Original Article

Retrograde intubation through nasal route in patients with limited mouth opening undergoing oral and maxillofacial surgery

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ABSTRACT

Background: Patients with limited mouth opening (LMO) often associated with difficult intubation. Retrograde intubation is an alternative technique of establishing definitive airway in these patients when blind nasal intubation fails and fiberoptic bronchoscope is not available. We tested the retrograde intubation through nasal route in patients with LMO less than 2 cm.

Materials and methods: The procedure was performed with some modification with regard to retrograde guide on 18 patients requiring maxillofacial surgical procedures to increase mouth opening. Indications for this technique were mandibular fracture (n=6), oral submucous fibrosis (OSMF; n=6), temporomandibular joint (TMJ) ankylosis (n=4) and internal derangement of TMJ (n=2). All patients were assessed for preoperative interincisal opening; during intubation through specific parameters and; also postoperative findings were observed.

Results: Mean time taken for successful intubation was 5.6 min ± 1.66. One patient had subcutaneous emphysema which was managed conservatively. Postoperatively, four patients had sore throat which resolved in few days. No other complications were encountered.

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

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1. Introduction

Maxillofacial surgical patients present a specific challenge to the anaesthetist. They commonly come across patients with limited mouth opening (LMO) conditions, which increase the difficulty in securing the airway.^{1,2} There are numerous causes for LMO and are categorised as intra-articular or extra-articular.³ Blind nasal intubation remains an important adjunct in establishing airway in these patients when expensive instrument like fiberoptic bronchoscope is not available.^{4–6} It is easier to describe than to perform and may require multiple attempts.² The solution in these situations is to perform an elective short-term tracheostomy before the operation, but it carries a high incidence of complications.⁷ Other methods are to introduce the tracheal tube through a submental⁸ or a submandibular approach;⁹ however, it can be impossible in TMJ ankylosis with deformed airway anatomy and is associated with complications such as scar formation, superficial

skin infection, salivary gland damage and damage to nerves. Also, the standard orotracheal intubation can be unsuitable for these patients; the nasal route is more preferable as these patients require surgical procedures either intraoral, extraoral or both.¹⁰ Retrograde intubation is an alternative technique of establishing definitive airway in these patients when other methods of providing airway are not suitable. We tested the retrograde intubation through nasal route as an alternative method for airway management in patients with LMO less than 2 cm.

2. Materials and methods

The study was performed on 18 patients with LMO posted for elective surgery under general anaesthesia at department of oral and maxillofacial surgery in our unit. Patients who underwent awake retrograde nasotracheal intubation under regional airway anaesthesia were included. Criteria for inclusion in the study were as follows: a) Patients with LMO less than 2 cm having difficult airway; b) nasal intubation suitable for surgical procedures. Patients with TMJ ankylosis who had failed 3 attempts of blind nasal intubation, underwent retrograde intubation were also

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included. Exclusion criteria were: a) oral intubation was suitable for surgical procedures; b) patients required a more invasive and surgical techniques for securing the airway; c) local infection in the nose or pathological abnormalities of airway; d) significantly deviated nasal septum and previous nasal surgeries. The institutional ethics committee approved the protocol. After detailed discussion, written informed consent was obtained from each patient for regional airway anaesthesia and retrograde nasotracheal intubation.

Demographic data was noted. The preoperative medical assessment included routine surgical profile, electrocardiography, and chest radiography followed by pre-anaesthetic evaluation. Previous history of surgery under general anaesthesia, difficulty in intubation and complications during surgery was enquired for each patient and noted.

Patients were explained about the need of awake nasotracheal intubation, its complications, the type of airway anaesthesia and need of any airway intervention in emergency. After detail explanation of the technique was provided; questions were answered. The patient's active participation in the process of intubation was asked. The patient was informed of what he or she has to do, to assist in a smooth intubation. For example, maintaining the head position, taking deep breaths, or swallowing secretions when requested. On the night before surgery, we gave ranitidine 150 mg and metoclopramide 5 mg orally for prophylaxis against acid aspiration and laxative 10 mg orally. Patients were kept under nil by mouth 6 hrs before surgery. On the morning of surgery, intravenous access was established and premedication was given 1 hr prior to procedure. It included Inj amoxicillin with clavulanic acid 1.2 gm, Inj. Metronidazole 100 ml 500 mg (antibiotic), Inj. Decadron 8 mg (steroid), Inj. Ondansetron 4 mg (antiemetic), Inj. Pantacid 40 mg (antacid), Inj. Glycopyrrolate 0.2 mg (Antisialagogue) and a nasal decongestant (Xylometazoline 2%). Because the mouth was closed we could not anaesthetize the oral and pharyngeal mucosa with lignocaine spray. Instead, lignocaine 2%, 3 ml was nebulized over 10 min. The patient was then asked to gargle and swish around 10 ml of lignocaine viscous 4% without swallowing. Following preparation of the neck with 10% povidone iodine, the cricothyroid puncture site was infiltrated with lignocaine 2%, 0.5 ml. Bilateral superior laryngeal nerve block and transtracheal injection of the local anaesthetic was 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 to 40 degrees 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 (Fig. 1). The J-tip of the wire was passed up the trachea until it

Fig. 1. 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.

retrieved from the nose with fingers (Fig. 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 (Fig. 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 (Fig. 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 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 anaesthetic 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, 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, Grade IV – violent movement observed), surgeon and anaesthetist's comfort and time saving (no surgical intervention needed to intubate the patient), post operative complications (nose pain, neck pain, sore throat) and patient satisfaction (excellent, good, fair) were noted.

