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Original Article

Nasal Retrograde Intubation in Oromaxillofacial Surgery Patients with Limited Mouth Opening: A Cross-sectional Study

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Abstract

Introduction: Retrograde intubation is an alternative technique of securing definitive airway in the patients with limited mouth opening (LMO) when blind nasal intubation fails, and fiber-optic bronchoscope is unavailable. Retrograde intubation in patients with LMO <2 cm through nasal route is an alternative method for airway management.

Materials and Methods: The procedure was performed on 36 patients requiring maxillofacial surgical procedures to increase mouth opening. Indication for this technique was oral mucous fibrosis (OSMF; *n* = 12), temporomandibular joint (TMJ) ankylosis (*n* = 8), mandibular fracture (*n* = 12), and derangement of TMJ (*n* = 4). All patients were examined for pre-operative interincisal opening; during intubation through specific parameters and also post-operative findings were observed.

Results: The mean time was 5.6 min in successfully intubated patients. Eight patients had sore throat which resolved in few days and two patients had subcutaneous emphysema managed conservatively. No other complications were detected.

Conclusion: Retrograde nasotracheal intubation is an effective and useful technique for airway management in LMO patients with minimal risk.

Key words: Intubation, Limited mouth opening, Maxillofacial surgery, Nasotracheal retrograde intubation

INTRODUCTION

Patients with limited mouth opening (LMO) conditions increase the difficulty in securing the airway.[1-3] Maxillofacial surgical patients present with specific challenge for the surgeon and anesthetist. Blind nasal intubation remains an important auxiliary subsidizing airway in such patients when fiber-optic bronchoscope is not available.[4-6] The key in these situations is to perform an elective short-term tracheostomy before the operation which carries high incidence of complications.[7] Other methods are to insert the tracheal tube to submental or submandibular approach;[8,9] however, it can be preposterous in temporomandibular joint (TMJ) ankylosis and is associated with complications such as skin infection, salivary gland damage, nerve damage, and formation of scar. Nasal route intubation is more favorable as these patients require surgical procedures either intraoral, extraoral, or both.[10] Retrograde nasotracheal intubation is an effective and useful technique for airway management in LMO patients <2 cm.

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MATERIALS AND METHODS

The study was performed on 36 patients with LMO posted for elective surgery under general anesthesia at the department of ENT head neck surgery. Patients who underwent awake retrograde nasotracheal intubation under regional airway anesthesia were included in the study. Inclusion criteria in the study were as follows: (a) Patients with LMO <2 cm and (b) nasal intubation suitable for surgical procedure. TMJ ankylosis patients who had failed 3 times blind nasal intubation underwent retrograde

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intubation were also included in the study. Exclusion criteria were as follows: (a) Patients required more invasive and surgical techniques for securing the airway, (b) significantly deviated nasal septum and previous nasal surgery, (c) local infection in nose or pathological abnormalities of airway, and (d) oral intubation was suitable for surgical procedures. The institutional ethics committee approved the protocol. After detail discussion and written informed consents were obtained from each patient for retrograde nasotracheal intubation.

The pre-operative medical assessment included routine surgical profile, electrocardiogram, and chest X-ray followed by pre-anesthetic evaluation. From each patient, previous history of surgeries under general anesthesia, difficulty in intubation and complication during surgery was asked and noted.

