Does submental intubation technique show an edge over percutaneous tracheostomy? A prospective study in complex oromaxillofacial surgery

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Abstract

Background: Complex oromaxillofacial fractures pose unique challenge for securing the airway. Techniques other than conventional tracheostomy and orotracheal intubation need to be explored to overcome shortcomings associated with conventional methods. This study compares median approach of submental intubation with percutaneous tracheostomy with respect to procedure time, time for extubation/decannulation, length of stay in intensive care unit and complications encountered. Aims: To evaluate procedure time, time for extubation/decannulation, length of stay in intensive care unit and complications for two techniques of airway management in oromaxillofacial surgeries.Settings and Design: Institutional, prospective study.Materials and methods: This prospective study included 25 patients who sustained oromaxillofacial fracture operated under general anesthesia from August 2008 to December 2009. In 15 patients, submental intubation and in 10 patients percutaneous tracheostomy technique were adopted. Complex oromaxillofacial fractures included Lefort 1 and 2, nose, ethmoid and orbit, maxilla and mandible. Airway technique of submental intubation and percutaneous tracheostomy were attempted on the basis of interincisor gap. The procedure time for the two techniques, the time for extubation/decannulation and the length of stay in intensive care unit were evaluated statistically.Statistical analysis used: unpaired ‘t’ test.
Results: Of the 25 patients, there were 12 males, 3 females and 8 males,2 females in the submental intubation and percutaneous tracheostomy group respectively. All patients belonged to ASA status 1 and 2. The first successful attempt achieved for submental intubation group and percutaneous tracheostomy group was 93% and 90% respectively. The mean time to perform the submental intubation procedure was 5.27 + 0.72(mean + standard deviation) minutes and 21.72 + 2.04 minutes for percutaneous tracheostomy group. The mean time for extubation was 4.73 + 8.18 days in submental intubation group and 23.3 + 5.25 days for decanulation in percutaneous tracheostomy group. The average length of stay in intensive care unit postoperatively were 6.73 + 8.18 days in submental intubation group and 25.8 + 6.81 days for percutaneous tracheostomy group. Theperformance time, the time for extubation/decannulation and the length of stay in intensive care unit were statistically highly significant for the two groups. Complications encountered in the two groups were recorded. Conclusions: Both, submental intubation and percutaneous tracheostomy can secure the airway in complex oromaxillofacial fracture reduction surgery. Both techniques allow uninterrupted surgical access to the operative field. Although submental intubation technique gives an imperceptible scar which has aesthetically greater acceptance compared to functionally challenging and unsightly tracheostoma which pose an enormous stress to the patient. The complications associated with tracheostomy are at times difficult to manage even in expert hands. Though submental intubation is easily performed, the selection of a particular technique should take into consideration factors other than preoperative airway assessment.

INTRODUCTION

Complex oromaxillofacial injuries involving skeleton framework can compromise airway which is part of the normal contour of the facial bones. In basal skull fracture, when maxillomandibular fixation forms part of surgical treatment, an alternative approach needs to be implied such that the inserted airway device not only avoids the nasal route but also does not obstruct the oral surgical field. Under such circumstances, the choice for securing airway are either percutaneous tracheostomy or submental intubation . This study evaluates the basis of choosing either option in complex oromaxillofacial fracture reduction surgery on the pretext of different factors.

MATERIAL AND METHODS

This prospective study assessed 25 patients with ASA

(American Society of Anesthesia) physical status 1 and 2 who sustained maxillofacial fractures from August 2008 to December 2009 scheduled for open reduction and fixation under general anesthesia. The patients were assigned in two groups: submental intubation (SMI) group and percutaneous tracheostomy (PCT) group on the basis of preoperative assessment of interincisor gap. A gap of 4 cm and above allowed laryngoscope blade into mouth for submental intubation. All patients with less than 3 cm underwent percutaneous tracheostomy.

Patients with head injury, cervical spine injury, thoracic and abdominal trauma and defective coagulation profile were excluded from the study. Basic monitoring during general anesthesia included heart rate, electrocardiogram, non invasive blood pressure, arterial O_2 saturation and end tidal CO_2.

Both the procedures were performed in operation theatre settings and time taken from skin incision to establishing connection of circuit, time for extubation(SMI group)/decannulation(PCT group) and length of stay in intensive care unit in post operative period were analysed statistically implying unpaired t test. P value < 0.05 were considered statistically significant. Submental intubation(SMI) was done after inducing with intravenous propofol, fentanyl and vecuronium as per their body weight and maintained with inhalational isoflurane in O_2. Percutaneous tracheostomy was performed without muscle relaxant.

