Submental Orotracheal Intubation in Maxillofacial Surgery

*พัชรี มาบุญญานนท์ พ.บ.**

Abstract: **Submental orotracheal intubation in maxillofacial surgery**

Patcharee Maboonyanon M.D.*

* Division of Anesthesiology, Paholpolpayuhasena Hospital, Kanchanburi 71000, Thailand.

Background: Airway management in patients undergoing maxillofacial surgery, the surgeon needs to control the dental occlusion and nasal pyramid assessment. For these reasons, oral and nasal endotracheal intubations are contraindicated. Tracheostomy often has perioperative and postoperative complications. Submental orotracheal intubation is now a recognized method of airway control during maxillofacial surgery. It provides a secure airway and does not interfere with maxillomandibular fixation or access to naso-orbito-ethmoid fractures. ***Method:*** This is a nine years retrospective review of patients who underwent submental orotracheal intubation in maxillofacial surgery. The following variables were recorded: patient gender and age, preoperative diagnosis, and complications associated with intubation technique. ***Results:*** Submental orotracheal intubation was performed 41 times on 41 patients. In all the patients, the submental orotracheal intubation permitted simultaneous reduction and fixation of all fractures. There were only two intra-operative complications, when the pilot balloon was leakaged and loosening of the connector after re-attachment. No postoperative complications was reported Conclusion: Submental orotracheal intubation is a simple technique associated with a low morbidity. It is an alternative to tracheostomy. For operative airway control in major maxillofacial traumas.

Keywords: *Airway management, maxillofacial trauma, Submental intubation*

* งานวิสัญญีวิทยา โรงพยาบาลพหลพลพยุหเสนา กาญจนบุรี 71000

** Corresponding author: Patcharee Maboonyanon

E-mail: pontree@hotmail.com

Background

Airway management in patients with maxillofacial trauma is a challenge for both the anesthesiologist and the surgeon, and requires good communication between them.[1] In most cases, the airway can be initially secured by oral endotracheal intubation. However, optimal surgical management of complex facial fractures requires temporary occlusion of the teeth and an unobstructed access to the oral cavity. At the same time, a secure patent airway must be maintained throughout the operative period. Various techniques of airway management have been used. In many cases, nasotracheal intubation will secure the airway without interfering with maxillomandibular fixation and the surgical approach. However, in patients with facial fracture involving the naso-orbital ethmoidal (NOE) complex, surgical reconstruction often requires switching the endotracheal tube from the nasal to oral route, which may compromise airway. Furthermore, fractures of the midface (Le Fort II or III) are frequently associated with the skull base fractures, involving the cribriform plate of the ethmoid, potentially creating a communication between the nasal cavity and the anterior cranial fossa with cerebrospinal fluid leakage.[2] In such cases, attempts at nasotracheal intubation may lead to a major complication, i.e., passage of the tube into the cranium.[3-4] Other potential complications include meningitis, sepsis, sinusitis, and epistaxis.[5] Therefore, nasotracheal intubation is considered to be relatively or even absolutely contraindicated in those patients.[3-4] An alternative technique for airway control is to perform a tracheostomy, considered the method of choice by many surgeons and anesthesiologists.[2,6] However, tracheostomy also carries its own morbidity.[7] Perioperative complications include loss of airway, arterial desaturation, hemorrhage, subcutaneous emphysema, pneumomediastinum, pneumothorax, and recurrent laryngeal nerve damage, with incidences ranging from 6 to 8%. Late complications, including stomal and respiratory tract infections, tracheal stenosis, tracheoesophageal fistula, and unesthetic scar, can even reach an incidence of 60%.

Hernandez Altemir,[8] in 1986, described an alternative method of airway management in maxillofacial trauma patients. This technique, called submental orotracheal intubation, it provides a secure airway, an unobstructed intraoral surgical field and allows maxillomandibular fixation while avoiding the drawbacks and complications of nasotracheal intubation and tracheostomy.

The objective of this study is to present the advantages and complications of submental orotracheal intubation technique.

