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Original Research Article

A study to evaluate the efficacy of submental intubation in panfacial trauma

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ABSTRACT

Context: Anaesthesia for pan-facial surgeries is challenging because the anaesthesiologist and surgeon have to share the common upper airway field. Oral and nasal routes for intubation are often not feasible. Submental intubation is alternative method to tracheostomy and other modes of intubation for management of airway during maxillofacial surgeries.

Aim: To provide safe and easy airway with unobstructed intraoral surgical field without causing much morbidity.

Materials and Methods: 30 ASA I and II patients who had pan-facial fracture, including Le Forte II, Le Forte III, with naso-orbital ethmoidal fracture requiring surgical correction admitted in MGM Medical College and MY Hospital Indore were selected for the study. The patients are intubated by submental route and various hemodynamic parameters were evaluated at different time interval during the surgery. In our study, we used two tube method of submental intubation in which another tube was drawn intra oral through submental incision and first tube was replaced.

Result: There were no episode of desaturation and no difficulty was encountered in secondary intubation. The average duration of secondary intubation was 3-4 minute (Mean+SD = 3.45+0.95) which is less than the conventional one tube method.

Conclusion: As per our experience in study and the review of literature, the submental intubation is very easy and safe method of intubation to provide the unobstructed surgical field for the Le forte II and III panfacial fracture surgeries.

1. Introduction

Trauma is one of the most serious health problems that we are facing in present world, in which the trauma due to road traffic accident occur most commonly. The global status report on road safety 2018 indicates that in the whole world, the total numbers of road traffic deaths are very high at 1.34 million deaths per year. Road traffic accident is the leading cause of death among the children and young adult aged 5-29 years. Pedestrian, cyclists, children and older people constitute more than half of total deaths occurring due to road traffic accident. In India, there are more than 1.3 lakh people who die per year due to road traffic accident. [1,2]

Due to prominent anatomical location, maxillofacial injuries and fractures are almost always associated with moderate to severe road traffic accident (RTA). Mandible and zygomatic arch is the commonest site of fracture. About $1/5^{th}$ of all maxillofacial injuries need open reduction and internal fixation where they are better dealt under the general anaesthesia. [3]

Delivery of anaesthesia for pan-facial surgeries is a challenge because the anaesthesiologist and surgeon have to share the common upper airway field. Conventional orotracheal intubation is not appropriate as it interferes with the surgical access of the operative field.

Orotracheal intubation is also unsuitable for temporary intramaxillary and maxillomandibular fixation of teeth which is necessary to check the alignment of fracture fragments. Choices in airway management in these patients

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include nasotracheal intubation, tracheostomy, retro molar intubation and submental intubation.

Nasotracheal intubation is not recommended in the presence of pan-facial fracture, cervical spine injury, cranial base fracture with or without CSF rhinorrhea, haemocoagulatory disorder, distorted nasal field, and when nasal packing is indicated. It may lead to epistaxis, sinusitis, meningitis, sepsis, injury to the adenoids, dislodgment of bony fragments and rarely intracranial intubation.[3,4]

Tracheostomy is an excellent and conventional method to establish the airway in such patients both routinely and in an emergency. However, it may be associated with immediate and late complications. The incidence of immediate complications is 6-8% and they include hemorrhage, surgical emphysema, pneumothorax, pneumomediastinum, and recurrent laryngeal nerve palsy. The incidence of delayed complications is 60% and they include stomal and respiratory tract infection, tube blockage, dysphagia, difficulty with decannulation, tracheal erosion, tracheal stenosis, tracheo-esophageal fistula and suboptimal visible scar.[3,5]

An alternative technique of airway management in pan-facial trauma, the submental intubation has been described by a Spanish faciomaxillary surgeon, Francisco Hernandez Altemir in 1986. It gives excellent access to the operative field and it also allows temporary intraoperative intermaxillary fixation without having to resort to tracheostomy.[6] J. D. Green and U. J. Moore in 1996 described modification of original technique also called TWO TUBE METHOD in which another tube is brought intraoral through submental incision and first tube is replaced.[6,7]

We conducted this study to access the feasibility and safety profile of submental intubation in panfacial fracture.

2. Materials and Methods

2.1. Methodology

The study design was a prospective study, conducted for a period of 12 months from June 2018 to June 2019 at department of anaesthesiology, MGM Medical College and M.Y. Hospital, Indore. Total no. of 30 patients who had pan-facial fracture, including Le Forte II, Le Forte III, with naso-orbital ethmoidal fracture of ASA I and ASA II requiring surgical correction were selected for the study. Sample size calculation was based on convenient sampling technique.

