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Case Report

Endotracheal Intubation Using Submandibular Approach for Maxillofacial Trauma Patients: Report of 2 Cases

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The indication for submandibular intubation is the requirement for intraoperative maxillomandibular fixation (MMF) in the presence of injuries that preclude nasotracheal intubation. Thus, We reported 2 cased of endotracheal intubations via submandibular approach that is applicable in patients with skull base fractures for a reliable general anesthesia. Endotracheal intubation via submandibular approach was applied during general anesthetic procedures for open reduction in three patients with Le Fort II, III or nasoorbitoethmoid (NOE) fractures. No complications due to submandibular intubation, such as infection, postoperative scarring, nerve injury, hematoma, bleeding, or orocutaneous fistula, were observed following submandibular intubation. Endotracheal intubation via submandibular approach is effective in patients with skull base fractures. In our method, the tube connector is removed in orotracheal intubation in order to avoiding the tube removal or displacement. The advantages of this method are very simple, safe, and to provide the good operation field.

Key Words: Intubation; Skull base fracture; Submandibular

The most common approach in endotracheal intubation for surgical procedures and emergency is endotracheal intubation using laryngoscope. This method allows either oral or nasal approach [1]. The oral approach with the technique is most frequently used, but the hindrance of this approach makes it impossible to evaluate the occlusion during the surgery. Occlusion in patients with maxillofacial fractures is important, so reduction of fractures require complete recovery of occlusion. This reason leads surgeons to utilize nasal approach in endotracheal intubation for oral and maxillofacial surgery [2, 3].

However, nasotracheal intubation is not always possible. There have been reports on danger related to panfacial and basal skull fractures. Especially, Le Fort II and III fractures in relation with cribriform plate can cause significant complications. It means that nasotracheal intubation could possibly cause damages to basal skull or brain in specific situations [2, 4].

Considerations for adoption of submandibular approach rise to reduce such complications [5]. This approach is stable in airway maintenance in cases of maxillofacial trauma with damages to the skull. The purpose of the study is to discuss the method to maintain airway during the anesthesia with submandibular approach in patients with disseminated facial fracture.

SURGICAL TECHNIQUE

On submandibular approach, tube connector of orotracheal tube is removed, and general anesthesia was guided with orotracheal intubation. It was placed medially to the inferior border of mandible and 2 cm anterior to the mandibular angle, 2 cm in length. This was to avoid damage to marginal mandibular branch of facial nerve. Muscle incision was placed internally to the dermal

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incision in order to avoid direct contact with the oral cavity. Blunt dissection was made closest to internal surface of mandible with curved artery forceps. Then, the tissue was exfoliated with curved hemostat. Myelohyoid muscle needed to be retracted laterally, not penetrated. Order of dissection follows: skin, fat, platysma muscle, investing layer of deep cervical fascia, myelohyoid muscle, and oral mucosa. Intraoral incision was located medial to the mandibular second molar. Kelly forceps was used for further exfoliation, and access opening was confirmed with a digit. Orotracheal tube was properly located from inside to outside. Tube connector was firmly set and was guided to ventilator. Then, tube was fixed with 2-0 silk of the dermal layer. Tube was carefully managed not to damage the orotracheal tube, not to displace the tube, and to remove any blood in the tube with suction. Removal procedure is the opposite from insertion. Orotracheal tube can be removed or left after resolving the dermal suture. Dermal incision line was closed with interrupted suture, and intraoral incision line also is sutured.

CASE REPORTS

Open reduction for two panfacial bone fracture patients with endotracheal intubation via submandibular approach was preceded in our operating room. Most cases displayed skull base fracture with NOE fracture.

1. Case 1

A 46 year-old male visited emergency room in April of 2011 with trauma. Unconsciousness, nasal bleeding, multiple facial contusions, and lacerations were present. The CT examination revealed Le Fort II, NOE, left zygomaticomaxillary complex fracture, maxillary palatal fracture and right madibular parasymphysis fracture (Fig. 1).

After orotracheal intubation, submandibular endotracheal intubation was performed because skull base fracture was evident and nasal intubation was dangerous. Submandibular approach allowed maintanence of intermaxillary fixation during the operation. No infection or complication was found in submandibular area after the surgery (Fig. 2).