Materials and Methods

This is a 9 years retrospective review of all patients who underwent submental orotracheal intubation at maxillofacial surgery unit in Paholpolpayuhasena Hospital, between January 2006 and December 2014. The following variables were recorded: patient gender and age, preoperative diagnosis, duration of intubation, and complications

associated with the intubation technique. All information was obtained from patient medical records and operative reports.

All the objects had their trachea intubated orally by standard direct laryngoscopy after induction of general anesthesia with reinforced (spiral-embedded) endotracheal tube having an internal diameter of 7.0 to 8.0 mm with a removable connector. The orotracheal intubation was then converted to a submental orotracheal intubation by using following procedure.

The submental skin is prepared with aqueous povidone iodine. A 2 cm skin incision is made in the submental region, one fingers breadth medial to the lower border of the mandible. A curved hemostat is used to bluntly dissect through subcutaneous fat, platysma, investing layer of deep cervical fascia, and mylohyoid muscle until the floor of mouth mucosa is penetrated. With the curved hemostat, the deflated pilot balloon was passed extraorally. Then the endotracheal tube was disconnected from the breathing circuit and the standard connector removed from endotracheal tube and the tube secondly passed through the submental incision with the curved hemostat. (Figure 1, 2)

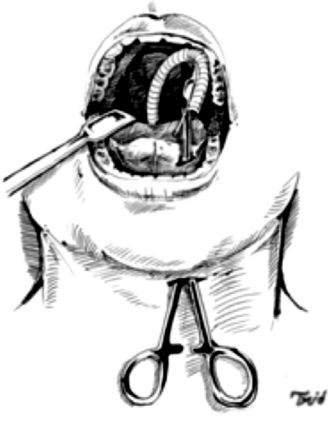

Figure 1 and 2 Endotracheal tube pass through the submental incision with the curved hemostat

To prevent any inadvertent pull being exerted on the tube from larynx, the tube was then manually stabilized and the tip of the endotracheal tube gently pulled out through the submental incision. After confirmation of its adequate tracheal position by capnography and bilateral auscultation of the lungs. Finally, the tube was reconnected and secured to the submental skin using a silk suture. Intraorally the tube was positioned between the tongue and the mandible just above mucosa of the floor of the mouth. (Figure 3)

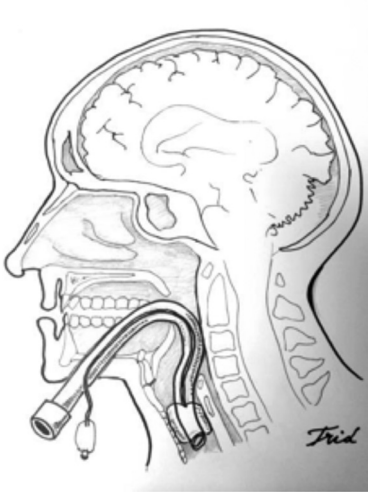

Figure 3 Sagittal view of submental orotracheal intubation

Thereafter, minute ventilation and FIO2 are adjusted to keep the ETCO2 between 35 and 40 mmHg and the arterial saturation greater than 97%.

Following surgery, submental orotracheal intubation converted to oral intubation. The endotracheal tube was pulled back intraorally in the reverse order (first the reinforced tube, then the pilot balloon). The submental skin incision was closed with interrupted silk sutures and the intraoral left to heal secondarily. Weaning from mechanical ventilation and extubation was done when the usual criteria were met.

The patients were followed up on regular basis at 1 week, 1 month and 6 months. Assessment was based on postoperative morbidity in terms of function and aesthetics.

Results

During the 9 years period of this study, submental orotracheal intubation was performed 41 times on 41 patients. Patients clinical data are presented in Table 1. The group included 33 men and 8 women. The mean age was 30.37 years (range is 11 to 60 years).The mechanisms of injury were blunt trauma resulting from motorcycle accident (n = 34), car accident (n =1), fall (n = 2), or other impact with blunt objects (n = 4)

The submental orotracheal intubation was realized successfully in every patient. The total duration of the procedure less than 10 minutes and was associated with minimal bleeding. Disconnection time from the ventilator was approximately 2 minutes. There was no significant oxygen desaturation in any patient during the procedure. Only two intraoperative complications were reported. In one case, the curved hemostat caused the pilot balloon to leak. After the reposition of the new tube, the problem was solved. In another case, after reattachment the connector loosened. The problem was solved by using adhesive tape. None of the subjects in the present study required postoperative ventilation. All 41 subjects were extubated in the operating room.