2.2. Inclusion criteria

1. Multiple Craniomaxillofacial traumatic injuries (Le Forte II, Le Forte III.
2. Patients with minimal neurological deficit.
3. Tube interference with surgical intraoral manipulation and maxillomandibular fixation.

2.3. Exclusion criteria

1. Refusal of the patient.
2. Patients with severe neurologic damage or major thoracic trauma.
3. History of keloid Formation.

2.4. Procedure

Written informed consent was obtained from all the patients, A thorough pre-anaesthetic evaluation was performed by taking the patient's history and by conducting clinical/ biochemical examination.

2.4.1. Preoperative preparation

Patient was NBM for 6 hours, face preparation (shaving of operative area) was done, preoperative antibiotics and chlorhexidine mouthwash was done half an hour before surgery.

2.4.2. General anaesthesia

After the premedication, induction was done as per normal general anaesthesia protocol.

2.4.3. Surgical technique

Airway was secured with orotracheal intubation and tube was fixed temporarily with the help of adhessive.

For submental intubation, the positioning of the patient was done with head extended with the help of shoulder pad.

Skin preparation of perioral region and chin was done with 10% iodine solution under full aseptic precautions and draped with sterile towel.

The incision site was marked with skin marker (Figure 1).

Local infiltration at the site of incision done with lignocaine 2% with adrenaline (Figure 2).

Subsequently, a 2 cm skin incision was made in the paramedian submental region, medial and parallel to the inferior border of the mandible (Figure 3).

A curved artery forceps was inserted through the platysma and mylohyoid muscles, as closely as possible to the lingual surface of the mandible to avoid the injury to the lingual nerve, sublingual gland and submandibular duct.

While the tongue was pushed backward, the tip of the artery forceps was visible just below the mucosal layer in the floor of the mouth. An incision was made over the top of the tip of the artery forceps, located antero-lateral to the wharton's duct papillae.

The second long artery forceps was grasped by first forceps and taken out from the incision to the extraoral site to grasp the second endotracheal tube which was the flexo-metallic type or spiral embedded tube (Figure 4).

Now, the second tube was passed into the mouth from the outside to inside via incision with the help of long artery forceps and kept in the position in oropharynx with the help

of Magill forceps and ventilation was continued with the first tube.

The orotracheal tube was then removed and second tube was advanced into the trachea with Magill forceps.

The breathing circuit was reconnected with this submental tube and tube was fixed with 2-0 silk suture after confirmation of the correct position of tube (Figure 5).

At the end of the surgery, Extubation was done uneventfully through the external skin incision only.

Skin wound was closed under local anaesthesia with 2% xylocaine infiltration using suture with full asepsis.

Post operative follow up done for immediate complications during hospitalized period and for late complications up to 6 month.

2.5. Statistical method

The data was initially entered into the microsoft excel from the customized proforma for analysis. MiniTab Version 17.0 was used for calculating the P values. Comparison of mean value of parameters in different time interval was done using paired‘t’ test. Descriptive statistics was presented in the form of numbers and percentages. A p value of <0.05 was taken as statistically significant. The final data was presented in the form of tables and graphs.

Fig. 1: Showing the mark of incision side which is medial and parallel to lower border of mandible

3. Observation & Results

Submental intubation with two tube method was performed uneventfully in all patients. There were no episode of desaturation and no difficulty was encountered in secondary intubation. The average duration of secondary intubation was 3-4 minute (Mean+SD = 3.45+0.95).

In our study we compared the mean value of various hemodynamic parameters like pulse rate, systolic blood pressure, diastolic blood pressure, blood oxygen saturation and end tidal CO_2 at different time interval. There were no significant changes (P value > 0.05) in the different parameters during secondary intubation as compared to after primary intubation and after induction except pulse rate in which there was significant change (P value < 0.05) in mean value during secondary intubation.

Fig. 2: Showing the infiltration of local anaesthesia at incision site

Fig. 3: Showing the incision for submental intub

Fig. 4: Showing the forceps come out through the incision to grasp the ETT

Fig. 5: Showing the final position of submental intubation

Fig. 6: Showing the undetectable submental scar (Healing after 6 month follow up)

All the patients were extubated at the end of operation without any complication, the postoperative follow up visits continued for at least 6 months, and no postoperative complications were reported except one patient who developed infection of submental wound after 3rd day of surgery (Figure 6).

The follow up showed no injury to any of the adjacent vital structure and no facial nerve and lingual nerve injury were reported.

Healing of submental wound and mucosa of oral cavity was almost perfect except the minimal scar on submental region seen in all patients and no case of hypertrophic scarring or keloid formation was found in our study, patients were fully satisfied.

