Submental Intubation in Maxillofacial Surgery: A Prospective Study

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Abstract We designed a prospective study with the objective to evaluate the efficacy, indications and our experience of submental intubation in different types of maxillofacial surgeries. From May 2008 to August 2010, 23 patients with different conditions were intubated by submental route of tracheal intubation and patients were evaluated on different parameters during and after surgery to find its efficacy, indications and utilization in

maxillofacial surgeries. All the patients were managed well with this technique of intubation with no significant difference in intubation and extubation time. We did not face any uneventful complication. There was only one reported complication that is rupture of the bulb of cuffed flexometallic tube but was managed well by changing tube. We found skull base access surgery as a new indication for submental intubation. The submental route for endotracheal intubation may be utilized as an alternative to blind nasal intubation or tracheostomy in the surgical management of patients involving complex maxillofacial surgeries. We hypothesized that the submental intubation should not be used where long term ventilation support is needed. We did a technique modification to deliver the endotracheal tube out from the submental region to avoid pilot cuff damage. Our study proposes that skull base access surgery is a safe and potential indication for submental intubation. In our experience submental intubation is a simple, secure and effective procedure for operative airway control in major maxillofacial surgeries.

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Introduction

Management of operative airway in cases of maxillofacial surgeries requires special consideration. Different methods of intubation and surgical airway are discussed in literature.

Maxillofacial surgeries often present peculiar difficulties to the surgeons and anesthesiologist, who are at present facing controversies regarding these points of common

interest. In maxillofacial surgeries there is a frequent need for maxillomandibular fixation (MMF) and use of orotracheal intubation significantly impedes this. Nasotracheal intubation on the other hand can be utilized, but it is contraindicated in certain situation like skull base fractures, comminuted midface fractures and septonasal defects causing physical obstruction to the passage of nasotracheal tube. Further, the presence of nasotracheal tube interfere with surgical reconstruction of the naso-orbito-ethmoidal complex fracture [1–3].

Tracheostomy is another alternative technique for establishment of airway. It is the method of choice for patients with excessive craniofacial injuries and multisystem trauma and those who require long term ventilator support. However, it is associated with significant morbidity and complications like hemorrhage, subcutaneous emphysema, pneumomediastinum, pneumothorax, recurrent laryngeal nerve damage, stomal and respiratory tract infection, tracheal infection, tracheal stenosis, tracheal erosions, dysphagia, problems with decanulation and excessive scarring [4, 5].

An alternative method of establishing an airway in patients who require maxillofacial surgery and do not require long term ventilator support is to perform submental intubation [2].

Submental intubation first described by Altemir [6] this provides a secure airway and allows unimpeded access to oral cavity and midface, whilst avoiding the potential complications associated with nasal intubation and tracheostomy.

In this study twenty-three patients who reported for serious maxillofacial surgeries in whom oral intubation was concluded inappropriate were evaluated after submental intubation was used. The technique was evaluated for ease of intubation, the time taken for the technique, bleeding during and after the procedure, any intra-operative or post-operative complications and for postoperative sequel like infection, scar, fistula, and neurological deficits.

Materials and Methods

A prospective study was conducted from May 2008 to August 2010. Twenty-three patients were intubated using orotracheal intubation and tube secured submental approach. Incidentally all were males with mean age of 27.5 years. Nineteen patients had suffered from facial fractures, three from skull base tumor and one from bimaxillary protrusion (Fig. 1). All the facial injuries were cases of poly trauma of face affecting occlusion, including anterior skull base fracture and nasal pyramid fracture. In

Fig. 1 Distribution of patient's diagnosis

the other cases submental intubation was used for unimpeded access and intraoperative occlusion guidance.

Patients with combined midface, mandible and nasal bone fractures, skull base fractures and pathologies and those requiring orthognathic surgery of both the jaws were included in the study. Patients with known history of hypertrophic scarring, those requiring multiple operations and long term post-operative ventilation support were excluded from the study.

All the patients were informed about the study and informed consent was obtained prior to the procedure. Approval from Research and Ethical Committees of the Institute was also taken prior to the study.

The patient's trachea was intubated orally using a flexometallic cuffed endotracheal tube by direct laryngoscopy or by blind technique and the bulb inflated. The orotracheal intubation was then converted into submental route by the technique explained by Altemir [6] (Fig. 2).

The side of the mandible that is used may be dictated by the presence of a concurrent mandibular fracture.

All the patients were monitored for any intra-operative and post-operative complication, time taken for intubation, extubation and tube in vitro and healing of extraoral and intra-oral wound.