Subjects were evaluated in the postoperative

period at 1 week, 1 month and 6months. No motor or sensory deficit was found. Normal healing in the mucosa of the floor of the mouth was observed. No bleeding or infection in the area was noted. The scar has been well accepted by the subjects without any hypertrophic scarring or keloid formation. No patient developed salivary fistula or presented injury to the submandibular or sublingual glands or canals, or to the lingual nerve.

Table 1 Patients clinical data

No.	Date	Age	Sex	Mechanism of injury	Maxillofacial fracture	Base of skull fracture	Complication (intraoperative)	Complication (postoperative)
1	02/02/2006	23	M	MCA	Lefort I, Rt. Zygoma, Mandible	Yes	No	No
2	18/06/2007	44	F	Impact	Lefort II, Lt. Zygoma, Mandible	Yes	No	No
3	30/04/2008	26	M	MCA	Lefort I, Zygoma, Nose	No	No	No
4	17/06/2008	25	M	MCA	Lefort II, Zygoma, Mandible, NOE, frontal bone	No	No	No
5	19/06/2008	38	M	MCA	Lefort II, Zygoma, Mandible	Yes	Leakage pilot balloon	No
6	22/08/2008	20	M	MCA	Lefort II, Mandible, Nose, frontal bone	No	No	No
7	12/12/2008	25	M	MCA	Multiple facial fracture	Yes	No	No
8	14/01/2009	47	M	Fall	Lefort I, Lt. Zygoma, Nose	No	No	No
9	17/04/2009	12	M	MCA	Lefort I, Mandible	Yes	No	No
10	06/05/2009	26	M	MCA	Lefort II, Rt. Zygoma, Mandible, NOE	No	No	No
11	27/05/2009	24	M	MCA	Lefort I, Zygoma, Mandible, Nose	No	No	No
12	25/08/2010	42	M	Impact	Rt. Zygoma, Mandible, Lt. Orbit	Yes	No	No
13	15/06/2010	24	F	MCA	Lefort II, Lt. Zygoma, Nose	No	No	No
14	06/07/2010	13	M	MCA	Mandible with severe subluxation	Yes	No	No
15	30/11/2010	46	M	Impact	Lefort II, Lt. Zygoma, Mandible	Yes	Loosening of the connector	No
16	12/01/2011	28	M	MCA	Lefort II, Lt.Zygoma, Depressed skull	Yes	No	No
17	22/02/2011	23	F	MCA	Lefort II, Rt. Zygoma, Nose	No	No	No
18	21/03/2011	19	F	MCA	Lefort I, Lt. Zygoma, Nose	No	No	No
19	28/06/2011	11	M	MCA	Lefort II, Mandible	Yes	No	No
20	02/08/2011	22	M	MCA	Lefort I, Zygoma, Mandible	Yes	No	No
21	05/10/2011	47	M	MCA	Lefort II, Mandible	Yes	No	No
22	08/11/2011	54	F	Car accident	Lefort II, Nose	Yes	No	No
23	17/01/2012	60	M	Fall	Lefort I, Zygoma, Mandible, Nose	No	No	No

Table 1 Patients clinical data (con.)