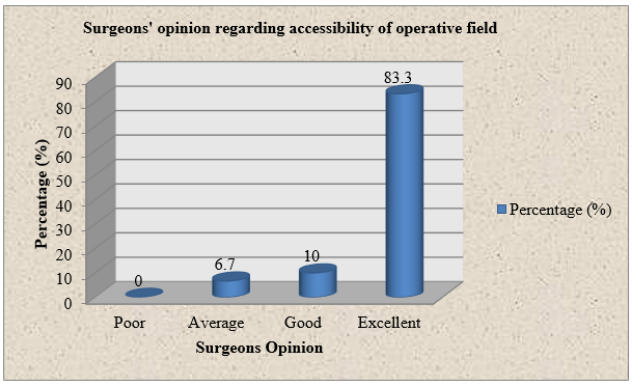
The surgeons found the technique of submental intubation as simple and safe. Most of the maxillofacial surgeon rated EXCELLENT for accessibility of operative field and ease in performing the procedure.

Table 1: Distribution of patients according to age

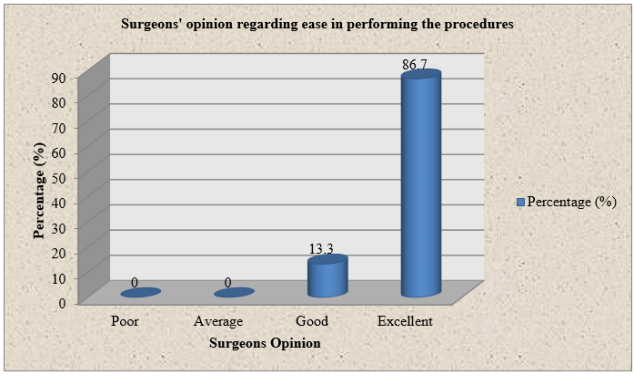
Age	Number	Percentage
18-25 years	9	30.0
26-35 years	11	36.7
36-45 years	5	16.7
46-55 years	5	16.7
Total	30	100.0

Table 2: Distribution of patients according to sex

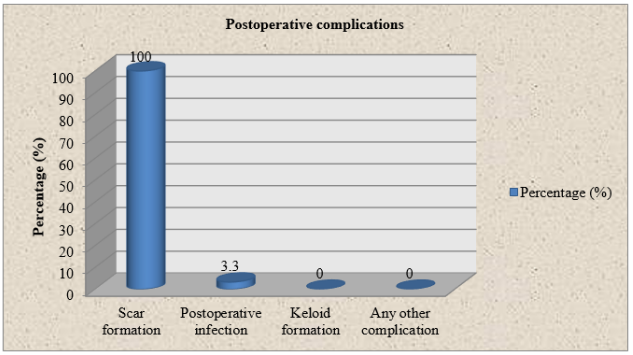
Sex	Number	Percentage
Female	6	20.0
Male	24	80.0
Total	30	100.0



Graph 1: Bar diagram showing surgeon's opinion regarding accessibility of operative field



Graph 2: Bar diagram showing surgeon's opinion regarding ease in performing the procedures



Graph 3: Bar diagram showing distribution of patients according to postoperative complications

4. Discussion

Securing an airway in complex maxillofacial trauma is always a challenging task for an anaesthesiologist and an oral and maxillofacial surgeon. The two most common routes used to secure airway in these injuries are the oroendotracheal and the nasotracheal. The orothracheal technique hampers intraoperative control of dental occlusion. Nasotracheal intubation is not indicated in cases of cranial base trauma because of the chances of iatrogenic meningitis, it also creates difficulty in performing the treatment of the bony nasal pyramid.[8]

In 1986, Francisco Hernandez Altmeir described a submental approach to the orotracheal airway as an alternative method for short-term tracheostomy in the surgery of panfacial trauma, because tracheostomy can cause significant morbidity. Now submental intubation is a recognized technique for airway control in severe maxillofacial injuries.[6]

We report our experience of submental intubation in the airway management of patients with panfacial fractures. We studied 30 patients, out of which, majority of the patients (36.7%) were in the age group 26-35 years. GDS Kalra et al**.** conducted the study of submental intubation in 40 patients of maxillofacial trauma out of which majority of the patients (65%) were in the age group of 18-30 years.[9]

There was male preponderance in our study group (80% male and 20% female) because the incidence of road traffic accident is more common in male. In the study of Luiz Fernando et al the total no. of patient was 30 out of which male was 28 (93.3%) and female was 2 (6.6%).[10]