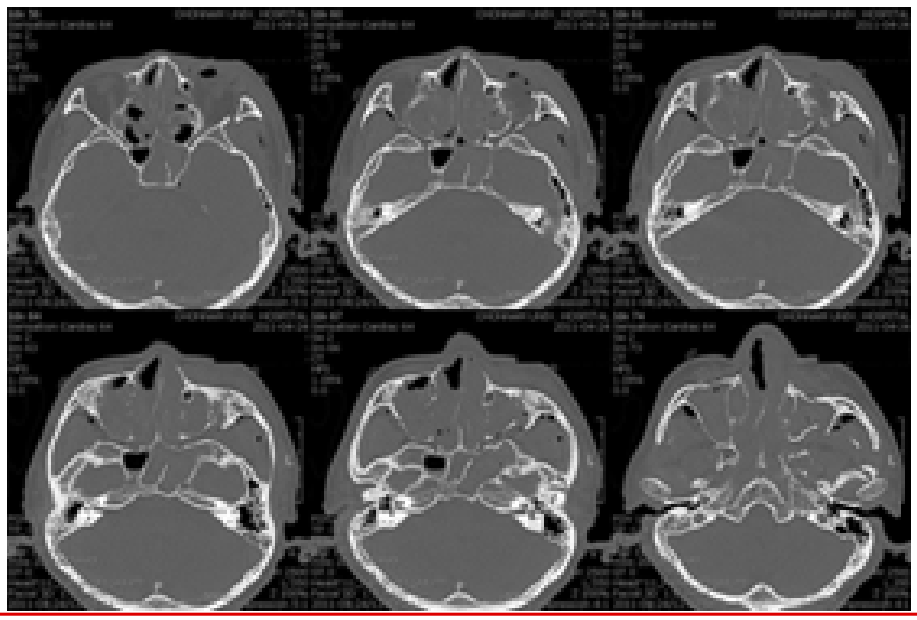

Fig. 1. The CT examination revealed Le Fort II, NOE, left zygomaticomaxillary complex fracture, maxillary palatal fracture and right mandibular parasymphysis fracture.

(A)

(B)

Fig. 2. (A) Tube connector of orotracheal tube is removed for safety, (B) Tube connector of orotracheal tube is removed, and general anesthesia was performed with orotracheal intubation. Blunt dissection was made closest to internal surface of mandible with curved artery forceps. Kelly was used for further exfoliation, and access opening was confirmed with a digit. Orotracheal tube was properly located from inside to outside. Tube then was fixed with 2–0 silk of the dermal layer.

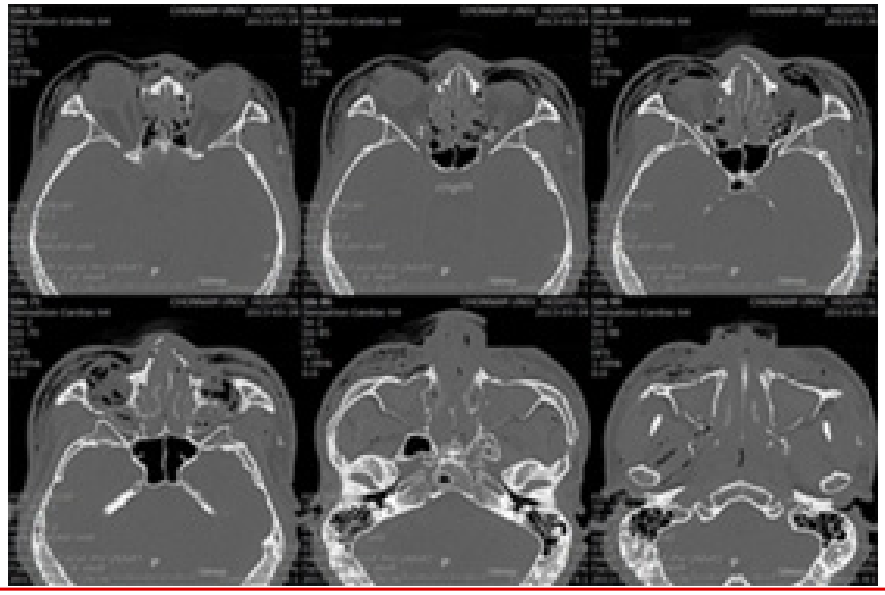

Fig. 3. CT examination showed Le Fort I, II and III fracture.

2. Case 2

The other patient 45 years of age with trauma was referred from ER of local hospital in March of 2013. CT examination showed Le Fort I, II and III fracture (Fig. 3). He was conscious, and nasal bleeding was seen.

