

A Novel Modified Technique for Sub Mental Intubation in Panfacial Trauma

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Abstract:

Patency of airway in pan facial trauma is paramount for both anaesthesiologist and surgeons for unrestricted access to airway and continuous access of surgical field respectively. Submental intubation has proven very effective technique in providing airways and yet easy for surgeon to operate in pan facial trauma cases. The study was conducted using a modification in submental intubation (SMI) for securing airways during the surgical procedures under general anesthesia. The patients were intubated using the procedure describe by Hernandez Altemir for submental intubation. The modification we performed was that the bulb of the cuff of the endotracheal tube (ET) tube was inserted into the lumen of the ET tube both during the insertion and delivery of the tube.

Methods: The prospective study was conducted to determine the usefulness and safety of submental intubation in patients with pan facial trauma. The following parameters were evaluated: mode of trauma, time required for intubation, accidental extubation, accidental perforation of the pilot balloon during its insertion, post-operative complications such as the healing of wound both intraorally and extraorally. We hypothesized that SMI would not interfere with the surgical procedures and may show less morbidity, less intubation time and reduced complication rates. Out of thirty patients, 73.3% were males and 26.7% were female patients. The mode of trauma for majority of cases was road traffic accident (90%) and only 3 % had history of fall. In 56.7% cases time required for SMI was noted as 8-10 minutes. The mean duration time of surgery for majority of the cases was 3-4 hours. Majority of the patients in the present study reported Glasgow Coma Scale of 15 (83.3%), the least being 13 (6.7%). There were no perioperative complications. Postoperatively, no patients experienced complications like cutaneous infection in the submental region, damage to submandibular duct, sublingual duct, sublingual nerve or abscess in the oral cavity. Additionally, only 6 case with haematoma, pain or hypertrophic scar were reported. SMI appears to be a safe, simple, and effective technique of immediate perioperative airway management in selected cases of panfacial fractures.

Conclusions: The modification enables lesser time and lesser discomfort during the procedure, decrease damage to the cuff and its system and single passage of the artery forcep through the incised tissue thereby reducing soft tissue manipulation and inflammation. On the other hand, the risk of displacement of ET tube during insertion, risk of aspiration of oral and throat fluids and accidental extubation of ET tube was completely eliminated.

Keywords: Panfacial trauma, airway, intubation, Cricothyroidotomy.

Introduction

Acquiring and maintaining a secure airway is a key to successful and safe surgical management of complex maxillofacial trauma and pathologies¹ that would obstruct the surgical field. This goal is challenging for both anaesthesiologist and surgeons due to “shared airway” problem². Intubation should allow both unrestricted access to airway and continuous access of surgical field³.

A number of conventional intubation techniques have been introduced including, nasotracheal, conventional orotracheal intubations, tracheotomy and submental intubation².

In certain cases like fractured skull base, maxillofacial tumors, nasal complex and comminuted midfacial fractures, these technique pose difficulty during the procedure such as obstruction of the surgical field, risk of damaging the tube, and inadvertent extubation⁴.Also, with conventional orotracheal intubations, it is not possible to achieve maxillomandibular fixation. Nasotracheal intubation is contraindicated in cases with nasal and basal skull fractures⁵. As it might negatively affect the management of airway and/or tube might breach the dura.

In such cases, tracheotomy is often employed but it might leads to a number of complications depending on circumstances, expertise, and postoperative care provided⁶.Complications of tracheotomy includes an aesthetically unpleasant scar on neck and an iatrogenic complication includes tracheal stenosis, laryngeal nerve damage, and fistula^{6,7}.Also, a careful and attentive postoperative care is must for tracheotomy. Retromolar intubation method allows unrestricted access to dental occlusion intraoperatively. It is a simple, fast, and easy technique. However, in adults with full complement of teeth availability of retromolar spaces cannot be predicted⁴. Submental intubation was introduced by Hernandez Altemir in 1986, as alternative technique of airway maintenance. This technique aimed to achieve an intraoperative access to dental occlusions when other intubation technique are difficult or contraindicated^{8,9}.Advantage of this technique is unimpeded access to nasal pyramid, facial bones along with dental occlusion¹⁰.It has proved to have a lower morbidity than tracheotomy, requires a less time, and has a shorter learning curve².

Thus, submental intubation might prove to be an excellent adjunct for securing airway in certain cases of maxillofacial surgeries.

Aim and Objective

The aim of this study was to determine the usefulness and safety of modified submental intubation in patients with panfacial trauma.

The objectives of this study were:

- To evaluate the efficacy of this procedure to maintain airway in the patient with maxillofacial injuries.
- To make the surgical work comfortable by avoiding the interference of endotracheal tube with intra operative manoeuvres.
- To identify the possible complication associated with the procedure operatively and post operatively.