Patients were told about the need of awake nasotracheal intubation, its complications the type of airway anesthesia and need of any airway intervention in emergency. After detail explanation about the technique, questions were answered. The active participation of the patients in the process of intubation was asked. The patients were informed of what he/she has to do, to assist in smooth intubation. For example, taking deep breaths, maintaining the head position, and swallowing secretion as and when required. On the night before surgery, pantoprazole 40 mg and metoclopramide 5 mg orally were given to prevent acid reflux and aspiration. Patients were kept nil by mouth 6 h before surgery. On the morning of surgery, intravenous access was secure and premedication was given 1 h before the procedure which includes injection amoxicillin with clavulanic acid 1.2 g, injection metronidazole 100 mL, 500 mg (antibiotic), injection dexona 8 mg (steroid), injection ondansetron 4 mg (antiemetic), injection pan 40 mg (antacid), injection glycopyrrolate 0.2 mg (antisialagogue), and a nasal decongestant (xylometazoline 2%). The patient was then asked to gargle and swish around 10 mL of lignocaine viscous 4% without swallowing. Bilateral superior laryngeal nerve block and transtracheal injection of the local anesthetic were given.[11,12] Cook retrograde intubation set (Cook Medical, Bloomington, IN, USA) was used. The procedure was performed as described by David Burbulys and Kianusch Kiai.[13] The technique proceed by an initial percutaneous puncture through the cricothyroid membrane made with the introducer needle and catheter at a 30–40° angle to the skin in a cephalad direction. The free flow of air bubbles in the syringe confirms entry into the trachea. Holding the catheter in place, the needle and syringe are removed [Figure 1]. The J-tip of the wire was passed up the trachea until it retrieved from the nose with fingers [Figure 1]. A black proximal positioning mark on the wire should be visible at the skin access site, ensuring that enough was exposed nasally to facilitate the subsequent passage of the guiding catheter (custom made guide by Cook) and endotracheal tube from the other end. The catheter sheath at the skin was removed, and the wire is clamped at this site to stabilize its entry into the skin at the cricothyroid membrane. The guiding catheter was advanced anterograde over the wire, by way of the nose, into the trachea until tenting is noted at the cricothyroid access site [Figure 2]. The needle holder was unclamped, and the wire was removed to prevent damage to cricothyroid membrane. The flexometallic endotracheal tube was then passed (railroaded) over guiding catheter into position below the level of the vocal cords [Figure 3] and guiding catheter was removed, as the endotracheal tube was further advanced into final position. Later, tracheal tube position was confirmed by observing the movements of

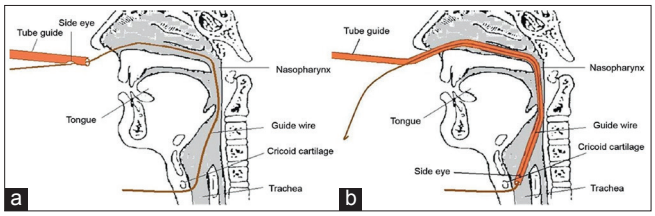

Figure 1: (a and b) An initial percutaneous puncture through the cricothyroid membrane and J-tip of the wire was passed up the trachea until it retrieved from the nose

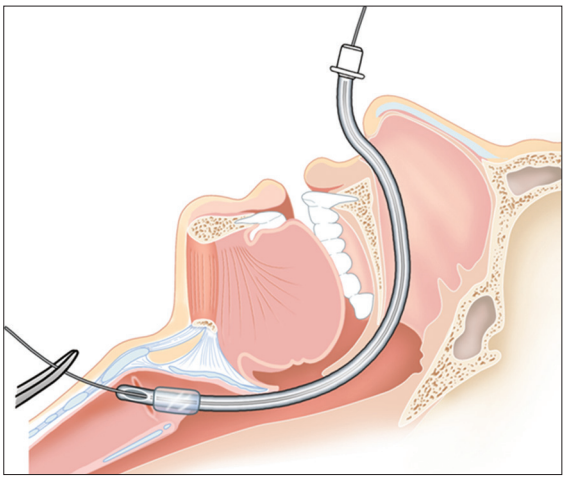

Figure 2: Guiding catheter advanced anterograde over the wire

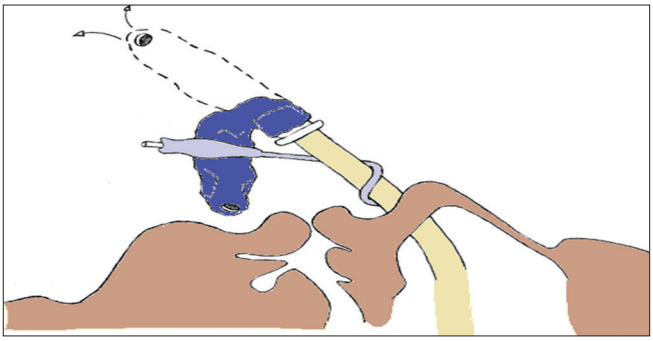

Figure 3: Flexometallic endotracheal tube passed (railroaded) over guiding catheter

reservoir bag of breathing circuit, capnography, and pulse oximeter. The balloon cuff was inflated, and tube was taped and secured. Endotracheal tube was connected to Boyle's machine and induction of anesthetic drugs done as usual fashion.

Size of endotracheal tube, nare intubated (right or left), exchange from one nare to another, number of attempts, time taken for successful intubation, tip of wire manipulation - manipulation of the tip of the instrument to obtain successful intubation (include 1. Not difficult - on initial introduction, little or no manipulation of the wire was needed, 2. Moderately difficult - moderate manipulation of the wire needed, and 3. Difficult - extensive manipulation of the wire including correction of wire to bring it out of nose and often with changes in position of the operator), patient comfort (Grade I - no movement observed, Grade II - coughing observed, Grade III - extremity movement observed, and Grade IV - violent movement observed), surgeon and anesthetist's comfort and time saving (no surgical intervention needed to intubate the patient), post-operative complications (nose pain, neck pain, and sore throat), and patient satisfaction (excellent, good, and fair) were noted.