No.	Date	Age	Sex	Mechanism of injury	Maxillofacial fracture	Base of skull fracture	Complication (intraoperative)	Complication (postoperative)
24	16/10/2012	26	M	MCA	Lefort II, Mandible	Yes	No	No
25	12/12/2012	47	M	MCA	Lefort II, Rt. Zygoma, Mandible	Yes	No	No
26	05/02/2013	30	M	MCA	Lefort II, Lt. Zygoma, Nose	No	No	No
27	10/05/2013	17	M	MCA	Lefort I, Mandible	Yes	No	No
28	30/07/2013	16	M	MCA	Lefort II, Mandible	Yes	No	No
29	30/09/2013	26	M	MCA	Lefort II, Mandible	Yes	No	No
30	01/10/2013	45	M	MCA	Lefort II, Rt. Zygoma, Nose	No	No	No
31	15/10/2013	17	M	MCA	Lefort II, Zygoma, Nose	No	No	No
32	01/11/2013	29	M	MCA	Lefort III, Zygoma, Nose, Frontal bone	Yes	No	No
33	26/02/2014	18	F	MCA	Lefort II, Lt. Zygoma, Nose	Yes	No	No
34	24/06/2014	40	M	Impact	Lefort II, Mandible	Yes	No	No
35	24/06/2014	32	F	MCA	Lefort II, Mandible, Nose	Yes	No	No
36	01/07/2014	33	M	MCA	Mandible, Zygoma, NOE	No	No	No
37	19/08/2014	38	F	MCA	Lefort I, Zygoma, Nose	No	No	No
38	21/08/2014	22	M	MCA	Lefort I, Nose, Frontal bone	No	No	No
39	26/08/2014	45	M	MCA	Lefort I, Lt. Zygoma, Nose	Yes	No	No
40	14/10/2014	52	M	MCA	Lefort II, Rt. Zygoma, Nose	No	No	No
41	09/12/2014	13	M	MCA	Open fracture mandible	Yes	No	No

NOE = Naso-orbito-ethmoidal complex

Discussion

For patients with facial trauma undergoing operations, patient safety, functional outcome, and esthetic result are the issues that have to concern. Management of the airway is always primary concern during any maxillofacial surgery. Operating in the field free from the intubation tube is comfortable for a surgeon; while for an anesthesiologist, the safety of the tube and efficiency of ventilation are important. The submental orotracheal intubation technique has been first described by Hernandez Altemir[8] in 1986, as an alternative route for airway control during the management of maxillofacial trauma. It provides a secure airway and does not interfere with intermaxillary fixation. Submental orotracheal intubation combines the advantages of nasotracheal intubation, which allows the possibility of checking the dental occlusion perioperatively, and those of orotracheal intubation, which allows nasal pyramid assessment for appropriate midfacial fractures management. It also avoids inherent complications associated with nasotracheal intubation and tracheostomy.

Many authors have studied the clinical use

of this procedure. Very low rates of complications have been reported. Many trials have shown the submental route to be a simple, quick and safe approach to airway management.[8-11] However, this method is contraindicated for patients who require a long period of mechanical ventilation, as multitrauma patients presenting with severe neurological damage or major thoracic trauma and also patients expected to need repeated operations.[9]

Since the first application of this technique, described for its role during maxillofacial trauma, numerous authors have now described its use in management dentofacial deformities. Chandu et al.[12] described its use during the management of 44 patients undergoing orthognathic surgery. Nyarady et al.[13] report its use in 13 similar patients, Whilst Mak et al.[14] described its use in a patient with beta-thalassemia major undergoing elective maxillary and mandibular osteotomies. Others[15] describe the use of submandibular intubation as an alternative to tracheostomy in cranial base surgery.

Various modifications on Altemir's original technique, a 2 cm incision made medial to the inferior border of the mandible, have been suggested. MacInnis et al.[16] in 1999, described a modified approach where a midline submental incision, posterior to the mandibular duct papillae, is used. Mahmood and Lello[17] also advocate a midline submental approach. However, they placed their intra-oral incision anterior to submandibular duct papillae. This technique was considered to reduce the risk of trauma to the lingual nerve and submandibular duct papillae. Bartowski et al.[18] also described a midline submental incision in combination with an intra-oral incision placed lateral to the lingual fraenum.

