Intubation Techniques: Preferences of Maxillofacial Trauma Surgeons

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Abstract

Objective To evaluate the clinical outcomes of alternative techniques of intubation in patients sustaining maxillofacial injuries, where nasotracheal intubation (NTI) is best avoided.

Material and Methods Alternative techniques to standard naso-tracheal intubation like submental intubation, orotracheal intubation-retrotuberosity/retromolar and missing dentition were used and variables of clinical outcome recorded.

Results Submental intubation provides an unobstructed intraoral surgical field, avoids intraoperative and postoperative complications of tracheostomy, and overcomes the disadvantages of NTI. In our experience with submental intubation (6 cases), we only had complication related to tube apparatus like damage to pilot balloon. With retrotuberosity intubation (5 cases) we did not encounter any complications and the only limitations were bulbous maxillary tuberosity. Retromolar intubation (4 cases) a safe

noninvasive technique has disadvantages like tube interference within the surgical field and not feasible in case of limited retromolar space. Orotracheal-missing dentition intubation (4 cases) is of great advantage i.e. it can be used in cases where NTI is contraindicated, no specialized skill required, no added cost, avoids the need for tracheostomy, no extra-oral procedures required and does not interfere with occlusion/MMF; with disadvantage of occasional tube interference within the surgical field.

Conclusion Preferred techniques of securing an airway like orotracheal, nasotracheal may not always be applicable, thus a trauma surgeon-anesthetist team should always have alternative techniques in their armamentarium to reduce the morbidity associated with these patients without interference with occlusion, which is prime goal in jaw fracture reduction. We have used these techniques in a country with limited resources and found them equally effective and convenient to use.

Keywords Maxillofacial trauma · Airway · Intubation

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Introduction

Maxillofacial trauma patients frequently cannot be managed with orotracheal intubation, which is the standard way of securing the airway during surgical procedures because the surgeon may have to perform temporary maxillomandibular fixation intraoperatively or at least have an intraoperative control of the dental occlusion and has to establish and repeatedly check the occlusion intraoperatively for adequate reduction of jaw fractures. Therefore, in most maxillofacial trauma cases the airway is secured by nasotracheal intubation (NTI) without interfering with the maxillomandibular fixation and surgical approach [1].

Sometimes NTI is contraindicated when the facial fractures involve the nasal pyramid or irradiate toward the base of the skull [2]. Furthermore, NTI after severe craniomaxillofacial trauma can result in the passage of the tracheal tube into the cranium with consequent brain damage [3]. That is a very rare complication, but a catastrophic one, dreaded by anesthesiologists [4]. In such cases, the method for airway control is tracheostomy, but it may be tiresome and may lead to many complications, such as tracheal stenosis, hemorrhage secondary to intraoperative injury of cervical vessels or thyroid gland, infections, and unsightly scars [5, 6]. It is, therefore, difficult to propose it to patients suffering from an isolated facial trauma who will not require prolonged airway management.

This paper collectively describes difficult airway management by various intubation techniques in patients with maxillofacial trauma.

Fibre-Optic Naso-Tracheal Intubation

In oral and maxillofacial surgery, the incidence of difficult airway is up to 15.4–16.9 %, due to temporomandibular joint (TMJ) illness, facial abnormalities, or fractures [7]. Blunt or penetrating trauma to the larynx, trachea, hyoid structure, and facial bones can result in a complex, difficult-to-manage airway. In these patients visualization of the glottis by direct laryngoscopy at-times can be difficult or impossible. Furthermore, in the presence of cervical spine injury, neck movement must be minimized if neurological injury is to be avoided; although optimal airway management in this circumstance remains controversial, no intubation technique has been shown to be clearly superior to any other [8]. The fiberoptic intubation (FOI) is considered the gold standard for the management of difficult airways (Fig. 1). Although FOI can be done in an unconscious individual, it is particularly suited to the awake patient and, with proper technique, produces minimal discomfort while maintaining a wide margin of safety [9]. Patients with massive facial injury, complete upper airway obstruction, apnoea, severe hypoventilation, or profuse upper airway bleeding are almost never appropriate candidates for FOI [10].

Lightwand guided nasotracheal intubation is an alternative to fiberoptic bronchoscope. In contrast to direct laryngoscopy, lightwand-guided intubation does not depend on the anatomical structure of the upper airway; therefore it has an advantage in difficult airway management and is already sometimes regarded as the first line option for a failed laryngoscopic intubation. In addition, the illumination of the lightwand is not influenced by blood or secretions, so the lightwand is more effective than the fiberoptic bronchoscope in patients with active bleeding in

Fig. 1 Nasotracheal intubation with the aid of fiberoptic bronchoscope

the oral cavity following facio-maxillary trauma [11]. Lightwand-guided nasotracheal intubation is superior to blind intubation in patients with difficult airways, with a higher success rate, more stable haemodynamic responses, and fewer postoperative complications [12]. We do not have any experience in using lightwand as it is not easily available in this part of the world, which may be one of its limitations.