Fig. 4. Submandibular approach for endotracheal intubation in this case was guided after normal orotracheal intubation.

Submandibular approach for endotracheal intubation in this case was guided after normal orotracheal intubation before open reduction and conduction for the fracture (Fig. 4).

DISCUSSION

Early open reduction and internal fixation allows less bleeding and minimizes swelling or infection in cases with disseminated facial fractures. Also, complex facial fractures can be reduced with the law of "bottom up, outside in." In other words, mandibular reduction is preferentially performed after fixation of maxillae is acquired, and then with the corresponding position, maxillary fracture can be repaired. This method of reduction with maxillae fixation is thought to be most reliable [6,7].

The indications for nasotracheal intubation are hindrance in oral opening with difficulty laryngoscope usage and obstacle from temporomandibular joint problems, yet a nasal tube needs to be longer and thinner than an oral tube, causing resistance during intubation and difficult in suctioning pulmonary secretion. Also, prolonged retention of the tube could damage nasal cavity and thus bring out abscesses, otitis media, sinusitis, and more [8]. Recent reports have revealed that cases with Le Fort II III, or basal skull fracture possess the greatest danger in the intubation [2,4,9].

For cases unable to acquire oral or nasal intubation and in emergency, an alternative is tracheostomy. Tracheostomy is applied on cases with ventilator dependence, airway obstruction, or pulmonary toilet [10,11]. On exposure of thyroid isthmus, it can be sutured onto upper tissue to expose pretracheal fascia and to exfoliate this layer. Passage of tube is made with incision between the second and third tracheal rings. As described above, tracheostomy is a complicated process, and the process could cause complications in patients. The complications can be grouped into early and late complications. Early complications include complications appear within seven days of the surgery. These include pneumomediastinum, subcutaneous emphysema, infection, and loss of airway. Late complication refers to those appear after seventh day of post surgery, and they are laryngotracheal stenosis, fistula (tracheoinnominate and tracheoesophageal) formation, delated stoma closure, tracheomalacia, and rarely vocal cord paralysis [6,10,12,13].

In contrast to tracheostomy, endotracheal intubation with submandibular approach is safe and simple technique in patients with disseminated facial fractures. Thus, submandibular intubation is an effective method for functional occlusion recovery in patients with nasal fractures, nasal-orbitalethmoidal fractures, skull base fractures, or congenital deformities.

There are two methods in intubation via submental approach. One is Altemir sequence with one tube usage, and the other is Green and Moore sequence with usage

of two tubes. Recent research discovered that Altemir sequence displayed 5% of complications while Green and Moore sequence showed 21% complication cases. For the current study, Altemir sequence was utilized with reinforced spiral embedded endotracheal tube or non-reinforced endotracheal tube in all three cases. Another recent study reported that no significant difference in probability for complications according to the tube [14].

According to several reports, submental approach of intubation may bring complications such as infection, endotracheal tube damage, fistula, right endobronchial intubation/obstruction, hypertrophic scarring, unpredicted extubation (paediatric), venous bleeding, excessive bronchial flexion, transient lingual nerve paresthesia, throat pack sticker dislodged, and mucocele formation. There have been reports on increase in chance of complications upon tube retention more than 72 hours [4,15]. Thus, replacement with oral endotracheal intubation might be proper for prolonged mechanical ventilation, but care is needed as disruption of operation site may occur due to patient's biting of the orotracheal tube [16].

Submandibular approach is a variation from submental approach, and it is well applicable to make a tunnel as the area has better ways around the anatomical structures. A careful extraperiosteal blunt dissection as close as possible to the internal surface of the mandible can minimize the damage of anatomical structures. Because accidental dislodgements of tube during pulling out have been reported [17], the connector of orotracheal tube removed in order to reduce the chance of dislodgement in this study. During the manipulation of mandible for fracture reduction, accidental extubation and inward displacement had been observed, so fixation of orotracheal tube is also thought to be important [17].

Maintenance of trachea is also critical. Extubation after the surgery sometimes is not proceded with the tube remaining, and intermaxillary fixation at this state may cause dangerous situation in airway security due to swelling of tissue. Thus, further studies recommend intermaxillary fixation after the extubation process, and rigid fixation may elimination requirement of intermaxillary fixation [16].

Therefore, endotracheal intubation with submandibular approach can be effective method with low side effects. We conclude that this technique is an ideal alternative for tracheostomy in patient with impossibility of endotracheal intubation via oral or nasal routes.

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