Material and Methods

This study was conducted in Oral and Maxillofacial Surgery division Bhopal. 30 admitted patients who had pan facial trauma (Figure 1) and underwent submental route of intubation were included for study. Patients who require long term airway support, patients with multi organ trauma and with a known history of keloid formation were avoided.

Materials Required: Flexometallic endotracheal tube, Xylocaine with 2% adrenaline, 2 ml syringe, Bp blade no.15 ,Bp blade handle, artery forceps ,Silk 3-0 suture , Suture cutting scissors.



Figure 1: 3-D CT reconstruction suggesting of bilateral Le-fort II fracture with mandibular left parasymphysis fracture (pan facial trauma)

Methodology

Before beginning the anaesthesia, appropriate size endotracheal tube is selected and connector which is adhered to the tube circuit is removed and placed back again to its normal position. After induction of general anaesthesia, standard oro endotracheal intubation is done. Skin over the submental region is prepared and draped for performing the submental intubation once the standard orotracheal is done (Figure 2). Injection of local anaesthesia having 2%xylocaine with 1: 200000 adrenaline is administered in the paramedian and submental region for haemostasis purpose.

Incision of 2cm length is given parallel to inferior border of mandible in the submental and paramedian region and at about 2cm below the mandibular border (Figure 3). After giving of the superficial incision, blunt dissection is performed through subcutaneous tissues, platysma and mylohyoid muscle with help of artery forcep. While performing blunt dissection one finger is kept intraorally in lingual side of mandible to feel the tip of the artery forcep and to direct its path. Dissection path is kept close to lingual surface of mandibular body to prevent damage to lingual nerve, salivary gland and ducts. After completing dissection, the tube bulb is deflated, the bulb is then inserted into the lumen of the ET tube and the wall of ET tube is grasped with the artery forcep and inserted via sub mental route and gently grasped in the submental region (Figure 4). The reverse is performed during extubation.



Figure 2: Insertion of the tube orally



Figure 3: Marking suggesting line of mandible, inferior border of mandible and the incision point.



Figure 4: Tube redirected out from submental region

Before disconnecting endotracheal tube from connector, patient is ventilated with 100% oxygen for 2 minutes. Then from breathing circuit endotracheal tube is disconnected and tube connector is separated from tube. With artery forceps reinforced tube is pulled out. While pulling reinforced tube, endotracheal intubation tube is firmly secured to prevent extubation of patient between the procedure. After successfully pulling reinforced tube, endotracheal tube is reconnected with connector and with breathing circuit^{11,12}.

And pilot tube is clean from blood and inflated again. By capnography and bilateral auscultation tube position is confirmed. And pack is placed in oropharynx to stabilize tube and prevent aspiration of fluids during surgery. With 2-0 silk stay suture tube is attached to the skin and secured. When surgery is performed and all fractured sites are reduced, then 2-0 silk stay suture is removed. The connector is detached from the tube and tube is passed back into mouth followed by balloon. Connector is reconnected to tube and then to breathing circuit.

Skin incision is sutured with silk 3-0 and intraoral wound is left to heal with secondary intention. Extubation is then performed in normal manner. Patient was observed on first, second, seventh day and after one month post-operatively to identify any complications if occur, due to submental intubation (Figure 4).

Statistical Analysis

The data collected was entered in Microsoft Excel and subjected to statistical analysis using Statistical Package for Social Sciences (SPSS, IBM version 20.0). The level of significance was fixed at 5% and $p \leq 0.05$ was considered statistically significant. Kolmogorov-Smirnov test and Shapiro-Wilks test were employed to test the normality of data. Chi square test will be employed to determine the statistical significance.

Results

The present study was carried out to evaluate usefulness, safety and complications of submental intubation in pan facial trauma surgery. The results are based on analysis of 30 patients determining the usefulness, safety and complications of submental intubation.

The mean age observed is 28.6 years ranging from 24 years to 43 years. A predominant male distribution (73.3%) was noticed in the study as compared to 26.7% female (Table 1). The time taken for submental intubation ranges from 7 min to 11 min, while the mean SMI was 8 min 93 seconds (Table 2). The duration of surgery ranges from 2 hours 40 min to 4 hours 15 min, while the mean duration of surgery 3 hours and 10 minute (Table 3).

An evaluation of aetiology of trauma among the patients in the present study revealed that the RTA (90%) was the most common cause of trauma followed by Fall (10%) (Graph 1). Among 30 patients, 6 patients complained of pain along with haematoma and in 6 patients developed hypertrophic. No local site infection or damage to submandibular duct, sublingual duct, sublingual nerve and oral floor abscess was observed. (Table 4).