Sub-Mental Intubation

Submental intubation was first reported by Francisco Hernandez Altemir in 1986 as a procedure that could avoid tracheostomy and allow for the concomitant restoration of occlusion and reduction of facial fractures in patients ineligible for nasotracheal intubation [13]. Since then, this technique has been modified. This procedure consists of exteriorizing an oral endotracheal tube through the floor of the mouth and submental triangle. The original surgical protocol dictates a 2 cm incision in the submental,

Fig. 2 **a** Preparation of submental region for extraoral incision. **b** curved artery forceps inserted into oral cavity through submental tunnel. **c** endotracheal tube transferred extraorally through submental tunnel. **d** submental intubation complete with tube secured to skin with stay sutures

paramedial region extending cephalad, the lingual mucosa is tented with a hemostat after which another 2 cm incision parallel to the mandible is made in the lingual gingivae. The breathing circuit is briefly disconnected as the tube is externalized through the submental region and reconnected to the circuit and secured to the patient (Fig. 2). The most substantial change was actually described by Green and Moore (1996): it involves the use of two endotracheal tubes, where the first oral tube is replaced by a second one introduced through the submental dissection channel. Other modifications included the use of either the midline or submandibular approach, rather than the latero-submental approach, using a nasal speculum with long flanges, a nylon guiding tube or covering the proximal end of the endotracheal tube with a blue cup of thoracic catheter to facilitate the externalization of the orotracheal tube [14]. Submental intubation and its modifications are versatile techniques that allow intubation of a patient in the presence of polytrauma and allows maxilla-mandibular fixation along with simultaneous access to fractures of the nasal pyramid.

In comparing submental intubation and tracheostomy, submental intubation has no significant reported major complications. The mortality rate of tracheostomy has been reported to range from 0.5 to 2.7 %. Literature review for submental intubation reveals 100 % success rate. Minor complications at 7 % reported in the literature are damage

to the tube apparatus, fistula formation, right mainstem bronchus tube dislodgement/obstruction, hypertrophic scarring, accidental extubation in paediatric patients, excessive bronchial flexion, transient lingual nerve paresthesia, venous bleeding, mucocele, and dislodgement of the throat pack sticker in the submental wound. No major complications associated with submental intubation have been reported in the literature [14]. In addition to fewer reported minor complications, submental intubation requires less time than a tracheostomy, costs less and results in an aesthetically well tolerated scar [14]. In our experience of six cases with submental intubation, we only had complication related to tube apparatus like damage to pilot balloon and difficulty in passing the pilot balloon extraorally through the tunnel.

Contraindications to submental intubation include patients who require long periods of assisted ventilation and a severe traumatic wound on the floor of mouth [15].

Orotracheal Intubation-Retrotuberosity/Retromolar

Once orotracheal intubation with a wire-reinforced tube has been completed, the orally placed armored tube can be positioned in the retrotuberosity/retromolar area and secured to an eyelet wire attached to the most posterior maxillary

Fig. 3 **a** Positioning the orotracheal tube in the retrotuberosity region. **b** Retrotuberosity intubation in place without interference in occlusion

Fig. 4 Retromolar intubation—oro-tracheal tube secured with the suture through the buccal mucosa

molar or premolar tooth, allowing the teeth to be placed in occlusion or the occlusion to be reestablished (Fig. 3). Nonfunctioning third molars may be removed to allow for passive positioning of the tube when the teeth are in occlusion. Retrotuberosity intubation is indicated when nasotracheal intubation is contraindicated and submental intubation cannot be done due to a high risk of hypertrophic scar but temporary maxillomandibular fixation is required during surgery to achieve optimal occlusion. Neither angular fractures of the mandible nor Le Fort fractures are contraindications to retrotuberosity intubation, because the tube does not interfere with fracture alignment and fixation. There are, however, some limitations to the application of this technique. Bulbous tuberosities with limited space may not leave enough space for the tube to be passively seated, and in this case reduction of the tuberosity or another method of intubation should be chosen. No complications involving the retrotuberosity technique are reported [16].

Retromolar intubation is a safe technique; being noninvasive it avoids additional 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. In our practice we secure the tube by passing a suture through the adjacent buccal mucosa and tying the knot around the tube (Fig. 4). The adequacy of the retromolar space can be determined by introducing an index finger into the patient's mouth and asking him or her to close the mouth. No compression on the finger indicates an adequate space. The disadvantages are that the tube can interfere with the surgical field and is not feasible in case of limited retromolar space. However, if necessary, a tracheal tube smaller than the standard size can be used for retromolar intubation. Some authors have described concurrent third molar extraction and bone removal by semilunar osteotomy in the region to enable retromolar intubation, although the latter method seems to add further morbidity to a technique designed to avoid it [17]. Destruction of bony anatomy for the sole purpose of making space for an endotracheal tube passage does not make sense, especially when the bone may be useful for fracture segment fixation devices [16].

Orotracheal Intubation-Missing Dentition

Dental injuries in the form of avulsion, crown &/or root fractures are a common presentation in patients with maxillofacial injuries [18]. These avulsed teeth can be of benefit during the airway management in patients sustaining maxillofacial injuries where NTI is contraindicated. First, orotracheal intubation is performed with a flexometallic tracheal tube using a standard general anaesthesia technique. The orotracheal tube is then passed transorally through the avulsed teeth sockets and fixed in a usual manner (Fig. 5). Most frequently the anterior teeth are avulsed due to their prominent position within the dental arch and due to their root morphology, and hence the tube can be brought straight forward transorally

Fig. 5 **a** 3-D reconstructed CT image showing missing/avulsed anterior teeth in both the arches. **b** Orotracheal intubation through the missing dentition

through these edentulous spaces. This simple technical modification of usual orotracheal intubation is of great advantage i.e. it can be used in cases where NTI is contraindicated, no specialized skill required, no added cost, avoids the need for tracheostomy, no extra-oral procedures required and the most important is that it does not interfere with occlusion/MMF. The disadvantage is that, at times the tube can interfere with the surgical field.

Conclusions

Maxillofacial injury patients often present with difficult airways due to changes in normal anatomy. Preferred techniques of securing an airway like orotracheal, nasotracheal may not always be applicable, thus a trauma surgeon-anaesthetist team should always have alternative techniques in their armamentarium to reduce the morbidity associated with these patients. One technique may not be applicable for every patient, thus knowledge about different techniques available is equally required. We have used these techniques in a country with limited resources and found them equally effective and convenient to use.

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Conflict of interest None.

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