RESULTS

A total of 36 patients (n) were enrolled over a study over a period of 2 years and fulfilled the inclusion criteria. Retrograde intubation was performed successfully on 28 males (77.8%) and 8 females (22.2%). Mean (SD) interincisal distance 11.7 (6.56) mm is shown in Table 1. All female patients ($n = 8$; 22.2%) were intubated with endotracheal tube size 7, compare to male patients ($n = 28$; 77.8%) intubated with 7.5. 28 patients (77.8%) were successfully intubated in the first attempt, whereas 6 patients (16.7%) underwent intubation in the second attempt and 2 patients (5.5%) underwent intubation in the third attempt, respectively.

Overall, mean time taken from puncture of cricothyroid membrane till confirmation of intubation was 5.6 (1.66) min. Most of the patients ($n = 18$; 50%) had no difficulty in manipulation of tip and showed Grade I patient comfort which was mostly seen in patients with mandibular fracture ($n = 12$) and OSMF ($n = 6$). However, 27.8% ($n = 10$) and 22.2% ($n = 8$) patients showed moderate difficulty and difficulty in manipulation of tip, respectively.

Grade II ($n = 6$; 16.7%) and Grade III ($n = 4$; 11.1%) patient comfort was seen among patients with OSMF and internal derangement of TMJ, respectively. Grade IV patient comfort with difficult tip manipulation was observed in patients with TMJ ankylosis ($n = 8$; 22.2%). Patients with internal derangement of TMJ had Grade III patient comforts. No major complications occurred to our patients except for minor bleeding from the nose and puncture site which stopped spontaneously. However, one patient with OSMF had surgical subcutaneous emphysema which was conservatively managed and resolved spontaneously [Table 2].

Table 1: Patient characteristics

Patient characteristics	*n* (%)	Mean (SD)
Overall mean age (years)		31.78 (7.27)
21–30	18 (50)	25.78 (2.48)
31–40	12 (33)	34.67 (1.96)
41–50	06 (16.7)	44 (2)
Sex		
Male	28 (77.8)	
Female	8 (22.2)	
Indication for retrograde intubation		
Mandibular fracture	12 (33.3)	
OSMF	12 (33.3)	
TMJ ankylosis	8 (22.2)	
Internal derangement of TMJ	4 (11.1)	
Interincisal distance (mm)		11.7 (6.56)
Site of surgery		
Mandible	12 (66.7)	
Buccal mucosa	6 (33.3)	

SD: Standard deviation

Table 2: Observations during intubation

During intubation	*n* (%)	Mean (SD)
Size of endotracheal tube		
7	8 (22.2)	
7.5	28 (77.8)	
Nare intubated		
Right	8 (22.2)	
Left	28 (77.8)	
Exchange from one nare to another	6 (16.7)	
Number of attempts		
1st	28 (77.8)	
2nd	06 (16.7)	
3rd	02 (5.5)	
Overall, mean time of successful intubation (min)		
Mean time of successful intubation for following indications (min)		5.6 (1.66)
Mandibular fracture		6.01 (1.50)
OSMF		4.42 (0.30)
TMJ ankylosis		6.66 (1.75)
Internal derangement of TMJ		5.95 (3.48)
Tip manipulation		
No difficulty	18 (50)	
Moderate difficulty	10 (27.8)	
Difficult	08 (22.2)	
Patient comfort		
Grade I	18 (50)	
Grade II	06 (16.7)	
Grade III	04 (11.1)	
Grade IV	08 (22.2)	
Surgical subcutaneous emphysema	02 (5)	
Surgeon's and anesthetist comfort	36 (100)	
Surgeon's and anesthetist time saving	36 (100)	

SD: Standard deviation

During post-operative period, 32 patients complained of nose pain and 28 patients pain near cricothyroid membrane puncture near anterior neck region which was resolved gradually as all patients were under intravenous antibiotics and intramuscular analgesics for 3 days. Four patients had sore throat which subsequently resolved in few days. Patient satisfaction was excellent in 18 patients (50%) and 33.3% good in 12 patients. TMJ ankylosis patients who had Grade IV patient comfort showed fair satisfaction ($n = 6$, 16.7%), but two patients had good satisfaction [Table 3].