Results

In our study submental intubation permitted simultaneous reduction and fixation of all fractures and intra-operative control of the dental occlusion as well as access to the tumor mass without interference from the tube during the operation. During the procedure no additional difficulties in passing the tube through the floor of the mouth was encountered and the total duration of the procedure was less than 10 min (Fig. 3). All the patients were extubated in the operation theater and the mean time of tube in vitro was

Fig. 2 ET tube in place fixed in submental region

4.41 h (Fig. 4). Disconnection time from the ventilator was approximately 2 min (Fig. 3). There was no significant oxygen desaturation in any patient during the procedure. Only one intra-operative complication was reported wherein the bulb of the cuff got ruptured during grasping the endotracheal tube with artery forceps, this was managed immediately by changing the tube. No motor or sensory deficit was found. Normal healing in the mucosa of the floor of the mouth was observed. No bleeding or infection in the area was reported. The salivary duct was preserved and a normal level of saliva fluids was maintained. The resultant scar was well accepted by the patients. No cases of hypertrophic scarring have been reported (Table 1).

Fig. 3 Distribution of time taken for intubation and extubation

Fig. 4 Distribution of duration of tube in vitro

Discussion

The submental route of tracheal intubation was first described by Altemir [6]. Stoll [7] described a similar technique to submental intubation but where the incision is placed further posteriorly in the submandibular region and Prochno [8] reported 14 patients who underwent submandibular transmylohyoid intubation. Green and Moore [9] described the use of two tracheal tubes. MacInnis and Baig [10–12] reported 15 patients in whom the submental incision was modified to utilize a strict midline approach. Drolet [13] reported using a lubricated tube was exchanger (Cook), which was passed through the tracheal tube. Once it was pulled through the submental incision, the tube was then exchanged for a fresh reinforced one.

In this study, we employed the technique performed by Altemir [6] for submental intubation. We prefer flexomental cuffed tube as it is safe to use due to its non-kinking property.

This technique provides a secure airway whilst at the same time allowing an unobstructed surgical field for adequate reduction and fixation of midface and panfacial fractures and other maxillofacial surgeries. Submental intubation was first described as an alternative route for oral or nasal intubation, especially in cases of poly trauma of face. Other indications, such as systemic pathology or cases of simultaneous orthognathic and plastic surgery, have been reported. The potential indications for submental intubation extend beyond maxillofacial trauma to include orthognathic surgeries and elective maxillofacial surgeries in which reference to dental occlusion is required [2, 10, 14].

We used submental intubation for access skull base surgery, as it provides unobstructed access without any potential complications. Submental intubation is not commonly used in cases of skull base access surgery; therefore we propose skull base access surgery as a one of the primary indications for submental intubation.

Table 1 Clinical details of patients (raw data)

No.	Gender	Age (years)	Diagnosis	Operative procedure	Bleeding		Complication		Time			Post-operative sequel			
					IO (ml)	PO	INT	EXT	INT (min)	EXT (min)	OPT (h)	I	F	S	ND
1	M	35	B/L leforte II + Rt parasymphysis	ORIF	>5	N	None	None	8	2	4	–	–	–	–
2	M	26	Pan facial	ORIF	>5	N	None	None	7.5	2.5	2	–	–	–	–
3	M	25	Bimaxillary prognathism	Le-fort I and BSSO	>5	N	None	None	8.5	3	2.5	–	–	–	–
4	M	35	B/L leforte II + Rt angle	ORIF	>5	N	None	None	8	2.5	5	–	–	–	–
5	M	43	Pan facial	ORIF	>5	N	None	None	7	3.5	5	–	–	–	–
6	M	18	Nasopharyngeal Angiofibroma	Maxilla swing to access skull base	>5	N	None	None	10	2.5	8	–	–	–	–
7	M	22	Pan facial	ORIF	>5	N	Bulb rupture	None	9	3	5	–	–	–	–
8	M	20	Pan facial	ORIF	>5	N	None	None	8.5	2.5	4	–	–	–	–
9	M	28	B/L leforte II + BL parasymphysis	ORIF	>5	N	None	None	8	2	3.5	–	–	–	–
10	M	35	Rt leforte I, Lt leforte II, Rt parasymphysis	ORIF	>5	N	None	None	8.5	2	6	–	–	–	–
11	M	22	B/L le forte II + Rt angle + Lt body	ORIF	>5	N	None	None	8.5	2.5	3	–	–	–	–
12	M	25	Lt ZMC, Rt leforte II, Rt angle	ORIF	>5	N	None	None	7.5	3	3.5	–	–	–	–
13	M	19	Nasopharyngeal Angiofibroma	Maxilla swing to access skull base	>5	N	None	None	8	2.5	10	–	–	–	–
14	M	29	B/L leforte II, Rt parasymphysis	ORIF	>5	N	None	None	9	2.5	4	–	–	–	–
15	M	33	Atlantoaxial disarticulation	Mandible swing to access vertebral column	>5	N	None	None	9	3	6	–	–	–	–
16	M	28	B/L leforte II, Nasal bridge	ORIF	>5	N	None	None	8	3	3	–	–	–	–
17	M	34	Pan facial fracture	ORIF	>5	N	None	None	8.5	3.5	4	–	–	–	–
18	M	36	Nasal bridge, mandible fracture	ORIF	>5	N	None	None	8.5	2.5	3.5	–	–	–	–
19	M	38	B/L leforte III, B/L parasymphysis fracture	ORIF	>5	N	None	None	9	3	4	–	–	–	–
20	M	39	Pan facial fracture	ORIF	>5	N	None	None	8	3	4.5	–	–	–	–
21	M	28	B/L le forte II + Rt angle + Lt body	ORIF	>5	N	None	None	7.5	3.5	3	–	–	–	–
22	M	40	Pan facial fracture	ORIF	>5	N	None	None	8	2.5	4.5	–	–	–	–
23	M	27	B/L leforte II, nasal bridge	ORIF	>5	N	None	None	7.5	3	3.5	–	–	–	–