Graph 1: Aetiology of trauma

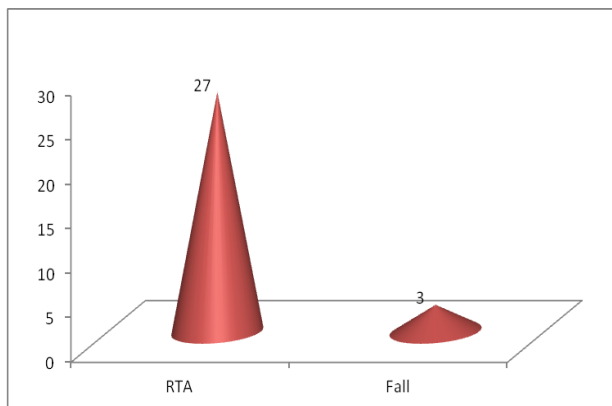


Table 1: Gender distribution

Gender	Male	Female
	N (%)	N (%)
Distribution	22 (73.3%)	8 (26.7%)

Table 2: Time required for SMI

Time Distribution	N (%)
Less than 6 minutes	-
6-8 minutes	6 (20)
8-10 minutes	17 (56.7)
10-12 minutes	7(23.3)

Table 3: Duration of surgery

Duration Distribution	N (%)
Less than 3 hours	10 (33.3%)
3-4 hours	14 (46.7%)
More than 4 hours	6 (20%)

Table 4: Post-operative complications in patients due to SMI

Postoperative complication	Present	Absent
	N (%)	N (%)
Infection	-	30 (100%)
Pain	6 (20%)	24(80%)
Haematoma	6 (20%)	24(80%)
Damage to Submandibular duct	-	30 (100%)
Injury to sublingual duct	-	30 (100%)
Injury to sublingual nerve	-	30 (100%)
Oral Floor abscess	-	30 (100%)
Hypertrophic scar	6 (20%)	24(80%)

No significant association between duration of surgery and post operative complications was observed in the study (Table 5)

No significant difference between the age of the patients and surgery duration (Table 6).

An evaluation of association between time required for SMI and post operative complications revealed no significant difference between the time required and surgery (Table7).

Table 5: Association between Duration of surgery and Post operative complications

Duration	Pain		P value
	Present	Absent	
Less than 3 hours	0	10	.06
3-4 hours	3	11	
More than 4 hours	3	3	
	Haematoma		
Less than 3 hours	0	10	.06
3-4 hours	3	11	
More than 4 hours	3	3	
	Hypertopic Scar		
Less than 3 hours	3	7	.343
3-4 hours	3	11	
More than 4 hours	0	6	

Table 6: Association of age with the Post operative complications

Age	Pain		P value
	Present	Absent	
< 30 years	1	14	.068
≥ 30 years	5	10	
	Haematoma		
< 30 years	1	14	.068
≥ 30 years	5	10	
	Hypertopic Scar		
< 30 years	2	13	.361
≥ 30 years	4	11	

Table 7: Association of time required for SMI with the Post operative complications

SMI	Pain		P value
	Present	Absent	
6-8 minutes	1	5	.218
8-10 minutes	2	15	
10-12 minutes	3	4	
	Haematoma		
6-8 minutes	1	5	.218
8-10 minutes	2	15	
10-12 minutes	3	4	
	Hypertopic Scar		
6-8 minutes	1	5	.810
8-10 minutes	3	14	
10-12 minutes	2	5	

Discussion

Injuries to the head and maxillofacial area can easily jeopardize the patient's ability to maintain the airway. The most advanced techniques in treating the facial trauma can be quite meaningless if attention was not first directed to the victim's airway.

Two disadvantages identified with regular naso-oral endotracheal intubation by a surgeon who is dealing with maxillofacial injuries were 1] interference of endotracheal tube while performing surgery in maxillofacial region which becomes a potential source of infection to the operated wound and 2] sometimes surgeon may unconsciously put inadvertent pressure on endotracheal tube which then kinks and interferes with flow of anaesthetic gases and oxygen in lungs, resulting in disturbance in maintaining complete effect of anaesthesia.

The reason beyond this is that the endotracheal tube further interferes in achieving absolute approximation of fractured fragments and in achieving better results. Interference of endotracheal tube can be avoided by maintaining endotracheal tube in places other than oral cavity (or) nasal orifices for an effective and unfettered anaesthetic administration. Cricothyroidotomy is a useful alternative to establish emergency airway in adults.

Floor of mouth and this submental region was the only better alternative choice. Hence, attempts made to maintain endotracheal tube in midline of submental region (or) in the para median (right or left) region.

