Intraoperative Endobronchial Intubation After Successful Submental Intubation

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In complex maxillofacial fractures in which orotracheal and nasotracheal intubation are otherwise contraindicated, alternatives for airway management include tracheostomy and submental intubation (SMI). In this case, SMI was used successfully, although it did result in accidental endobronchial intubation intraoperatively that was quickly recognized and managed appropriately. SMI can be a useful method for securing a patient's airway, but like all surgical approaches, it does carry the potential for complications. We report a case involving the use of SMI during which an unintended endobronchial intubation occurred.

Key Words: Submental intubation; Maxillofacial fractures; Endobronchial intubation.

Airway management for patients with facial fractures can be challenging for anesthesiologists. For cases of mandibular and LeFort fractures that involve dental occlusion, oral intubation may be contraindicated. Nasotracheal intubation may be another approach[1]; however, it may be contraindicated in some cases involving more extensive facial fractures (eg, panfacial, midfacial, or basilar skull fractures with or without cerebrospinal fluid leakage). Safely passing a nasotracheal tube may be difficult for patients with nasal airway stenosis because of a deviated nasal septum, hypertrophic turbinates, nasal polyps, and other intranasal pathologies.[2,3] While elective tracheostomy to establish a surgical airway is a relatively common and effective approach in these types of situations, submental intubation (SMI) is another option that may be considered.

Hernández Altemir first introduced SMI for airway management in patients admitted with maxillofacial trauma in 1986. SMI uses a completely different anatomical approach than a traditional tracheostomy and involves percutaneous passage of a flexible endotracheal tube (ETT) through a small incision in the floor of the mouth after the airway is secured via orotracheal intubation.[4] Surgical complications such as ranula formation, hypertrophic scarring, oral cutaneous fistula, lingual nerve damage, bleeding, hematoma, and infection have been reported.[5] In addition, other issues can arise such as accidental extubation or displacement of the ETT, inadvertent endobronchial intubation, or trauma to the salivary glands.[6] This case report describes the impact of an accidental right mainstem endobronchial intubation as a complication stemming from SMI.

CASE PRESENTATION

A 30-year-old man (height, 165 cm; weight, 60 kg; body mass index, 22 kg/m^2) presented with multiple fractures secondary to trauma including left midfacial fractures consisting of zygomatic frontal, zygomatic arch, and maxillary fractures. He also had closed left forearm fractures, a left femoral shaft fracture, a closed comminuted fracture of the left patella, closed left fractures of the lower leg, and a closed fracture of the left clavicular shaft. However, the patient was conscious and oriented upon presentation despite the extensive nature of his injuries. The patient reported that he snored but denied any other significant medical history or surgical history. He was deemed an American Society of Anesthesiologists Physical Status class I. Upon examination of his airway, his mouth opening was 3 fingers wide with a Mallampati classification of III.

Due to his extensive midface fractures, the patient was scheduled for emergency surgery. He was taken to the operating room, and standard anesthetic monitors were applied. Due to the possibility of poor nasal patency, nasotracheal intubation was not chosen for securing his airway. Orotracheal intubation

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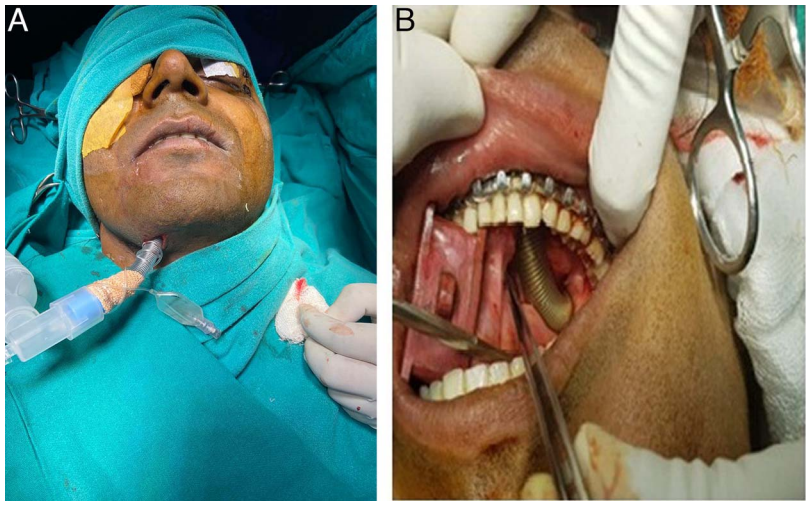
Figure. Patient After Submental Intubation