B/L bilateral, *Rt* right, *Lt* left, *ORIF* open reduction internal fixation, *IO* intraoperative, *PO* postoperative, *N* negligible, *INT* intubation, *EXT* extubation, *OPT* operative, *I* infection, *S* scar, *F* fistula, *ND* neurological deficit, *BSSO* bilateral sagittal split osteotomy

Since the first application of this technique, less than 20 years ago, many authors have studied the clinical use of this procedure. Very low rates of complications have been reported. Many trials have shown the submental route to be

a simple, quick and safe approach to airway management. Submental intubation combines the advantages of nasotracheal intubation, which allows the mobilization of the dental occlusion, and those of orotracheal intubation,

which allows access to frontonasal fractures. It also avoids the risks of iatrogenic meningitis or trauma of the anterior skull base after nasotracheal intubation, as well as complications, such as tracheal stenosis, injury to cervical vessels or the thyroid gland, related to tracheotomy [1–6, 10–12, 14, 15].

The possible limitation of this technique is in patients who present with neurological deficit or thoracic trauma and need more than 7–14 days of post-operative ventilator support. We hypothesized that prolonged intubation with submental route can lead to salivary fistula, saliva aspiration and tube disposition. However, no studies have been undertaken to substantiate these complications. Therefore in cases where prolonged intubation is required, tracheotomy is known to be a safer procedure than endotracheal intubation. It is therefore difficult to propose it to patients suffering from an isolated facial trauma who will not require prolonged airway management.

In this study we included 23 patients in whom submental intubation was used. Of these, maximum cases were of poly trauma of face and one case of known indication of this technique i.e. orthognathic surgery and three cases of new indications i.e. skull base access surgery.

The mean time encountered for intubation is 9 min and for extubation 2.5 min which is slightly greater than the overall results of Navaneetham [5]. There is no effect on the time of the surgery reported with this technique.

In our case series we did not report any potential complication as mentioned in literature like accidental extubation, tube obstruction, wound infection, submandibular mucocoele, salivary fistula, lingual nerve damage and hypertrophic scars [3, 4, 9, 10, 15–17]. The scar formed was inconspicuous in all the patients.

Our results are comparatively better than the results of Navaneetham [5] who reported tube blockage intra-operatively in 2 out of 15 patients, Caubi [18] in his review of 13 patients reported one intra-operative complication as deviation and compression of tube due to which tracheal pressure increased, and Garg [16] who reported two complications in his review of ten patients which was not encountered in our case series.

The only complication we encountered is rupture of pilot cuff while holding the tube with artery forceps to deliver tube extra-orally which was managed immediately by changing the tube without any uneventful sequel. This complication can be avoided by carefully grasping the ET tube and delivering it out first and then cautiously delivering the pilot cuff extra-orally. We performed a new technique modification to overcome this complication, the pilot cuff can be placed in the orifice of the endotracheal tube and then the tube was delivered out safely.

Further research is needed to evaluate the effect of submental intubation in cases which require long periods of

ventilation support as in our study all the patients were extubated within 24 h after surgery.

Submental tracheal intubation is a useful alternative for airway management in selected patients with complex maxillofacial injuries and other maxillofacial surgeries. It demands a certain amount of surgical skill, but it is simple, safe and quick to execute. It also allows operative control of the dental occlusion and concomitant surgery of the nasal pyramid in major maxillofacial traumas and avoids iatrogenic placement of the tube in skull base in cases of nasal and skull base fractures. In our study the technique we used for submental intubation was similar to that proposed by Altemir with the modification of using armoured tube, which is probably the reason for the low complication rate we faced. This study proposes that skull base access surgery is a safe and potential indication for submental intubation. Finally, it presents a low incidence of intra-operative and post-operative complications and eliminates the risks and side effects of tracheotomy. In our series we faced only one complication which can be considered as the surgeon's fault rather than the potential complication of the technique. However, this technique should be avoided when the patient is expected to be placed on long term ventilation and has to undergo repeated surgeries at short intervals. Further studies are needed to evaluate the efficacy in prolonged intubation.

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Conflict of interest None.

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