These two variations have now become the choice depending on lacerations of soft tissues and bony architecture of face involved in trauma. Francisco Hernandez Altemir¹³ developed newer technique of Submental route for endotracheal intubation to remove possibility of its interference with Oral and Maxillofacial region. He advocated paramedian approach to avoid crossing of the geniohyoid and the genioglossus muscles and thus sparing the insertion of the anterior belly of the digastric muscle. Various indications of Submental intubation in Maxillofacial region were described by E.Mac Innis et al¹⁴ and A.Chandu et al¹⁵. Based on such indications thirty patients were chosen for alternative route of intubation via submental region in this study who had fractures involving naso-ethmoidal and maxillary complex with or without associated mandibular fractures.

Nasal intubation was avoided in our patients as endotracheal tube might displace the whole of ethmoidal complex and might perforate the cribriform plate creating a path directly inside anterior cranial fossa¹⁶. Nasal intubation interferes with intraoperative manipulation of fracture of nasal bone either by closed reduction or open reduction.

In case of fractures that involve the naso ethmoidal complex, manipulation might lead to a retrograde infection through CSF and the resultant meningeal infection has to be avoided. Acceleration of CSF rhinorrhoea might need a delayed closure with fascialata as a second surgery. Also, it was noticed that prolonged nasotracheal intubation was associated with significant sinusitis¹⁷.

Routine oral intubation in such patients was not preferred because endotracheal tube interferes with intra operative process of restoring ideal dental occlusion by using intraoperative Maxillomandibular fixation which was a prerequisite to the appropriate anatomic reduction and fixation of facial fractures. It was for above mentioned considerations, the alternative route for intubation via Submental region was selected, the preferred choice for both anaesthetist and surgeon. In all thirty patients paramedical approach was originally described by Francisco Hernandez Altemir¹³ was followed.

In this study we operated on 30 patients having multiple facial fractures out of which 22 were male and 8 were females with the mean age of 28.6 years. The main cause of trauma that we observed was road traffic accident (RTA). Negligence towards wearing protective gears or helmet while riding may be one of the reason for trauma in a road traffic accident. The regions like Bhopal and surrounding places where majority of male population ride bike can also be the reason for more number of male patients that we encountered in our study.

Glasgow coma scale score observed in the patient included ranges between 13-15. All the patients were primarily stable and neurological clearance was obtained before the maxillofacial surgery.

Mean submental intubation time was 8 minutes 93seconds. Whereas mean submental intubation time seen by Thomas et al⁶ was 10minutes. Mean SMI time observed in our study is in coordination with the mean SMI time present in other literature as well. This proves SMI is a not a time consuming procedure.

Minimal bleeding was observed at submental site after giving the incision. Similar to the result stated by Emara TA et al¹⁸. This proves that it is a minimally invasive procedure After the completion of the maxillofacial surgical procedure, there was no significant difficulty observed during extubation.

There were no major complication like accidental tube extubation or kinking of tube in any of the patient.

6 patient (20%) (table7) experienced pain associated with hematoma which gradually subsided within 7 days post-operatively. There was 1 case which required a incision to drain the haematoma.

In follow up after 1 month, 6 patients developed surgical scar. Clinically the long term follow up was not possible of the patient with hypertrophic scar due to patient's non-cooperation or they find it aesthetically acceptable. According to Meyer et al⁴¹ 4% of case with submental intubation develop hypertrophic scar.

Infection, or other common complications during submental intubation were not observed in any of the patient. In a study done by Chandu et al¹⁵, 2 cases among 44 developed infection in the submental region. In study of Nyarady et al⁴² in total of 8 cases, no case developed infection in submental region. The reason can be due to all the patients were administered intravenous antibiotics prophylactically 1hour before surgery and submental region was closed with new 3-0 silk suture in interrupted pattern. This might be responsible for complete absence of infection and complete asepsis.

Other complications like damage to Wharton's duct, sublingual gland and floor abscess were absent in all of the cases. Damage to the sublingual gland can be avoided by carrying out the dissection close to the lingual border of mandible.

In our study all the patients underwent intraoperative manipulation for the correction of occlusion as well as for the reduction of the maxillofacial bone either by open or close reduction. Any hindrance during manipulation was not observed by the surgeon in any of the cases. The endotracheal tube was out of surgical field, thus making it easier for the surgeon to operate. And since no kinking of tube and no complication during extubation was observed by anaesthetist, making submental intubation an ideal alternative method of intubation where nasal and oral intubation will affect the prognosis.

Conclusion

Potent advantages of this technique is that it is simple, requires no additional equipment, no interference of ET tube with intraoperative procedures of fracture reduction and stabilization, reduces probability of contaminating the operative field and the flow of anaesthetic gases are evenly maintained during complete course of anaesthesia.

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