Submental intubation an alternative to tracheostomy in patients with panfacial fractures

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Abstract
Introduction
In panfacial injuries, a choice has to be made among different ways of intubation, especially when short-term airway management is desirable only for intraoperative management of a case in the presence of difficult oral and nasal airway access and frequent intraoperative dental occlusion. We report our experience with submental intubation as an alternative to tracheostomy in the airway management of patients with complex panfacial fractures. The aim of this article was to evaluate the outcome of airway management in patients with complex maxillofacial fractures by submental intubation, time required for intubation, accidental extubation and postoperative complications and to discuss indications, contraindications, advantages and disadvantages of submental intubation.

Materials and Methods
Three patients of panfacial fractures who underwent submental intubation from May 2013 to December 2013 were reviewed, and no statistical analysis was used.

Results
At the end of the procedure, all three patients were extubated without any complications.

Conclusion
Submental endotracheal intubation is a simple technique with very low morbidity and can be used as an alternative to tracheostomy in cases of complex maxillofacial trauma.

Introduction
Panfacial fractures involve the cranium, midface and the mandible. Early reconstruction of patients with panfacial fractures by open reduction and rigid internal fixation is now the standard of care. An important consideration at the time of surgery is the maintenance of airway without interfering with the reconstruction of fractured segments. Essentially, the anaesthesiologist and the surgeon are competing for the same space. The surgeon needs access to an unobstructed field; and in most instances maxillomandibular fixation is required intraoperatively for adequate reconstruction of facial fractures. Therefore, in these types of injuries, the mode of intubation is controversial.

In such circumstances, when both oral and nasal routes for intubation cannot be chosen, tracheostomy is the next, standard route to the trachea. Tracheostomy has often been reported to lead to numerous complications; though these complications can be avoided with care, tracheostomy is generally avoided unless the patient needs to be kept intubated, for maintaining airway, even after the surgery.

Submental intubation, thus as an alternative to tracheostomy, can be used when short-term control of airway is desirable with the presence of undisturbed access to oral as well as nasal airways and a good dental occlusion. Submental intubation was first described by Altemir. The submental approach for intubation allows an unhindered reduction and fixation of the complex maxillofacial fractures in which simultaneous access to nasal pyramid fractures is required, thereby avoiding the need for tracheostomy.

We present a study of three cases with review of literature, emphasizing on the preoperative status and outcome, indications, contraindications, advantages, disadvantages and complications of submental intubation for surgical correction of panfacial trauma.

Materials and Methods
A total of three adult male patients who had undergone submental intubation for management of complex panfacial fractures were reviewed, data recorded included personal details, type of maxillofacial fracture, time required for intubation and intraoperative and postoperative complications related to the use of submental intubation.

Anaesthesia technique
All preparations for difficult airway were carried out. The patient was premedicated with glycopyrrolate, ondansetron, preoxygenated and anesthesia induced with propofol and fentanyl. Mask ventilation was performed and 100 mg of suxamethonium chloride was administered. Flexometallic Endotracheal Tube (ETT) is preferred for intubation since it is reinforced with a metallic spring material which has a shape memory, and thus the tube is flexible, is kink resistant and retains patency despite the acute angle of the airway, particularly at the submental route. Initially, standard orotracheal intubation was carried out and ETT is connected to the breathing circuit. The sealed connector was loosened from...
the proximal end of the tube prior to intubation so that it could be easily disconnected during the procedure. The cuff was inflated with about 10 ml of air to secure the airway from oropharyngeal secretions and bleeding. The orotracheal intubation is then transformed into the submental intubation using the following surgical technique.

Surgical technique

The submental skin was scrubbed with aqueous povidone iodine solution and the site draped (Figure 1). Subsequently, a 1.5–2 cm skin incision was made in the paramedian submental region, directly adjacent to the medial aspect of the lower border of the mandible (Figure 2). The muscular layers were traversed using a pair of curved artery forceps. The mucosal layer in the floor of the mouth was incised over the distal end of the forceps and the forceps were then opened, creating a wide tunnel so that the tube can be drawn easily. The tube cuff was first introduced into the mouth. After its deflation, a closed curved artery forcep was inserted intraorally through the surgically created tunnel, then the tube cuff was grasped with curved artery forceps and pulled inferiorly to pass through the tunnel and emerge through the incision in the submental skin. The endotracheal tube was briefly disconnected from the breathing circuit and the tube connector was removed from the tube. The same manoeuvre was then carried out with the proximal end of the ETT. After the ETT had emerged extrorally through the tunnel, the connector was reattached and the endotracheal tube reconnected to the anaesthesia breathing circuit. It should be noted that the patient is ventilated with 100% oxygen for around 3 min to prevent oxygen desaturation during the period of ventilator interruption while passing the ETT across the floor of the mouth. Auscultation was used to confirm the final position of ETT. At this point, the position of the ETT was reassessed and adjustments of the ETT were made so that there is equal bilateral air entry. A pharyngeal pack was then inserted to seal the pharynx from blood and debris during surgery. Stay sutures with 3-0 silk were placed round the ETT to secure it (Figure 3), thus minimising the perioperative movement and prevent accidental extubation (Figure 4).