(A) Submental intubation with the lateral approach modification. The ETT is externally positioned in the right submental area and is ready for suturing to secure its position and avoid displacement during surgery. (B) Intraoral surgery after successful submental intubation. The ETT is passed percutaneously through the submental incision and the floor of the mouth to permit the use of maxillomandibular fixation to maintain dental occlusion during the surgical procedure.

was also not considered as it would hinder the surgical procedure which required the need to ascertain his dental occlusion as well as the intraoperative use of maxillomandibular fixation. Therefore, the anesthetic plan included SMI since it would still permit occlusion of the teeth (Figure A and B).

The patient was premedicated with intravenous (IV) fentanyl (100 μg) and midazolam (1 mg), and general anesthesia was induced with propofol (100 mg). After successful bag-mask ventilation of the patient with 100% oxygen, IV vecuronium (6 mg) was administered. General anesthesia was maintained with isoflurane along with nitrous oxide (60%) and oxygen (40%), and intermittent doses of vecuronium (1 mg) were given at regular intervals to facilitate neuromuscular paralysis intraoperatively.

SMI Procedure

The patient's airway was initially secured by oral intubation with a flexible, wire-reinforced, cuffed, 8.0 size ETT that notably lacked any depth markings. Successful ETT placement was initially confirmed by capnography and auscultation of the lungs, which revealed equal and bilateral breath sounds. Orotracheal intubation was then converted to a submental endotracheal intubation using the following procedure.

Local anesthetic (3 mL of 1% lidocaine with 1:200,000 epinephrine [total dose: lidocaine 30 mg and epinephrine 0.015 mg]) was injected subcutaneously at the SMI site located 2 cm lateral to the midline (Figure A). After a 1.5-cm incision was made percutaneously, the submandibular fat, platysma muscle, and mylohyoid muscle were bluntly dissected using Kelly hemostat forceps. The soft tissue dissection followed the lingual cortex of the mandible to avoid damaging the digastric muscle and the ducts of the submandibular and sublingual glands. Intraoral palpation was performed by the surgeon to help direct the forceps during the dissection.

Once the incision through the oral mucosa and into the oral cavity was made, the forceps were opened to enlarge the incisional opening and allow passage of the ETT. After detaching the ETT connector, artery forceps were passed percutaneously through the intraoral incision to grasp the proximal end of the ETT and pass it through the incision. It took approximately 6 minutes to correctly reposition the ETT through the SMI site and reattach the ETT connector. Positioning of the ETT was confirmed with capnography and bilateral lung auscultation, after which it was ready to be secured (Figure A). Temporary black silk sutures were placed to secure the ETT externally, one on either side of the tube and another placed circumferentially by the surgical team. The patient remained hemodynamically stable with an SpO_2 of 100% throughout the entire SMI procedure.

However, approximately 30 minutes into the surgical procedure, the patient began to desaturate (SpO_2 85%), increased peak airway pressures (41 cm H_2O) were noted, and decreased breath sounds were noted on the left side upon auscultation. Accidental endobronchial intubation was immediately suspected, the ETT was carefully withdrawn from submental incision, and after repositioning, successful ventilation with equal bilateral breath sounds was observed. The ETT was then resecured, and the surgery resumed

(Figure B). The patient remained well oxygenated (SpO_2 ≥98%) throughout the remainder of the surgery.