Procedure steps for submental intubation: Trachea was intubated with cuffed oral wire reinforced flexometallic(spiralbind) endotracheal tube of appropriate size. A throat pack was inserted. The submandibular space was draped. A 2 cm long longitudinal skin incision was given with right hand approximately 1.5 cm adjoining lower mandibular margin in the median region of submental area.

A blunt dissection was carried out with a curved dissecting forceps between the muscular layers of mylohyoid to create a tunnel into the floor of mouth near the lingual mandibular margin. This was aided by placing two fingers of other hand at the floor of mouth pushing aside tongue and feeling the correct direction of the curved dissecting forceps. The forceps was opened to widen the tunnel. Hemostatis was maintained. The cuff of the endotracheal tube was deflated and pilot balloon with its valve was grasped with dissecting forceps and negotiated out first through the tunnel followed by proximal end of the flexometallic tube after disconnecting from the ventilator and removing the connector. The ventilator connection was re-established subsequently(figure 1-4). The flexometallic endotracheal tube secured at skin in the submental region with 3.0 silk. At the time of extubation the endotracheal tube was retrieved through submental incision and skin approximated with subcuticular stitch.

Figure 1

Figure 1

Figure 2

Figure 2

Figure 3

Figure 3

Figure 4

Figure 4

Procedure steps for percutaneous tracheostomy (Grigg's technique): Optimal positioning with the head extended and placing a roll on the back between the two shoulder blades. After skin preparation and surgical draping, a horizontal 2.0 cm long skin incision in midline at the level of second tracheal ring and dissection carried out. The trachea was identified as the needle with saline filed syringe pierced the space between second and third tracheal ring aspirated air. Guidewire was passed through a side channel in the needle which was subsequently withdrawn. Serial dilators were passed over the guide wire to dilate the track. Finally Griggs forceps introduced over the guidewire to widen the track formed in the anterior wall of trachea. The tracheostomy tube placed through the track and correct position confirmed with bilateral air entry in lungs and persistent square waveform on end tidal CO_2 .

After completion of surgery, all patients were shifted to recovery and later to intensive care unit in postoperative period. Occlusion was obtained for postoperative period with elastic rubber which was removed and patient subsequently extubated/decannulated in intensive care unit.

RESULTS

Submental intubation was carried out in 15 patients and percutaneous tracheostomy in 10 patients undergoing fixation of oromaxillofacial fractures(table 1) . Demographics of these patients is shown in table 2. The success rate achieved in the two groups in first and second attempt for inserting endotracheal tube in SMI group and

tracheostomy tube in PCT group, the average total duration of the procedure from skin incision to establishment of closed airway circuit, the time taken for extubation/decannulation in both groups and the length of stay for each group in intensive care unit are depicted in table 3. Procedural and post procedural complications are enumerated in table 4.

Figure 5

Table 1

S No	Fracture	Surgery	Group	Outcome
1	Lefort I, L parasymphisis Md	ORIF	SMI	Extubated at end of surgery
2	Lefort II, symphisis Md	ORIF	SMI	Extubated at end of surgery
3	Lefort II NOE,L parasymphisisMd	ORIF	SMI	Extubated at end of surgery
4	Lefort I, R parasymphisis Md	ORIF	SMI	Extubated at end of surgery
5	Lefort II, symphisis Md	ORIF	SMI	Extubated at end of surgery
6	Lefort I NOE, L body Md	ORIF	SMI	Extubated at end of surgery
7	Lefort II, L angle Md	ORIF	SMI	Extubated at end of surgery
8	Lefort II, L parasymphisis	ORIF	SMI	Extubated at end of surgery
9	NOE and frontal, R body Md	ORIF	SMI	Extubated at end of surgery
10	Nasal, symphisis Md	ORIF	SMI	Extubated POD 3 b/o AE
11	Lefort I, L parasymphysis	ORIF	SMI	Extubated POD 3 b/o AE
12	Lefort II NOE, L parasymphisis	ORIF	SMI	Extubated POD 4 b/o AE
13	Lefort I, R condylar(malocclusion)	IMF(O)	SMI	SMI converted to PCT(DC POD 21)
14	NOE, L condylar(malocclusion)	IMF(O)	SMI	SMI converted to PCT(DC POD 20)
15	NOE b/l condylar(malocclusion)	IMF(O)	SMI	SMI converted to PCT(DC POD 20)
16	NOE, malunited bilateral condylar	IMF(O)	PCT	Decannulated on POD 21
17	Nasal, R condylar, angle Md	IMF(O)	PCT	Decannulated on POD 20
18	Nasal, R condylar, parasymphsis	IMF(O)	PCT	Decannulated on POD 21
19	Lefort I, L subcondylar, body Md	IMF(O)	PCT	Decannulated on POD 22
20	Lefort II, L body, subcondylar	IMF(O)	PCT	Decannulated on POD 21
21	Nasal, b/l malunited condylar Md	IMF(O)	PCT	Decannulated on POD 22
22	Lefort II, R condylar, angle Md	IMF(O)	PCT	Decannulated on POD 23
23	NOE, L condylar, body Md	IMF(O)	PCT	Decannulated on POD 23
24	Lefort I, R angle, body Md	IMF(O)	PCT	Decannulated on POD 22
25	Nasal, b/l malunited condylar	IMF(O)	PCT	Decannulated on POD 38