DISCUSSION

Several modifications [2,7,13-17] of this technique have been made since its introduction for almost 55 years ago by Butler and Cirillo,[18] to secure difficult airways in both elective and emergency cases resulting in fewer complications. In the present study, J-shaped wire was removed before the insertion of endotracheal tube through guiding catheter which minimized trauma associated with wire at the cricothyroid site. At the same time, guiding catheter should be held in position firmly to prevent accidental dislodgement of tip of endotracheal tube into the esophagus, and guiding catheter is removed slowly as endotracheal tube is advanced into final position in the trachea. Pressure applied should be normal as overzealous pressure of the tube may lead to folding.[19] The interesting finding of this study not reported earlier was that patients ($n = 28$, 77.8%) had increased incidence of intubation through the left nare [Figure 1]; probably, because it depends on the exit of wire and is beyond the anesthetist control.

Barriot and Riou[20] reported retrograde technique in 19 patients with either maxillofacial trauma or cervical spine injury and found all were intubated successfully within 5 min on only one attempt. In the present study, most of the patients succeeded on the first attempt ($n = 28$, 77.8%) with Grade I patient comfort due to no difficulty in tip manipulation and mean time taken to intubate all patients was 5.6 min. However, patients who had more than one attempt took more time (6.66 min) to intubate were with TMJ ankylosis ($n = 8$; 22.2%) and had Grade IV patient comfort due to difficult tip manipulation. They had distorted anatomy of airway[21] with severe restriction in mouth opening, microgenia and had failed attempts of blind nasal intubation, which could be the possible reason. Similar finding was reported by Bhattacharya *et al*.[2] in two patients with TMJ ankylosis requiring gap arthroplasty but used a suction catheter to retrieve an epidural catheter from the pharyngeal cavity, which had been passed retrogradely from a cricothyroid puncture to aid intubation successfully in their patients. To have Grade I patient comfort, regional anesthesia of the airway should also be effective.[11] In patients with TMJ ankylosis due to deformed airway anatomy, achieving profound regional airway anesthesia may be difficult. However, patients who had moderate difficulty in tip manipulation and Grades II and III patient comfort were because as tracheal tube impinges against the larynx during retrograde intubation and multiple attempts may be required to negotiate it into the trachea as stated by Shantha.[16]

Table 3: Post-operative findings

Post-operative findings	*n* (%)
Nose pain	16 (88.69)
Sore throat	4 (22.2)
Pain near cricothyroid puncture	14 (77.8)
Patient satisfaction	
Excellent	9 (50)
Good	6 (33.3)
Fair	3 (16.7)

In retrograde intubation technique, there are two parts: "Guidance" consists of retrograde insertion of a catheter from the larynx to the mouth or nose, and the "blind" part is the insertion of endotracheal tube into trachea without visualization of vocal cords. Hence, it is perhaps better described as guided blind intubation or translaryngeal intubation.[7] We present OSMF and internal derangement of TMJ as new indications of retrograde intubation than those wide range of other indications reviewed by Dhara[7] previously. Furthermore, we used in mandibular trauma and TMJ ankylosis.

In the present study, Cook retrograde intubation set was used successfully with no complications except for one patient who had surgical subcutaneous emphysema which was conservatively managed and resolved spontaneously. Furthermore, minor bleeding was noticed at the puncture site during intubation. Each technique has some complaints from the patient side. Postoperatively, patients complained of nose pain, pain near anterior neck region, and sore throat that was resolved gradually. We encountered no such major complications. The main advantages of retrograde technique as observed in this study were as follows: Simple and useful technique in LMO patients, especially when blind nasal intubation fails and expensive equipment fiberscope is not available,[2,7] minimal requirement of equipment, and laryngeal inlet does not have to be identified or negotiated[7] and can be performed safely in experienced hands without any complications.[7,13] In patients with LMO retrieval of the guide and achieving retrograde nasotracheal intubation can be challenging.[7]

In the present study, the technique was successfully used in 36 patients with LMO <2 cm undergoing oral and maxillofacial surgery. It was found that most patients had excellent satisfaction and add no complications of its

own. In conclusion, retrograde nasotracheal intubation is a convenient, effective, and useful technique for airway control in patients with LMO and with only a small risk potential.

Many retrograde and anterograde guides have been reviewed by Dhara.[7] Many studies[22-25] described new approaches to retrograde intubation. Unfortunately, some mouth opening is essential to use these approaches. If absolutely no mouth opening is present, a pharyngeal catheter may be used.[2]

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