At the end of the procedure, the stay sutures around the ETT were removed and the deflated pilot tube cuff and the ETT were pulled in reverse order from the tunnel to the oral cavity, and thus submental intubation transformed into orotracheal intubation. The skin wound was closed with simple interrupted sutures using 3-0 prolene while the intraoral wound was left to heal secondarily.

A standard extubation procedure was carried out after completion of the anticipated procedure.

Results

Submental orotracheal intubation was completed successfully in three male patients with complex panfacial fractures.
There was no difficulty in passing the tube through the floor of the mouth, and the total duration of submental intubation procedure ranged from 8 to 12 minutes.

Disconnection time from the ventilator was approximately 2 min, and there was no significant oxygen desaturation in any patient during this manoeuvre.

In all subjects, submental intubation allowed simultaneous treatment of all the fractures without changing the method of intubation and without any interference from the tube during the operation.

The intubation method itself did not lead to any intraoperative complications.

No major complications such as haemorrhage, injury to the sublingual glands, lingual nerve or orocutaneous fistula were observed.

Patients were evaluated in the postoperative period and no motor or sensory salivation deficit was found. Normal healing in the mucosa of the floor of the mouth was observed.

**Discussion**

Difficulty in securing an airway is often associated with the management of complex maxillofacial trauma. Modern techniques for surgical treatment of midfacial and panfacial fractures in maxillofacial trauma pose special problems for airway management.

When neither nasotracheal nor orotracheal intubation is suitable, tracheostomy is a traditional method favoured by some surgeons and anaesthesiologists. However, this procedure is associated with complications such as haemorrhage, subcutaneous emphysema pneumomediastinum, blockage of tracheostomy cannula, cellulitis, pulmonary atelectasis, tracheoesophageal fistula, tracheocutaneous fistula, pneumothorax, recurrent laryngeal nerve damage, stomal and respiratory tract infection, tracheal stenosis, tracheal erosions, dysphagia, problems with decanulation and excessive scarring and requires careful surgical and perioperative management.7–10

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Study design</th>
<th>Technique used</th>
<th>Complication</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altemir et al.</td>
<td>1986</td>
<td>Case study</td>
<td>Submental intubation</td>
<td>None</td>
<td>Nasal speculum used to facilitate passage of the tube through submental region</td>
</tr>
<tr>
<td>Green and Moore</td>
<td>1996</td>
<td>Case study</td>
<td>Two-tube submental intubation</td>
<td>None</td>
<td>Two tubes, one oral and second tube submental, this modification allows use of endotracheal tube with nondetachable connector</td>
</tr>
<tr>
<td>Mac Innis and Baig</td>
<td>1999</td>
<td>Case study</td>
<td>Submental intubation</td>
<td>None</td>
<td>Modification: Midline incision 2 cm posterior to Wharton’s duct to minimise bleeding by damage to lingual artery</td>
</tr>
<tr>
<td>Drolet et al.</td>
<td>2000</td>
<td>Case study</td>
<td>Submental intubation</td>
<td>None</td>
<td>Lubricated tube exchanger avoids delay in exchanging damaged tube</td>
</tr>
<tr>
<td>Altemir et al.</td>
<td>2003</td>
<td>Case study</td>
<td>Submental intubation</td>
<td>None</td>
<td>Modification: Combitube SA through submental route allows dental occlusion, unimpeded surgical field, ease of ventilation</td>
</tr>
<tr>
<td>Taglialetela et al.</td>
<td>2006</td>
<td>Retrospective study</td>
<td>Submento-submandibular intubation</td>
<td>Superficial wound</td>
<td>Average time less than 10 min using two-tube technique</td>
</tr>
<tr>
<td>Schutz and Hamed</td>
<td>2008</td>
<td>Retrospective study</td>
<td>Submental intubation</td>
<td>Damage to ETT apparatus</td>
<td>Nothing significant</td>
</tr>
<tr>
<td>Chandu et al.</td>
<td>2008</td>
<td>Retrospective study</td>
<td>Submental intubation</td>
<td>Superficial infection in two cases, mucocele in one case, lingual nerve injury in one case</td>
<td>Average time required 20 min</td>
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</table>

Nasotracheal intubation is frequently avoided in these groups of patients with panfacial and nasoorbito-ethmoid complex fracture as there is risk of accidental passage of the tracheal tube into the cranial cavity during nasal intubation; this can lead to major complications such as meningitis, sepsis and cerebrospinal fluid leakage. Also there could be epistaxis, trauma to the pharynx, pressure necrosis of external nares, otitis media, sinusitis and inability to pass a tube through nasal passages. Often, surgical correction of these nasal fractures requires tube-free surgical areas, which can be achieved by opting for avoidance of nasal intubations.