Some authors have recommended the technique of lateral incision through the body of mandible.[19-20] Stoll et al.[21] describe a technique where the incision is placed in the submandibular region and Prochno[22] presented their experience with submandibular transmylohyoid intubation in 14 patients. However, for two reasons we opted for midline approach as described by MacInnis et al16: firstly, only few anatomic structures are present and there is minimum risk of neurovascular damage. Secondly, the midline incision heals almost imperceptibly and therefor is cosmetically superior. Green and Moore[23] described the use of two tubes whereby the patient is intubated orally in a standard fashion. A second tube is then placed intra-orally via a submental incision and passed into the trachea after removal of the original tube. The authors believe that this technique reduces the risk of compromising the patients' airway whilst the tube is pulled through the submental incision.

There have been several attempts to achieve short-term airway management, including retromolar intubation and nasal tube switch technique. According to literature, retromolar intubation has been reported to have disadvantages like being more traumatic, obtrusive, costly and requiring more operating time.[24] Another alternative nasal tube switch technique was not performed due to problems associated with the intraoperative re-intubation, risk of aspiration due to posterior nasal bleeding, potential airway compromise with need for emergency tracheostomy/

cricothyroidotomy, unfavorable manipulation of an unstable cervical spine, excessive stress on fixations with possible loosening of plates and screws.[25]

Whilst the morbidity associated with submental orotracheal intubation appears to be low,[11,26-27] a number of complications have been reported. Caron et al.,[10] in a review of 25 patients who underwent submental orotracheal intubation, found that only one complication, superficial infection, occurred. Chandu et al.,[12] in a series of 44 patients undergoing orthognathic surgery, described two instances of accidental extubation, two episodes of local infection at the submental incision site, and another patient who developed a mucocele. Stranc et al.[28] also reported the development of a submandibular mucocele in a patient 6 months after submental orotracheal intubation. The authors of that paper believe that this complication may have been avoided if the oral mucosa was incised prior to blunt dissection. Other complications include inadvertent advancement of the tracheal tube into the right main bronchus,[29] damage to the pilot balloon during extubation,[30] abscess formation in the floor of the mouth,[9] damage to the tracheal tube cuff,[31] hypertrophic scarring,[9] and salivary fistula.[31]

In our series, there were two minor complications during the procedure, one case had damage to the pilot balloon and another case had loosening of the connector after reattachment. Both of these problems were solved immediately. No episodes of compromised airway or arterial desaturation occurred during the procedure. Other possible potential complications such as orocutaneous fistula, trauma to the submandibular and sublingual glands or canals, damage to the lingual nerve, and hypertrophic scar were also not observed.

There are technical problems with the original techniques described.[8,16,21-23,30] Because of the tight seal of the connector with the flexometallic ETT, it is difficult to separate the connector and tube during the transfer from the oropharynx through the submental tract. Moreover, damage to the ETT and pilot balloon as a result of being grabbed with forceps during retrieval through the submental tract has been reported.[30] Amin et al.[11] recommended the Euro Medical ILM ETT designed for use with an intubating laryngeal mask airway as ideal for submental orotracheal intubation as the connector is specially designed for detachment and reattachment. Another technique, the ETT was inserted submentally directly over a previously positioned tube exchanger, thus avoiding the need for connector detachment or first securing the airway with a regular orotracheal tube. In our technique, we used Euromedical and Mallinckrodt reinforced tracheal tube. These tubes have connectors that are hard to disconnect. We recommend the connector should be disconnected carefully before intubation and reattached to ensure no loosening of the connector has occurred. After the case showed damage to the pilot balloon. We modified the technique by placing the endotracheal tube to submental area only. We left the pilot balloon in the oral cavity and it not interferes with the operation. This technique is easier, takes less time during procedures and avoided damage to the pilot balloon during removal. (Figure 4, 5)

Figure 4 and 5 Pulled only endotracheal tube to submental area, left the pilot balloon in oral cavity

All the patients were extubated at the operating room after the operation was done. Tracheal extubation of these patients must be done only after adequate evaluation. It is based on the patient's ability to maintain airway reflexes, the potential for residual respiratory depression, and airway edema.[32] If mechanical ventilation or intubation is required postoperatively, the submental orotracheal intubation could be switched over back to standard orotracheal intubation.[10] However, if mechanical ventilation is expected to be required for prolonged period because of severe head or torso injury, tracheostomy remains the preferred technique for airway management.[10]

Some precautions must be considered to make submental orotracheal intubation a successful technique with minimal morbidity. At every step, good communication between the surgeon and the anesthesiologist is mandatory. Submental orotracheal intubation is always a second step after the airway has been secured. During the submental orotracheal intubation procedure, the endotracheal tube must be firmly secured intraorally to prevent accidental extubation. To avoid injuries to the salivary glands and ducts, blunt dissection with the hemostat clamp must run in close approximation to the medial border of mandible.