After surgery completion, the SMI was converted back into a standard orotracheal intubation without any complications or significant disruptions in ventilation or oxygenation. The patient remained orally intubated and sedated while he was transferred to the intensive care unit. He was extubated 24 hours later, at which point he was conscious and well oriented with no signs of respiratory compromise. Bilateral breath sounds were equal upon auscultation, and a postoperative anteroposterior chest radiograph was obtained, which was otherwise normal.

After completion of the case, potential causes of the inadvertent endobronchial intubation were analyzed. We determined that the ETT had not been fully withdrawn during the SMI procedure and the excess length had coiled somewhat within the patient's mouth. After securing the ETT with sutures, we believe it uncoiled, which led to the distal end of the ETT moving caudally, resulting in a right mainstem intubation.

DISCUSSION

In patients undergoing repair of maxillofacial fractures, a detailed discussion between the surgery team and the anesthesiologist is essential regarding the planned surgical procedure(s) and the route for intubation/airway management. During cases in which orotracheal intubation is contraindicated, possible options include nasotracheal intubation, tracheostomy, and SMI.[7,8] In this case, we chose SMI as an alternative approach due to the surgeon's preference to avoid a tracheostomy; however, SMI has its own set of complications. This case report also highlights the potential for endobronchial intubation with SMI if the flexible, reinforced ETT is not fully withdrawn from the incision site to remove any excessive slack. If too much of the ETT is left inside the oral cavity, it may bunch up or coil and lead to endobronchial intubation once the proximal end of the ETT is secured at the incision site.

Endobronchial intubation is a common complication associated with almost all types of endotracheal intubation, although it is less likely to occur with certain approaches (ie, nasotracheal intubation) given the various limitations of typical patient anatomy and ETT sizing standards and shapes. Depth markers that are typically present on most ETTs serve to help prevent overinsertion. However, ETTs without those markings, such as the reinforced ETT used in this case or specialized metallic ETTs used in laser cases, likely carry a higher risk of mainstem intubation and should be used with care. Auscultation of the lungs to assess for symmetry of lung sounds is a critical step for all intubation approaches but especially if an unmarked ETT is used.

Although unintentional endobronchial intubation is usually identified and corrected quickly and easily, it can lead to disastrous outcomes if unrecognized or mismanaged. Clinical indications that suggest endobronchial intubation can include increased peak airway pressures, arterial oxygen desaturation, changes in end-tidal CO_2 concentration or waveform, and asymmetrical breath sounds upon auscultation, many of which were noted in this case. Management is usually simple, requiring ETT withdrawal until symmetrical breath sounds are noted and ventilation improves. However, significant interventions may be needed in the event of serious endobronchial intubation-related complications such as atelectasis, barotrauma, and pneumothorax.

SMI was initially introduced by Hernández Altemir in 1986 and underwent a modification by MacInnis and Baig in 1999, which included the use of a lateral entry site versus the original midline approach to help prevent injury to the lingual nerve and sublingual and submandibular glands and ducts. SMI may be used as an alternative to nasotracheal intubation and tracheostomy in select cases.[9]

Contraindications to SMI include the need for long-term airway support, known keloid formers, multisystem trauma, and severe neurologic defects.[10] Potential complications including accidental extubation, damage to the ETT, cuff rupture, pilot balloon entrapment/detachment, bleeding, postoperative infection, mucocele formation, damage to salivary ducts and glands, and submental scarring have also been described in previously published case reports.[11,12] This case report describes another potential complication that may occur from SMI: unintended endobronchial intubation attributed to bunching or coiling of the ETT somewhere within the posterior oral cavity, oropharynx, or hypopharynx that resulted in right mainstem intubation once the ETT uncoiled, preventing total ventilation of the lungs.

CONCLUSION

For cases in which orotracheal or nasotracheal intubation are otherwise contraindicated, SMI is another useful method for securing the airway. Because the risk of endobronchial intubation may be higher with SMI, assessing for proper ETT placement is especially warranted with this approach. Auscultation of breath sounds and continued monitoring for signs of impaired ventilation and oxygenation are critical steps that must be considered.

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