental intubation, submental endotracheal intubation, and submental tracheal intubation. All pertinent studies, which reported on the use of SEI in maxillofacial trauma, were included in this review (11, 12, 15, 16, 19–28). Together with the present prospective study, a total of 711 cases were evaluated.

Patients

From 2008 to 2011, seventeen patients benefited from SEI procedures. All patients were attended to the emergency unit of João XXIII Hospital/FHEMIG, in Belo Horizonte, Brazil. The clinical profile of the patients and data concerning the SEI procedures are presented in Table 1.

Submental endotracheal intubation technique

The SEI technique used in this study was a progressive adaptation of general principles described by Altemir (13) (1986). A standard anesthesia technique was performed on all patients. Initially, these patients underwent orotracheal intubation by standard direct laryngoscopy using a number 7 or 7.5 reinforced endotracheal tube. The connector was released from the tube with the aid of mosquito forceps in such a way that it could be easily removed and reattached in the next step. After sterile painting and draping of face and the neck, 2 ml of lignocaine with adrenaline (2%) was injected at the incision site. An incision of 1–1.5 cm was made medial to the inferior border of the mandible in the submental/submandibular region.

When possible, this incision was made on the opposite side of mandibular fractures. A curved hemostat was passed from the submental incision through the subcutaneous layer, platysma, mylohyoid muscle, submucosal layer, and mucosa. The hemostat is then opened to create a passage for the endotracheal tube (Fig. 1b).

After the surgical access had been performed, the tube cuff was first introduced into the mouth and then passed through the tunnel using forceps. The tube was then disconnected from the ventilator, and the standard connector was removed. The proximal end of the endo-tracheal tube was covered by a glove finger, and the same maneuver was repeated. After confirmation of the correct placement of and connection to the anesthesia machine, the tube was attached to the skin with sutures, using 2–0 or 3–0 nylon sutures (Fig. 1c,d). The SEI procedure was performed in <10 min in all cases, and no major complications were encountered.

After the surgery has been completed, the endotracheal tube and pilot balloon were passed intraorally in reverse order, respectively. The submental incision was closed with interrupted 5–0 nylon sutures. Extubation, when appropriate, was performed after the patient had recovered consciousness and adequate muscle strength.

Next, all patients were sent to a recovery room and were examined by a maxillofacial team and other professionals, when necessary. An antibiotic cover was given to all patients (Cefazolin, 1 g intravenously, 3 times per day for 72 h). Oral hygiene was maintained using a 0.12% chlorhexidine mouthwash twice per day. An antiseptic dressing of the submental incision was performed, and stitches were removed seven to fourteen days after the surgery. After the discharge, the patients followed for at least 6 months.

Results

The mean age of the patients was 29.6 years, and gender ratio male to female was 16:1. The most frequent etiology of the trauma was traffic accidents (n = 15). The most common fracture type was Le Fort II with nasal fracture (41%). In two cases (12%), patients presented with an isolated mandibular fracture, and nasal intubation was supposed to be done as usually. One patient was overweight, presenting extensive soft tissue swelling, while another presented nasal concha hypertrophy. In these patients, nasal tracheal intubation was attempted several times without success, which led to the decision to perform SEI. One patient (6%) could not be extubated because of a persistent massive edema; therefore, a tracheotomy was performed on the fifth postoperative day.