Altemir's original submental intubation technique used armored detachable connector tubes. This one-tube technique involves the passage of the oral tube from inside to outside through a submental incision. It is better performed by using a reinforced tube, where its universal connector is removed easily for tube passage through the submental incision. Unfortunately, Altemir submental intubation technique cannot be performed with non-detachable connector tube and armored detachable connector tubes are not always available in operating room.[11]

The most substantial modification of SMI with non-detachable connector tubes was actually described by Green and Moore in 1996. It involved the use of two endotracheal tubes where the first oral tube is replaced by second one. The main problem with this technique is that the cuff of the tube can be damaged during vigorous manipulation by the Magill forceps.[7,11]

In our study we used the TWO TUBE METHOD of intubation, which is the modified method of conventional submental intubation.

These finding correlate with the P. H. K. Mak and R.G.B. Ooi study who also used two tube method. Sahand Samieirad et a**l**andDr Manish Banjare and Dr Deepak Sharma also found the double tube method as safe and even easier.[5,11,12]

In our study we compared the mean value of various hemodynamic parameters like pulse rate, systolic blood pressure, diastolic blood pressure, blood oxygen saturation and end tidal CO_2 at different time interval. There were no significant changes in the different parameters during secondary intubation as compared to after primary intubation and after induction except pulse rate in which there was significant change in mean value during secondary intubation.

In the study of Geeta A. Patkar et al, changes in the different heamodynamic parameters during submental intubation were statistically not significant.[13]

Damage of the endotracheal tube cuff was occurred in two patients during the manipulation with Magill forceps into the trachea. But we excluded those cases from the study because extra time taken during tube exchange could alter the result of the study.

In our study, we preferred the paramedian approach for submental incision because (1) hide of incision scar is better in paramedian region as compare to midline approach and, (2) there is less chances of injury to the wharton's

duct and avoids the separation or injury of geniohyoid and genioglossus muscles, as compared to midline approach.[14]

In our study the average duration of secondary intubation (submental intubation) was 3-4 minute (Mean+SD = 3.45+0.95). In the case series of N kishoria et al duration of submental intubation was 8-10 min who used one tube method.[15]

Premalatha M Shetty et al also used conventional one tube method, in their study, the total duration of submental intubation procedure ranged from 5 to 8 minutes.[16] So, on this basis, we concluded that the two tube method is better than one tube method.

The complications of submental intubation include abscess formation in the floor of the mouth, infection of the submental wound, salivary fistula, development of mucocele and facial scarring.[14] Infection of submental wound developed in one patient of our study. The wound was cleaned and dresssed with 10% iodine solution. Healing was achieved in five days. Healing of submental wound and mucosa of oral cavity was almost perfect except that the minimal scar on submental region was seen in all patients and no case of hypertrophic scarring or keloid formation was found in our study.

Ryosuke Kita et al conducted the study of submental intubation in 30 patients, out of which, two patients developed submental wound infection. Slight scarring developed in one patient because the submental tracheal tube was removed 2 days after surgery in this patient. Rest of the patients were extubated at the end of surgery.[17]

Venkata Ramana Murthy V and Chandra Shekhar Krishnamurti selected 60 cases for submental intubation out of which wound dehiscence was observed in 2 cases of trauma due to superficial infection, which resolved after using topical application of antibiotics and delayed suturing.[18]

Stranc MF and Skorachi R has reported the development of mucocoele formation while dissecting mucocutaneous track from the interior to exterior. No such complication occurred in our study as the dissection was carried out from exterior to interior.[14]

The primary objective of our study was to provide safe and easy airway with unobstructed intraoral surgical field without causing much morbidity. For the evaluation of our objectives, we also used the two parameters in the form of surgeon opinion i.e. accessibility of operative field and ease in performing the procedure. Most of the surgeons marked excellent for both the parameters.

5. Conclusion

Submental intubation is as easy and safe method of intubation to provide the unobstructed surgical field for the surgery. This is always a better option than conventional method because there are less chances of compromising the airway due to difficulty during passing the tube because ventilation is continued from the orotracheal tube and submental intubation can be performed with nondetachable connector tube. The average time in performing modified submental intubation method is 3-4 min (Mean+SD = 3.45+0.95), which is less than the conventional one tube method.[5,11]

6. Rational

Submental intubation is a better option to provide the unobstructed surgical field for surgery. Complication of short term tracheostomy are also avoided in the surgery of panfacial trauma because tracheostomy can cause significant morbidity.

7. Limitation of Study

In our institute detachable connector tube was not available that's why comparison with conventional one tube method was not possible in our study.

8. Conflict of Interest

None.

9. Source of Funding

None.

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