ORIF- open reduction internal fixation, Md- mandible, IMF- Intermaxillary fixation,O- mouth occlusion,NOE- nasal,orbital,ethmoid, POD- post operative day, b/l- bilateral, R- right, L- left, b/o- because of, AE- airway edema, SMI- submental intubation, PCT-percutaneous tracheostomy

Figure 6

Table 2(Demographic profile and criteria for selection of patients)(mean standard deviation)

	SMI	PCT	P value
Number	15	10	
Age(years)	27.06 ± 5.14	27.8 ± 3.32	0.4021(NS)*
Weight(kgs)	59.26 ± 7.58	58.1 ± 7.57	0.3754(NS)*
ASA status(1:2)	14:1	9:1	
Male:Female	12:3	8:2	
Interincisor gap			
1 cm	0	6(60%)	
2 cm	0	3(30%)	
3 cm	0	1(10%)	
4 cm and above	15(100%)	0	

*NS: Nonsignificant(P>0.05)

Figure 7

Table 3

Successful attempts for insertion	SMI	PCT	P value
First	14(93.3%)	9(90%)	
Second	1(10%)	1(10%)	
Procedure time(minutes)	5.27 ± 0.72	21.72 ± 2.04	29.375(VHS)*
Time for extubation/decanulation(days)	4.73 ± 8.18	23.3 ± 5.25	6.31(VHS)*
Length of stay in ICU(days)	6.73 ± 8.18	25.8 ± 6.81	6.21(VHS)*

*VHS:Very highly significant(P<0.0001)

Figure 8

Table 4(Complications)

	PCT	SMI
Bleeding	5/10	6/15
False passage	1/10	0/15
Damage to pilot balloon/endotracheal tube /tracheostomy	0/10	1/15
Endotracheal/ tracheostomy tube dislodgement	0/10	1/15
Damage to vital structure(lingual nerve, Wharton's duct, submandibular gland, Inominate vessels)	0/10	0/15
Tracheal stenosis	1/10	0/15

DISCUSSION

With the advent of dynamic compression plates and mini plates maxillofacial surgery is being accomplished with proficiency. Airway management in these complex fracture reduction surgery has always been challenging. Nasal route of securing tracheal intubation in patients with fracture involving base of skull and Lefort can possibly misdirect the tube into cranium leading to brain damage.[1,2] Therefore this route of intubation is best avoided. Surgical procedure of maxillary fixation preclude conventional oral route for intubation.[3,4] Under such circumstances, percutaneous or surgical tracheostomy provides opportunity to secure airway but associated complications with this technique like hemorrhage, subcutaneous emphysema, respiratory infection, difficulty in decannulation, tracheostomal stenosis make it necessary to explore other options.[5] Submental intubation is safe, easy to perform, less invasive with fewer complications which can be easily managed and overcome.[6] A basic knowledge of neck anatomy would facilitate blunt dissection and avoid encountering complications from damage to Wharton's duct and its gland and other vital structures present in floor of mouth. The technique of submental intubation diverts the proximal end of orotracheal intubation through a tunnel from floor of mouth to its exit at submental region without any impediments. During the study only one incidence of detachment of pilot balloon from the inflating tube of the endotracheal tube was recorded while attempting to bring it out through the tunnel. The cuff of this damaged tube was found to have been dislodge into

oropharynx during manipulation. This endotracheal tube was therefore abandoned and immediately replaced without losing control of airway. Despite this, shorter procedure time, earlier removal of endotracheal tube, less stay in intensive care unit and less incidence of complications give submental intubation some edge over tracheostomy. The only limitation of this technique being situation requiring prolong(more than 7 days) postoperative mechanical ventilation support or in condylar fractures where postoperative IMF(intramaxillary fixation: mouth closed) is maintained.