Postoperative complications of the SEI could be observed in three patients. One (6%) presented with a skin infection after 45 days of postoperative follow up. This infection was treated by antibiotics and local cleansing. Two patients (12%) returned 3 months later with unesthetic scars. These were classified as a hypertrophic scarring, as they were restricted to the surgical cutaneous wound and did not spread into the adjacent tissue. Both patients were advised to massage the locale and returned every week for a follow up. At 6 months of postoperative follow up, the patients' scars had

Patients	Age	Gender	Etiology of the Trauma	Fracture type	Postoperative Tracheotomy	Complications	Follow up (Months)			
1	47	М	Traffic accident	Le Fort II and mandible	Yes	No	27			
2	34	Μ	Traffic accident	Le Fort II and nose	No	Skin infection	25			
3	23	F	Traffic accident	Le Fort III and mandible	No	Unaesthetic scar	17			
4	63	Μ	High fall	Le Fort II and nose	No	No	16			
5	27	Μ	Physical violence	Le Fort II and NOE	No	No	15			
6	28	Μ	Traffic accident	Mandible	No	No	13			
7	17	Μ	Traffic accident	Le Fort II and nose	No	Unaesthetic scar	13			
8	27	М	Traffic accident	Le fort II and nose	No	No	11			
9	19	Μ	Traffic accident	Mandible	No	No	11			
10	24	Μ	Traffic accident	Le Fort II and mandible	No	No	9			
11	27	Μ	Traffic accident	Le Fort II and nose	No	No	9			
12	33	М	Traffic accident	Le Fort II and nose	No	No	9			
13	18	М	Traffic accident	Le Fort II and mandible	No	No	9			
14	25	М	Traffic accident	Le Fort II and NOE	No	No	9			
15	25	М	Traffic accident	Le Fort II and NOE	No	No	9			
16	34	М	Traffic accident	Le Fort II and nose	No	No	6			
17	32	М	Traffic accident	Le Fort II and mandible	No	No	6			
Total	Mean: 29.6 years	Ratio M/F 16/1	88% Traffic accident	41% Le Fort II and nose						
	Range: 17–63 years		6% High fall	29% Le Fort II and mandible	6% Postoperative tracheotomy	82% No complications	Mean: 12.6 months			
			6% Physical violence	18% Le Fort II and NOE	,	12% Unesthetic scar	Range: 6–27 months			
				12% Mandible		6% Skin infection				
				6% Le Fort III and mandible						
M, male; F, female; NOE, Naso-Orbito-Ethmoidal.										

Table 1. Clinical profile of 17 patients who underwent submental-endotracheal intubation

<image>

Fig. 1. Patient who underwent submental endotracheal intubation for the management of maxillofacial fractures. (a) 3D computed tomography showing midfacial Le Fort types and nasoorbito-ethmoidal fractures. (b) Curve hemostat passed through the submental route. (c) The 7.5 reinforced tube in the submental tunnel attached to the skin with 2.0 nylon sutures. (d) Lateral cervical radiograph showing the reinforced tube in the trachea, passing into the submental region.



improved, as compared to their status at 3 months postoperatively; however, the scars were still considered to be unsatisfactory. For the majority of patients evaluated in the present study (88%), the postoperative scar was nearly invisible after 6 months (Fig. 2a,b).

Discussion

PubMed search of English-language literature between 1986 and 2011 was performed using the following keywords: complications, submental intubation, submental

Fig. 2. Late surgical wounds after submental endotracheal intubation. (a) Nearly invisible surgical wound in the submental region (yellow head arrow). (b) Slight mucosa wound on the left floor of the mouth (blue head arrow).

Table 2. Clinical profile of 711 patients who underwent submental endotracheal intubation

