Transmyloheid/Submental Endotracheal Intubation in Pan-facial Trauma: A Paradigm Shift in Airway Management with Prospective Study of 35 Cases

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Abstract The present study was planned to assess the efficacy, utility and complications of transmyloheid intubation in facial polytrauma patients, by setting and design: prospective study. This study was conducted between May 2008 and May 2011 and 35 patients of facial polytrauma were included irrespective of sex, caste and religion. All the selected 35 patients were male and the age of patients ranged between 15 to 45 years (mean age 31 years). All the patients were intubated with transmyloheid, orotracheal intubation using an armoured endotracheal tube (ETT). Average time to perform transmyloheid intubation was 15.51 ± 1.85 min (mean $\pm$ standard deviation). Average time for drawing the ETT transmyloheid from the submental incision was 49.7 ± 24.8 s. Mean duration for which the ETT was kept indwelling was 0.37 ± 1.03 days. Accidental extubation of ETT was noted in two patients. Minor post operative complications like swelling in the submental area (2 patient), dehiscence of the submental incision (2 patient) and minor infection at the site of submental incision (3 patients) were noticed, which were found to be statistically insignificant. The transmyloheid intubation allowed simultaneous reduction and fixation of all the facial fractures and intraoperative control of dental

occlusion without interference from the tube during the surgery without interfering in the maintenance of the anesthesia and air way.

Keywords Transmyloheid · Intubation · Submental · Airway · Maxillofacial trauma · Facial Polytrauma

Introduction

The modification of airway management techniques is essential during the surgical management of pan-facial fractures. The surgeon and the anesthetist work in the same small but vital area. During the management of the multiple facial fractures the nasotracheal intubation cannot be done in majority of cases due to the presence of nasal bone fracture and traumatic septal deviation, which obstruct the nasal passage. The nasoethmoidal fractures associated with or in the close proximity of the base of the anterior cranial fossa are one of the distinct contraindication for the nasotracheal intubation as there is a risk of dural tear or intracranial infection. The presence of nasal tube may interfere with the application of the disimpaction forceps and mask the access. While treating the facial fractures which involve the dental apparatus, such as Le-Fort I, II or III fractures and mandibular fractures, establishing proper dental arch relation and the occlusion during the reduction is one of the most important steps. During the fixation of the fractures maintenance of occlusion is necessary which is achieved through the intermaxillary fixation. The orotracheal intubation always interferes with this important step.

When neither nasotracheal nor orotracheal intubation are suitable, an alternate technique for airway control in the form of elective tracheostomy was considered by many as

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the preferred route for airway management in patients with complex maxillofacial fractures [1]. This technique however, is associated with significant morbidity and complications like haemorrhage, surgical emphysema, tube blockage, recurrent laryngeal nerve injury, tracheal stenosis and unsightly scar [2]. An alternative to this, Hernandez Altemir in 1986 described the classic method, the submental route for tracheal intubation. The term transmylohyoid intubation described by Muzzi et al. [3]. However the terms 'submental' and 'transmylohyoid' are commonly used to describe this technique. The present study was undertaken for assessing the utility of transmylohyoid intubation (submental intubation) in the cases of pan-facial trauma where the nasotracheal or orotracheal intubation was not possible.

Materials and Method

This present study was carried out at Department of Oral and Maxillofacial Surgery, Acharya Vinoba Bhave Rural Hospital, Wardha, Maharashtra, India between December 2008 to December 2011. Out of 198 patients of facial fractures, 35 patients with pan-facial fractures where the naso-tracheal or oro-tracheal intubation was not possible, were included irrespective of their sex, caste and religion. All the patients were male and age of patients was between 15 to 45 years with mean age of 30 years.

Surgical Technique

Prior to oro-tracheal intubation, the universal connector was removed or cut off from the ETT and replaced with a removable connector which was kept in hot water to allow easy detachment. After routine oro-tracheal intubation with a sterile, disposable, armoured ETT, under the aseptic precautions, a 1.5 cm skin crease incision was made in the submental region 1 cm below and behind to the inferior border of the mandible, approximately one-third of the way from the symphysis to the angle of the mandible (Fig. 1). The side of the mandible was dictated by the presence of a concurrent mandibular fracture. Mouth opening was maintained using a gag or dental prop and the tongue was retracted, exposing the floor of the mouth. A closed pair of 9 inch, blunt artery forcep was then introduced into the submental incision and blunt dissection was carried out towards the floor of the mouth, staying as close as possible to the inner (lingual) cortex of the mandible to avoid damage to the sublingual salivary gland, submandibular duct and lingual nerve (Fig. 2). The tissue layers encountered were subcutaneous fat, platysma, investing layer of deep cervical fascia and mylohyoid muscle until the tip of the artery forceps tents the mucosa of the floor of the

Fig. 1 Skin incision site

Fig. 2 Intraoral incision marking for transmylohyoid intubation

mouth, in the lingual vestibular fold. A counter incision was placed over the tented oral mucosa for easy delivery of the tip of the artery forceps into the oral cavity. The beaks of the forcep were then spread to a distance equating the diameter of the tube and the tube was gently passed in an oral-to-skin direction through the surgically created transmylohyoid tunnel. Similarly the cuff of the ETT was also drawn through the same tunnel. The connector was then attached, the cuff re-inflated and the ETT reconnected to the breathing circuit. The ETT was kept in the sulcus in the floor of the mouth between the tongue and the mandible. Due precaution was taken during the entire procedure to ensure that the accidental extubation does not occur. The proper position of the ETT was ascertained by capnography and chest auscultation. The tube was then secured to the skin of the submental region with a heavy (2/0) black silk suture (Fig. 3). Periodic intra operative monitoring of the position of the tube and air entry was done to ensure the proper position of the tube.

