Current Perspectives in Intra Operative Airway Management in Maxillofacial Trauma

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Abstract

Objective Maxillofacial trauma presents a complex problem due to the disruption of normal anatomy. In such cases, we anticipate a difficult oral intubation that may hinder intraoperative IMF. Nasal and skull base fractures do not advocate use of nasotracheal intubation. Hence, other anesthetic techniques should be considered in management of maxillofacial trauma patients with occlusal derangement and nasal deformity. This study evaluates the indications and outcomes of anesthetic management by retromolar, nasal, submental intubation and tracheostomy. **Methodology** Of the 49 maxillofacial trauma cases reviewed, that required intraoperative IMF, 32 underwent nasal intubation, 9 patients had tracheostomy, 5 patients utilized submental approach and 3 underwent retromolar intubation.

Results Among patients who underwent nasal intubation, eight cases needed fiberoptic assistance. In retromolar approach, though no complication was encountered, constant monitoring was mandatory to avoid risk of tube displacement. Consequently, submental intubation required a surgical procedure which could result in a cosmetically acceptable scar. Though invasive, tracheostomy has its benefits for long term ventilation.

Conclusion Intubation of any form performed in a maxillofacial trauma patient is complex and requires both sound judgement and considerable experience.

Keywords Maxillofacial trauma · Nasal intubation · Submental intubation · Retromolar technique · Tracheostomy · Intermaxillary fixation

Patients with maxillofacial trauma present unique airway management challenges in the emergent, operative, and postoperative settings [1]. Surgery often requires manipulation and movement of the head, neck and mouth, creating the risk of obstructing, transecting, disconnecting or removing the airway. Airway management during surgical treatment of patients with maxillofacial trauma is complicated by injury to route of intubation. Maxillomandibular fixation, or at least a possibility to establish and repeatedly check the occlusion, is needed intraoperatively for adequate reduction of jaw fractures. Therefore, maxillofacial trauma patients frequently cannot be managed with orotracheal intubation, which is the standard way of securing the airway during surgical procedures [2]. Changing from a nasal tube to an oral tube at the end of an operation to treat nasal fractures is traditionally the least invasive way to manage the airway. However, this can lead to contamination of the surgical field and compromise the accuracy of reduction of the nasal fractures. Usually, nasotracheal intubation would be the alternative for airway management. However, nasotracheal intubation is also contraindicated in cases of fracture base skull. Accidental passage of the tube into the cranial cavity is a very rare complication, however a catastrophic one, dreaded by anesthesiologists [3, 4]. In such circumstances retromolar intubation—a non invasive technique [5], submental

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intubation [6] or tracheostomy remains a choice of securing an airway [7].

The purpose of this paper is to evaluate the outcomes of airway management by various intubation techniques in patients with maxillofacial trauma requiring intermaxillary fixation.

Material and Method

Forty-nine patients reported to our unit with maxillofacial injury who required intraoperative intermaxillary fixation were included in this study. All intubations were done by skilled and experienced staff member of department of anesthesiology. Selection criteria for choosing the type of intubation was made after preanesthetic evaluation and discussion between anesthetist and surgeon.

Retromolar Intubation

Inclusion criteria:

Patient requires inter maxillary fixation during surgery
When sufficient space is available distal to last molar

Nasal Intubation

Inclusion criteria:

Sufficient space distal to last molar is not available

Exclusion criteria:

NOE fracture
Injury to base of skull

Submental Intubation

Inclusion criteria:

Sufficient space distal to last molar is not available
NOE fracture
Injury to base of skull

Exclusion criteria:

Post operative ventilation may be required

Tracheotomy

Inclusion criteria:

Other injuries like head injury, fracture of Pelvis, Femur or tibia etc.
Patient requiring ventilation pre operatively

NOE fracture

Injury to base of skull

Postoperative ventilation may be required.

Among them 32 underwent nasal intubation, 9 patients had Tracheostomy (Fig. 1), 5 patients utilized submental approach (Fig. 2) and 3 underwent retromolar intubation without removal of any tooth to create space for tube (Fig. 3). The parameters used were time taken for intubation, bleeding encountered during intubation, decrease in O₂ saturation, displacement of tube, interference in surgical

Fig. 1 Tracheostomy

Fig. 2 Submental intubation

Fig. 3 Retromolar intubation

field, infection, need for tube to be retained after surgery and scarring.