Authors	Number of patients	Period of time	Mean age (years)	Gender ratio (M:F)	Tracheotomy postoperative	Number of complications/(%)	Type of complications	Mean time of technique (minutes)		
Manganallo Souza	10	NA	NA NA	NA	0	2 (20%)	Skin infaction			
(21)	10	NA	NA	NA	0	2 (20%)		NA		
MancInnis and	15	NA	NA	NA	0	0 (0%)	No	6		
Baig (15)	ig (15)							_		
Caron et al. (11)	25	1995-1998	36	5.2:1	2	1 (4%)	Skin infection	Few		
Amin et al. (22)	12	1999–2002	28	2:1	0	3 (25%)	and partial extubation	NA		
Meyer et al. (16)	25	1997–2003	35	2.1:1	0	3 (12%)	2 abscesses on the floor of the mouth and unaesthetic scar	<8		
Davis (23)	11	NA	NA	NA	0	0 (0%)	No	7		
Taglialatela Scafati et al. (19)	107	2000–2004	25	2:1	0	19 (18%)	11 cases of skin infection 8 cases of salivary fistula	10		
Sharma et al. (24)	20	2005–2008	27	3:1	0	2 (10%)	Accidental partial extubation Skin infection	9		
Caubi et al. (25)	13	2003–2005	27	13:0	0	1 (8%)	Tube compression	<10		
Schultz and Hammed (26)	8	2004–2007	23,5	7:1	1	1 (12.5%)	Slight damage to endotracheal tube	NA		
Gadre and Waknis (12)	400	1989–2009	37	3.3:1	0	5 (1%)	2 cases of salivary fistula 2 cases of unaesthetic scar 1 case of damage to tube	<10		
Garg et al. (27)	10	2006–2008	30	1.5:1	0	2 (20%)	Accidental disconnection of tube and Skin infection	8		
Lima et al. (28)	15	1999–2009	41	14:1	0	0 (0%)	No	10		
Agrawal and Kang (20)	25	2006–2009	29	25:0	0	3 (12%)	Venus bleeding and skin infection in 2 cases	7.08		
Current study	17	2008–2011	29	16:1	1	3 (18%)	Skin infection and unesthetic	10		
Total	711	1989–2011	30,6	6.7:1	4	45 (6.3%)	42% (19) Skin infection 22% (10) Salivary fistula 16% (7) Accidents related to the tube 12% (5) Unesthetic scar 4% (2) Bleeding 4% (2) Abscess on the floor of the mouth	7.3		
NA not available: M male: F female										

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endotracheal intubation, and submental tracheal intubation. All pertinent studies, which reported on the use of SEI in maxillofacial trauma, were included in this review (11, 12, 15, 16, 19–28). Together with the present prospective study, a total of 711 cases, were evaluated. The data from these cases are presented in Table 2.

The current prospective study demonstrated that maxillofacial trauma associated with patients who required SEI is more prevalent in young male adults who had suffered traffic accidents. This result is in accordance with data from epidemiological studies (29, 30).

The evaluation of English-language literature demonstrates that the complications that arise from SEI procedures are relatively rare (6.3%) (6, 11, 22, 26). Additionally, the main complication reported in the literature was skin infection (42%), followed by salivary fistula (22%), accidents related to the tube (16%), unesthetic scars (12%), bleeding (4%), and abscesses on the floor of the mouth (4%). In the present study, one case of skin infection (6%) and two cases of unesthetic scars (12%) were observed.

Gadre and Waknis (12) (2010) described that the inconvenience related to the SEI is scar formation. However, this scar is by far less visible than a tracheotomy scar and proved to be well tolerated by the patients from the present study. Postoperative salivary fistula, as reported in the literature regarding the cases of prolonged ventilation (4, 13), was not documented in the current study. The risk of a sepsis or an abscess in the submental tunnel is real and is related to the passage of the possibly contaminated balloon and endotracheal tube during extubation (16). One case of skin infection after 45 days was observed in the present study.

In this current study, the contraindications of SEI included the likelihood that patients will require a long period of assisted ventilation, that is, multitrauma patients presenting severe neurological damage, patients with major thoracic trauma, or patients for whom repeated operations could be anticipated. In these cases, tracheotomy should be the standard procedure. The same applies for patients presenting with severe traumatic wounds on the floor of the mouth.

In conclusion, SEI is a safe procedure for intraoperative airway control in maxillofacial trauma patients who present contraindication to nasotracheal intubation. This procedure allows for the operative correction of occlusion and enables surgery for associated nasal fracture, and in the event of concomitant skull base trauma, it avoids the dangers of classical nasotracheal intubation.

Conflict of interest

None.

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