Conclusion

Submental orotracheal intubation is a useful alternative technique of airway management in patients with panfacial fractures. This technique is simple and safe to be performed with a very low morbidity and complication rate. It allows checking the dental occlusion perioperatively and concomitant surgery of the nasal pyramid in major maxillofacial traumas. It also avoids the potential complications associated with nasotracheal intubation and tracheostomy. Thus, when possible, this method of airway management should be used for patients experiencing panfacial fractures.

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การนำท่อหายใจผ่านทางใต้คางในผู้ป่วยที่มาทำผ่าตัดกระดูกใบหน้าหัก

บทคัดย่อ

บทนำ: การจัดการทางเดินหายใจในผู้ป่วยที่มาทำผ่าตัดกระดูกใบหน้าหัก ในระหว่างการผ่าตัด ศัลยแพทย์ต้องการดูการสบฟันและทำหัตถการบริเวณจมูก ด้วยเหตุนี้ทำให้ไม่สามารถใส่ท่อหายใจทางปากและจมูกได้ ดังนั้นในผู้ป่วยที่มีกระดูกใบหน้าหักอย่างรุนแรง จึงพิจารณาเจาะคอ แต่การเจาะคอมักพบภาวะแทรกซ้อนทั้งระหว่างผ่าตัดและหลังผ่าตัดได้บ่อย ในปัจจุบันการนำท่อหายใจผ่านทางใต้คางเป็นวิธีที่นำมาใช้ได้ผลดี เนื่องจากสามารถจัดการทางเดินหายใจได้โดยไม่ขัดขวางการทำผ่าตัดกระดูกใบหน้าและขากรรไกร หรือการทำหัตถการบริเวณจมูก ***วิธีการศึกษา:*** การศึกษานี้เป็นการศึกษาแบบทบทวนย้อนหลัง ในผู้ป่วยที่ได้รับการนำท่อช่วยหายใจผ่านทางใต้คางเมื่อมาทำการผ่าตัดกระดูกใบหน้าหัก โดยเก็บข้อมูลเรื่อง เพศ อายุ การวินิจฉัยก่อนผ่าตัด ภาวะแทรกซ้อนที่สัมพันธ์กับการนำท่อหายใจผ่านทางใต้คาง ***ผลการศึกษา:*** ได้ทำการนำท่อหายใจผ่านทางใต้คางทั้งหมด 41 ครั้ง ในผู้ป่วย 41 คน ผู้ป่วยทั้งหมดสามารถทำผ่าตัดกระดูกใบหน้าหักได้สำเร็จ โดยมีภาวะแทรกซ้อนจากการนำท่อช่วยหายใจผ่านทางใต้คางที่เกิดขึ้นระหว่างผ่าตัด 2 ราย คือมีการรั่วของ pilot balloon และข้อต่อปลายท่อช่วยหายใจหลวมเมื่อต่อกลับ ไม่พบภาวะแทรกซ้อนหลังผ่าตัด ***สรุป:*** การนำท่อช่วยหายใจผ่านทางใต้คาง เป็นวิธีที่ง่ายและพบภาวะแทรกซ้อนน้อย จึงเป็นทางเลือกหนึ่งแทนการเจาะคอ ในการดูแลทางเดินหายใจในผู้ป่วยที่มาทำผ่าตัดกระดูกใบหน้าหัก

คำสำคัญ : *การจัดการทางเดินหายใจ, อุบัติเหตุกระดูกใบหน้าหัก, การนำท่อช่วยหายใจผ่านทางใต้คาง*