Results

Time taken for intubation was noted in all patients. Tracheostomy took longest time mean 14 min with range of 9–19 min. 4 patients underwent emergency Tracheostomy. The Retromolar took time in range of 4–5 min with mean 4.43 min. The Submental intubation was done in range 6–11 of 8 min. Whereas, time varies, if fiberoptic assistance was required it took additional time. The range noted for nasotracheal intubation was 4–17 min with mean 6.78 min. Among patients who underwent nasal intubation, eight cases needed fiber optic assistance. Bleeding was

Table 1 Patients managed by nasal intubation

	Age	Sex	Facial injury	Time taken for intubation
1	27	M	Mandibular symphysis and bilateral condylar fracture	4 min
2	29	M	Mandibular body fracture	5 min
3	33	M	Mandibular parasymphysis fracture	7 min 30 s
4	42	F	Mandibular body and angle fracture	10 min
5	44	M	Mandibular parasymphysis and zygomatic complex	6 min 30 s
6	50	F	Mandibular symphysis and bilateral condylar fracture	8 min
7	31	M	Mandibular parasymphysis fracture	7 min
8	41	M	Mandibular parasymphysis fracture	4 min
9	18	M	Mandibular angle fracture	11 min
10	24	M	Mandibular bilateral parasymphysis fracture	17 min
11	34	F	Lefort I, mandibular body and condylar fracture	7 min 30 s
12	27	M	Mandibular symphysis fracture	6 min
13	55	M	Mandibular parasymphysis fracture	10 min
14	19	F	Lefort I, mandibular body and condylar fracture	7 min
15	51	M	Mandibular symphysis and bilateral condylar fracture	5 min
16	33	M	Mandibular angle and zygomatic complex	4 min
17	29	M	Lefort I, mandibular body and condylar fracture	8 min
18	45	F	Mandibular body and condylar fracture	11 min
19	67	F	Mandibular parasymphysis fracture	6 min
20	59	M	Mandibular parasymphysis and body fracture	8 min 30 s
21	71	M	Mandibular angle fracture	3 min 30 s
22	65	F	Lefort I, mandibular body and condylar fracture	9 min 30 s
23	21	M	Mandibular body and angle fracture	8 min 30 s
24	23	M	Mandibular symphysis and bilateral condylar fracture	5 min 30 s
25	19	M	Mandibular angle fracture	5 min
26	18	F	Mandibular parasymphysis and condylar fracture	4 min 30 s
27	17	M	Mandibular parasymphysis and condylar fracture	6 min
28	39	F	Mandibular angle and zygomatic complex	3 min 30 s
29	42	M	Mandibular symphysis and bilateral condylar fracture	5 min
30	47	M	Mandibular parasymphysis fracture	7 min
31	16	F	Lefort I, mandibular body and condylar fracture	6 min
32	17	M	Mandibular symphysis and bilateral condylar fracture	7 min

controlled and did not encounter any complication due to that. There was no major bleeding. 15.6% in nasal, 20% in submental and 11.1% in tracheostomy encountered bleeding. The amount of bleeding was not measured. In Retromolar approach, though no complication was encountered, constant monitoring was mandatory to avoid risk of displacement and kinking of tube. Consequently, Submental intubation required a surgical procedure which could result in a cosmetically acceptable scar. Scar remained more evident in 44.4% of tracheostomy and 20% submental intubation after healing. None of the patient came back for

scar revision. Though invasive, Tracheostomy has its benefits for long term ventilation. Tables 1, 2, 3 and 4 show details of type of injury and selected intubation. Results are tabulated in Table 5 and Mean, Range and Standard deviation for time taken for intubation in Table 6.

Discussion

Oro tracheal intubation is not feasible when intraoperative inter maxillary fixation is required. Nasotracheal

Table 2 Patients managed by retromolar intubation

	Age	Sex	Facial injury	Time taken for intubation
1	18	F	Lefort I, mandibular body and condylar fracture	4 min
2	33	M	Mandibular symphysis and bilateral condylar fracture	5 min
3	42	M	Nasal, mandibular parasymphysis fracture	4 min 30 s

Table 3 Patients managed by submental intubation

	Age	Sex	Facial injury	Time taken for intubation
1	22	M	Nasal, mandibular angle and zygomatic complex	11 min
2	31	M	Lefort II, symphysis fracture	6 min
3	48	M	NOE, Lefort I and mandibular body fracture	9 min
4	19	M	Nasal, parasymphysis and bilateral condylar fracture	8 min
5	26	F	Nasal, parasymphysis and condylar fracture	6 min

Table 4 Patients managed by tracheostomy

	Age	Sex	Facial injury	Time taken for intubation
1 ^a	28	M	Lefort I, left parasymphysis and right condylar fracture	12 min
2	41	M	Lefort III, NOE and dentoalveolar fracture	20 min
3	37	F	Lefort II, bilateral parasymphysis fracture	15 min
4 ^a	55	M	Nasal, symphysis and bilateral condylar fracture	9 min
5	19	M	Lefort II, zygomatic complex, mandibular body fracture	13 min
6	21	M	NOE ^b , mandibular right parasymphysis fracture	14 min
7 ^a	48	M	Mandibular symphysis and bilateral condyle	11 min
8 ^a	22	F	Right mandibular body and left mandibular condyle	19 min
9 ^a	66	F	Nasal, Lefort I and zygomatic complex	13 min