At the end of the surgery the procedure was reversed. The skin sutures were cut and the tracheal tube was briefly disconnected from the breathing circuit. The universal connector was then removed and the deflated pilot cuff was

Fig. 3 Sutured ETT at submental area

pulled back through the passage in the floor of the mouth, followed by the tracheal tube. The connection was then re-established and the tube was secured. The submental incision was closed in two layers. The skin sutures that were removed after 5–7 days. No attempt was made to close the oral defect in case the tube was kept indwelling during the post operative period and the oral wound was allowed to heal by secondary intention.

Results

In all patients of the present study, transmylohyoid intubation permitted simultaneous reduction and fixation of all fractures and intraoperative control dental occlusion without interference from the tube during the surgery. Out of the 35 patients in the present study, 28 patients were intubated from right side (80%), six patients were intubated from left side (17.4%) and one patient from median approach (2.8%). No significant difference in the ease of intubation, complications or healing was noticed as per the site. The time for the complete procedure of transmylohyoid intubation was between 8–15 min, with the mean time being 15.5 min ($SD \pm 1.85$). Intubation time in 74.2% of patients was more, i.e. 11–15 min. This could be primarily because of distortion of airway, oedema of airway due to pan-facial trauma.

After the oro-tracheal intubation, the transmylohyoid passage of the ETT and reattachment of the ETT to the anesthetic circuit took 49.7 ± 24.8 s on an average suggesting that the procedure could be accomplished in a short time and the patient was not without ventilatory support for a long time thereby eliminating the risk of hypoxia and hypoxia related complications.

In three patients the transmylohyoid tube was kept indwelling for a longer period of 1–4 days postoperatively

for maintaining the patency of the air way. The Transmylohyoid tube was well tolerated by these patients and with routine maintenance of the tube with periodic suction no tube related complications were observed.

In two patient accidental extubation of ETT which was managed promptly. The healing of the intraoral and the submental skin incision was uneventful and the mean healing time being 6.65 days ($SD \pm 1.93$). Minor surgical site infection was noticed in three patients.

Discussion

One of the most critical aspects of the facial trauma management is the maintenance of the air way. The endotracheal intubation is challenging in view of the altered air way anatomy and the specific surgical requirements. The fractures of middle third of facial skeleton often lead to airway compromise when displaced severely. The ensuing bleeding, presence of clots, airway oedema further pose problems in maintenance of patient airway. The proximity of cranial bones with the anterior cranial fossa can lead to dural tear and cerebrospinal fluid leakage. Problems associated are difficulty in nasoendotracheal intubation in the presence of complex nasoethmoidal fractures, deviated and dislocated nasal septum, mucosal edema, posing problems to passage of the ETT, possibility of cranial intubation in the presence of fracture of base of the skull and interference with the surgical reconstruction of fractures of the naso-orbital ethmoid (NOE) complex, therefore this route of intubation is best avoided. Surgical procedure of intermaxillary fixation preclude conventional oral route for intubation. 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. Submental intubation is safe, technically easy to perform, less invasive and associated with fewer complications which can be easily managed and overcome.

The submental route for tracheal intubation was first described by Hernandez Altemir [4]. This technique provides a secure airway whilst at the same time allowing an unobstructed surgical field for adequate reduction and fixation of midface and -facial fractures. A basic knowledge of the regional anatomy would facilitate blunt dissection and avoid encountering complications from damage to Wharton's duct sublingual salivary gland and other vital structures like lingual nerve present in floor of mouth. MacInnis and Baig reported that their experience with standard technique as described by Altemir was less satisfactory because of bleeding, difficult tube passage and