Orotracheal intubation significantly facilitates manoeuvres for reduction and stabilisation of the jaws, which often requires immobilisation with arch bars and wires. Hence oral intubation was avoided.

Different solutions have been proposed as an alternative to tracheostomy including retromolar intubation and nasal tube switch technique; switching an endotracheal tube from the nasal route to the oral route without extubation was proposed by Werther et al. The switch method interferes with sterility of the surgical field, and retromolar intubation has been reported to have disadvantages like being more traumatic, obtrusive, costly and requiring more operating time.

Indications of submental intubation besides management of complex maxillofacial fractures are simultaneous orthognathic surgery with rhinoplasty and transcranial base surgery. In orthognathic surgery, submental intubation allows a simultaneous rhinoplasty procedure without any interference and allows better assessment of soft-tissue changes in the nose and lip.

A review of literature reveals that the Altemir’s original technique which has been modified can be divided into anatomical and anaesthetic modifications. Anatomical modification includes the variation in path of exit of the ETT. Stoll et al. advocated the submandibular approach instead of the submental subcutaneous approach. MacInnis and Baig found the latesubmental approach was less satisfactory because of difficulty in tube passage, bleeding and sublingual gland injury and thus preferred the submental incision in the midline. However, the midline approach can traumatis the Wharton’s ducts and interfere with attachment of the genioglossus.

Anaesthetic modifications have been given by several authors (Table 1). Green and Moore first secured the airway with orotracheal intubation, then passed the reinforced ETT through the submental wound into the oral cavity and substituted the reinforced tube in place of the conventional oral tube after withdrawal of the oral tube.

Submental intubation is now known as an alternative to tracheostomy to secure airway in the management of severe panfacial fractures. It is a versatile technique which allows intubation of patients in the presence of polytrauma and allows maxillomandibular fixation along with simultaneous access to nasal pyramidal fractures. Apart from securing airway, it provides an unobstructed airway, it provides an unobstructed airway with orotracheal intubation, that is, an option to perform tracheostomy is contraindicated in patients who require a prolonged period of assisted ventilation, that is, polytrauma patients presenting with severe neurologic damage or major thoracic trauma and patients expected to need repeated surgical interventions.

There are disadvantages of the submental intubation technique as well, but less severe than tracheostomy. It is an extraoral procedure, and reported complications include detachment of the pilot balloon or its damage during exteriorisation, damage to the cuff of the tracheal tube, abscess formation in the floor of the mouth, infection of the submental wound, salivary fistula, development of mucocele and facial scarring.

Schutz and Hamed in their comparative study between submental intubation and tracheostomy concluded that the submental intubation is associated with low morbidity and can replace tracheostomy in selected cases of maxillofacial trauma. In our series, no episodes of compromised airway or arterial desaturation occurred during the procedure. Other potential complications such as detachment or damage to the cuff, orocutaneous fistula, trauma to the submandibular and sublingual glands or canals, damage to the lingual nerve and hypertrophic scar were also not observed.

In our patients, we opted to use single reinforced ETT, a paramedian submental approach. In all our patients, submental intubation permitted simultaneous reduction and fixation of all fractures and intraoperative control of dental occlusion without interference from the tube in the surgical field and most importantly without compromising the airway.

**Conclusion**

According to the literature and our own experience, submental intubation is a simple technique with low morbidity. Our series re-establishes...
that submental intubation is a useful alternative technique of airway management in patients with facial fractures. The technique with no specialized equipment required gives a unique advantage over other techniques used to avoid tracheostomy. It combines the advantages of the nasotracheal and orotracheal intubation by allowing access to the interdental occlusion and nasal pyramid, respectively. Submental intubation has proven effective in terms of both the result and surgical time required. It presents a low incidence of operative and postoperative complications and eliminates the risks and side effects of tracheostomy. Thus, it can be used as an alternative to tracheostomy in selected cases of maxillofacial trauma, where nasotracheal or orotracheal intubation is impossible or contraindicated and long-term ventilation support is not required.

Consent
Written informed consent was obtained from all patients for publication of this series study and accompanying images. A copy of the written consent is available for review by the editor-in-chief of this journal.

References