^a Patients underwent emergency tracheostomy

^b Nasoorbital ethmoid fracture

Table 5 Results

	Nasal	Retromolar	Submental	Tracheostomy
Time taken for intubation (min)	7	4.5	8	14
Bleeding encountered during intubation	5	0	1	1
Decrease in O ₂	0	0	0	0
Displacement of tube	5	2	0	0
Interference in surgical field	0	1	0	0
Infection	0	0	1	0
Need for tube retained after surgery	0	0	0	8
Scarring	0	0	1	4

Table 6 Range, mean and standard deviation of time taken for intubation

	Tracheostomy	Submental	Retromolar	Nasal
Range (min)	9–19	6–11	4–5	4–17
Mean	14	8	4.43	6.94
SD	3.57	2.12	0.05	2.81

SD standard deviation

intubation, an alternate technique of securing airway, is contraindicated in certain conditions such as fracture of the base of the skull and nasoorbital ethmoid complex. Nasotracheal tube interferes with operative correction of septal and nasoorbital ethmoid fractures. Unfortunately, surgical reconstruction in patients sometimes precludes Nasal endotracheal, or requires switching the endotracheal tube from the nasal to the oral route at a certain stage of the operation [2]. This may compromise the airways in skull base injury, there is risk of intra cranial introduction of endotracheal tube with direct mechanical damage [3, 4].

This can be prevented with use of fiberoptic bronchoscope or glidescope video laryngoscope [1]. It is believed that nasotracheal intubation risks the introduction of foreign material from the nasopharynx into the subarachnoid space and consequent risk of meningitis. In a study of 160 patients with base of skull fractures and CSF rhinorrhoea, it was reported that the route of tracheal intubation had no influence on the postoperative complication rate. The incidence of meningitis was the same, 2.5% after oral and nasal intubation. The authors concluded that nasal intubation was not contraindicated in the presence of frontobasal fractures [8]. Although most anaesthesia texts include basilar and facial fractures in the list of contraindications to nasotracheal intubation, the evidence to support this recommendation is sparse and mainly based on anecdotal reports. The reports suggest that, in this clinical situation, the nasogastric tube is far more dangerous than the endotracheal tube [9]. Midface fractures of Lefort Type II and III may be displaced postero-inferior by along the inclined plane of the base of the skull, blocking the nasal airway. Nasal intubations may be difficult and require disimpacting by pulling the maxilla forward in the mouth. This fact should also be kept in mind while surgeon does so during surgery. Nasal tube may be pulled out leading to inadvertent extubation [9].

Retromolar intubation is a safe technique being noninvasive it avoids surgical procedure in majority of cases. After oral intubation in patients with missing or impacted third molars, a reinforced endotracheal tube can be passed through the retromolar space and secured to an adjacent tooth with dental wire [10]. Patients who can close their

jaws after introducing an index finger into the retromolar space likely have adequate room for this maneuver. The disadvantages are that the tube can interfere with the surgical field and in case of limited retromolar space, is not feasible. Some authors have described concurrent third molar extraction [5] and bone removal by semilunar osteotomy in the region to enable retromolar intubation [11], although the latter method seems to add further morbidity to a technique designed to avoid it.

Perhaps the simplest and least morbid technique of avoiding tracheostomy in patients with panfacial fractures is retromolar intubation.

Different technique of submental intubation according to the site of incision has been described. That includes a more posterior approach, in the submandibular area without complications [12]. Laryngeal mask airway in the submental route can be performed [13]. In a recent review submental intubation has been found to be safe but observed increased tracheal pressure as a result of deviation and compression of tube [14]. Tracheostomy is ideal in cases where post operative ventilation is required [15]. The usual sequelae of severe maxillofacial trauma, such as upper airway edema, airway obstruction, and the need for tracheobronchial hygiene are considered by some surgeons to be good indications for tracheostomy [16]. The advantages of tracheostomy over endotracheal tube include greater patient comfort, easy aspiration of tracheal secretions and relatively easy reinsertion in the event of unanticipated decannulation. The patients may also be able to swallow and mouth care is easier compared with an endotracheal tube. The comminuted mandibular fractures, midfacial fractures at the Lefort III level, and panfacial fractures may require tracheostomy [17]. The recent studies suggest that tracheostomy is an extremely safe procedure and that laryngeal injuries associated with prolonged endotracheal tube intubation may be far more serious than stenosis after tracheostomy [17, 18].

Conclusion

Intubation of any form performed in a maxillofacial trauma patient is complex and requires both sound judgment and considerable experience. Each technique has its own advantages and limitations. Multiple options exist for securing the emergent airway, and specific interventions will depend on the availability of instruments and experience of practitioners in each setting. Single universal technique of intubation may not find favor in all circumstances. Good communication is always required between surgeon and anesthesiologist before choosing appropriate intubation technique.

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