sublingual gland involvement. Instead of slight lateral exit wound sub mentally, they modified the technique to strict midline approach in 15 patients with satisfactory results [5]. We did not encounter such difficulty through paramedian approach which was a original technique described by Hernandez Altemir and the side was selected according to site of fracture mandible (symphyseal-parasymphyseal fracture), where in, fracture side was avoided for intubation to avoid risk of periosteal tear leading to haematoma. In such cases where no mandibular fracture is present, right side was preferred as it is convenient side for surgeon to perform surgery. It also allows better visualization of the intraoral position of the tube with direct laryngoscopy [1]. Lim et al. modified this technique by covering blue cap of thoracic catheter on the end of ETT and pilot balloon while passing the ETT through submental area to reduce injury to the surrounding tissues and passing the ETT smoothly through submental tunnel without influx of soft tissues or blood into the ETT [6]. Nyarady et al. introduced '2-2-2 rule' incision (2 cm long, 2 cm away, 2 cm medial to the mandible) in submental region to create a tunnel [7]. Gadre recommended that the path of the ETT need not be restricted to the submental triangle but can be anywhere from the mandibular first molar on one side to the mandibular first molar on the other side, that is from 36 to 46, anterior to facial artery region [8, 9]. Terminology of transmylohyoid intubation seems more appropriate to use rather than submental intubation, as the passage of the tube is through the mylohyoid muscle, which has been mentioned in other studies. This also does not restrict the tube in the midline and allows for the use of a lateral incision as documented by other authors [9–11]. Use of transmylohyoid intubation need not be restricted to management of pan-facial trauma but can also be used in cases of failed nasal intubation [9, 12]. Langford encountered difficulty in passing the tube through incision and found that the ETT and the inflation cuff tube had taken different passages through the submental tissue, resulting in a loop of the inflation tube caught within the incision. This complication may be less likely to occur if the ETT and inflation tube are both passed through the same orifice in the submental tissue [13]. Further to avoid this complication, the dissection should be carried out in such a way that the width of the tunnel should be equal to that of the submental skin incision, which should be wide enough to facilitate smooth passage of the tube and the inflation tube and at the same time should not be too wide to create a pouch where the saliva will get collected and cause infection.

Transmylohyoid ETT withdrawal time or disconnection time from ventilator was less than 2 min in all our 35 patients (Caubi et al. [14]; Wakis [9]; Meyer et al. [15] and was not significant as patients were well ventilated and no hypoxic event was noticed in any of the patients. It is an

important parameter to be recorded because prolonged transmylohyoid ETT withdrawal time can cause hypoxia and hypoxic injury to the vital organs.

The submental route as described by Hernandez Altemir has subsequently been modified by Green and Moore [16] who described using two tracheal tubes. The patient is initially intubated in the normal fashion with an orotracheal tube. A submental incision is then made and a second tube pulled through the incision, cuff end first and passed into the trachea after removal of the first tube. This was considered safer than a single tube, which may be dislodged as it is pulled through the submental incision or if difficulties were encountered re-attaching the connector. Hence, the tube switch method needs use of an ETT exchanger to prevent accidental extubation [9, 17, 18]. In this present study, this technique was used in two patients and found difficulty in exchanging the ETT, also the intubation time was more. Drolet [19] reported using a lubricated tube exchanger, passed through the tracheal tube once it has been pulled through the submental incision, and the tube then exchanged for a fresh reinforced one. This ensures that a ventilation device remains in the airway at all times and avoids the problem of fixed connectors to reinforced tracheal tubes. Hernandez Altemir and Hernandez Montero (2000) performed a procedure consisting of the reinforced tube of a laryngeal mask in a supraglottic position in laryngotracheal trauma patients passing intraorally to the submental region [20]. Schutz and Hamed [21] noted damage to the ETT. Causes of damage to ETT could be detachment of pilot tube from ETT, holding the cuff with tip of artery forcep while pulling through the tunnel and also during manipulation of occlusion in an unconscious patient. However these complications were not observed in this study. Due care exercised during the procedure minimizes the chances of such complication and the need for intubation using two tubes as originally described by Green and Moore.

During the present study, the transmylohyoid ETT was kept indwelling in five patients post operatively for 1 and 4 days. Because in 14.2% of patients, varying factors like distortion of airway, airway oedema, chances of postoperative bleeding and then aspiration or intermaxillary fixation was done. It was observed that patient compliance to transmylohyoid tube was more and chances of accidental biting and damage to tube are minimum in transmylohyoid technique than oral intubation. Neither pain/discomfort was experienced by patients nor any kinking/difficulty in maintenance of ETT was observed in this study as the armoured tubes were used. However in one patient, superficial infection with ETT in submental area was observed postoperatively on 4th day, which could be attributed to oral contamination. Biglioli [22] and Caron et al. [1] noted infection at submental area and we also

observed infection in other two patients. Causes of infection at submental area may be due to trickling of saliva from intraoral wound, poor oral hygiene of the patient and performing intubation in an improper aseptic condition. The morbidity associated with submental tracheal intubation is low [10, 23–25].

Post Operative Management of Airway

The transmylohyoid ETT is delivered orally and can be left in situ for some time for maintenance of the airway in anticipation of inseting of edema due to injudicious manipulation. The skin incision is sutured in double layer and dressing is given with daily wound care.

Transmylohyoid was found to be a safe, technically easy technique of endotracheal intubation for the management of the patients with poly trauma of face. It had minimum complications and the patient compliance was adequate. It avoided the need for conventionally performed tracheostomies for such patients there by reducing morbidity and eliminating the risk of tracheostomy related complications. The surgeon and the anesthetist could work comfortably in the small common space without any hindrance to their undertaken tasks.

Conflict of interest I have no any conflict of interest regarding any of financial and personal relationships with other people and organisations that could inappropriately influence (bias) my work.

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