In the present study 9 patients in SMI group where extubated at end of surgery without any problems, 3 patients were extubated after 3-4 days due to airway edema and in 3 patients tracheostomy had to be performed to maintain airway because of IMF.

Besides median approach of submental intubation which we followed, other authors have applied lateral approach of submental intubation.[7] The drawback with it being the presence of submandibular gland in the region which can likely get damaged. Martinez-lage describe retromolar intubation where the orotracheal tube is negotiated through a space carved out by semilunar osteotomy.[8]

Green and Moore secured airway first by orotracheal intubation which they removed after separately passing a reinforced tube from submental incision.[9] Later tube exchangers were brought into practice for converting nasal tube into oral. [10,11]

10 patients with limited mouth opening in preoperative assessment guided us to perform tracheostomy. Although this procedure require more skills and expertise in either performing or dealing with complications, it offers greater safety to patient intra and postoperatively particularly when mandibular occlusion continues in intensive care unit. 4(40%) patients in PCT group had occlusion in postoperative period whereas in SMI group it was only 3(20%).

Minor bleeding was encounted in both the groups. Bleeding during SMI is minor and unproblematic while it can be devastating in PCT if thyroid gland or isthmus is breeched or innominate vessel gets damaged if low tracheostomy is attempted. One false passage was created during PCT which was immediately rectified and one patient suffered difficult decannulation due to tracheostoma.
A prosthetic rehabilitation device provided to this patient maintained the airflow after decannulation.

It is prudent to adopt a cautious approach to airway management in oromaxillofacial surgeries. A particular technique cannot be opted for airway management in oromaxillofacial fractures merely on preoperative airway assessment. Definite surgical plan need to be discussed with the operating surgeon than to struggle with complicated airway which can endanger patients life. Many patients can be managed by submental intubation technique which is less time consuming but also safe, easy and convenient method. Percutaneous tracheostomy cannot be overlooked in situation where postoperative IMF(mouth closure) need to be maintained to avoid malalignment. Postoperative IMF is commonly done for condylar fracture of mandible.

References

1. Muzzi DA, Losasso TJ, Cucchiara RF: Complication from a nasopharyngeal airway in a patient with a basilar skull fractures. Anesthesiology; 1991Feb;74(2):366–68.
2. Bahr W, Stoll P: Nasal intubation in the presence of frontobasal fractures. J Oral Maxillofac Surg; 1992May;50(5):445–47.
3. Davis C: Submental intubation in complex craniomaxillofacial trauma. ANZ Journal of surgery;2004;74:379-81.
4. Zoltán N, Ferenc S, Lajos O and József N: Submental endotracheal intubation in concurrent orthognathic surgery: A technical note. Journal of Cranio-Maxillary surgery;2006;34:362-65.
5. Biglioli F, Mortini P, Goisis M, Bardazzi A and Boari N: Submental Orotracheal Intubation: An Alternative to Tracheotomy in Transfacial Cranial Base Surgery. Skull base;2003Nov;13(4):189-95.
6. Maclnnis E, Baig M:. A modified submental approach for oral endotracheal intubation. Int J Oral Maxillofac Surg; 1999Oct;28(5): 344-46.
7. Hönig JF, Braun U: [Laterosubmental tracheal intubation. An alternative method to nasal-oral intubation or tracheostomy in single-step treatment of panfacial multiple fractures or osteotomies] Anaesthesist;1993 Apr;42(4):256-58.
8. Martinez–Lage J, Esclava JM, Cebrecos AI, Marcos O: Retromolar intubation. J Oral Maxillofac Surg;1998;56:302–06.
9. Green JD, Moore UJ: A modification of sub–mental intubation. Br J Anaesth; 1996;77:789–91.
10. Cooper RM: Conversion of a nasal tube to an orotracheal intubation using an endotracheal tube exchanger. Anesthesiology; 1997;87:717–18.
11. Drolet P, Girard M, Poirier J, Grenier Y: Facilitating submental endotracheal intubation with an endotracheal tube exchanger. Anesth Analg; 2000;90:222–24.

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