Fig. 2. Guiding catheter advanced anterograde over the wire.

Fig. 3. Flexometallic endotracheal tube passed (railroaded) over guiding catheter.

3. Results

A total of eighteen patients (n) were enrolled in the study over a period of 24 months and fulfilled the inclusion criteria. Retrograde intubation was performed successfully on 14 males (77.8%) and 4 females (22.2%). Mean (SD) interincisal distance was 11.7 (6.56) mm (Table 1). All female patients (n=4; 22.2%) were intubated with endotracheal tube size 7, compared to male patients (n=14; 77.8%) intubated with 7.5. Most of the patients were intubated through left nare (n=14; 77.8%). Fourteen patients (77.8%) were successfully intubated in first attempt whereas 3 patients (16.7%) and 1 patient underwent intubation successfully in second and third attempt respectively. Exchange from one nare to another was seen in 3 patients who underwent intubation in second (n=2; 11.1%) and third attempt (n=1).

Table 1
Patient characteristics.

Patient characteristics	Number (%)	Mean (SD)
Overall mean age (years)		31.78 (7.27)
21–30	9 (50)	25.78 (2.48)
31–40	6(33.3)	34.67 (1.96)
41–50	3(16.7)	44 (2)
Sex		
Male	14(77.8)	
Female	4(22.2)	
Indication for retrograde intubation		
Mandibular fracture	6(33.3)	
OSMF	6(33.3)	
TMJ ankylosis	4(22.2)	
Internal derangement of TMJ	2(11.1)	
Interincisal distance (mm)		11.7 (6.56)
Site of surgery		
Mandible	12(66.7)	
Buccal mucosa	6(33.3)	

SD, standard deviation.

Overall mean time taken from puncture of cricothyroid membrane till confirmation of intubation was 5.6 (1.66) min. Most of the patients (n=9; 50%) had no difficulty in manipulation of tip and showed grade 1 patient comfort which was mostly seen in patients with mandibular fracture (n=6) and OSMF (n=3). However, 27.8% (n=5) and 22.2% (n=4) patients showed moderate difficulty and difficulty in manipulation of tip respectively.

Grade 2 (n=3; 16.7%) and grade 3 (n=2; 11.1%) patient comfort was seen among patients with OSMF and internal derangement of TMJ respectively. Grade 4 patient comfort with difficult tip manipulation was observed in patients with TMJ ankylosis (n=4; 22.2%). Patients with internal derangement of TMJ had grade 3 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).

During post operative period, sixteen patients complained of nose pain and 14 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 9 patients (50%) and 33.3% good in 6 patients. TMJ ankylosis patients who had grade 4 patient comfort showed fair satisfaction (n=3, 16.7%) but 1 patient had good satisfaction (Table 3).

4. Discussion

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 trans-laryngeal 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 S.S. Dhara⁷ previously. Also, we used in mandibular trauma and TMJ ankylosis.

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 minimised 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 oesophagus, 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=14, 77.8%) had increased incidence of intubation through left nare (Fig. 1), probably because it depends on the exit of wire and is beyond the anaesthetist control.

Barriot and Riou²⁰ 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 first attempt (n=14, 77.8%) with grade 1 patient comfort due to no difficulty in tip manipulation and mean time taken to intubate all patients was 5.6 min. But patients who had more than one attempt took more time (6.66 min) to intubate were with TMJ ankylosis (n=4; 22.2%) and had grade 4 patient comfort due to difficult tip

Table 2

Observations during intubation.

DURING INTUBATION	n (%)	Mean (SD)
Size of endotracheal tube		
7	4(22.2)	
7.5	14(77.8)	
Nare intubated		
Right	4(22.2)	
Left	14(77.8)	
Exchange from one nare to another	3(16.7)	
Number of attempts		
1st	14(77.8)	
2nd	3(16.7)	
3rd	1(5.5)	
Overall mean time of successful intubation (min)		5.6 (1.66)
Mean time of successful intubation for following indications (min)		
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	9(50)	
Moderate difficulty	5(27.8)	
Difficult	4(22.2)	
Patient comfort		
Grade 1	9(50)	
Grade 2	3(16.7)	
Grade 3	2(11.1)	
Grade 4	4(22.2)	
Surgical subcutaneous emphysema	1(5)	
Surgeon's and anaesthetist comfort	18 (100)	
Surgeon's and anaesthetist time saving	18 (100)	

SD, standard deviation.

Table 3

Postoperative findings.

Postoperative findings	n (%)
Nose pain	16(88.9)
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)

manipulation. They had distorted anatomy of airway²¹ 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 and co-workers² 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 1 patient comfort, regional anaesthesia of the airway should also be effective.¹¹ In patients with TMJ ankylosis due to deformed airway anatomy, achieving profound regional airway anaesthesia may be difficult. However, patients who had moderate difficulty in tip manipulation and grade 2 and 3 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 TR.¹⁶

Many retrograde and anterograde guides have been reviewed by S.S.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

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. Also, minor bleeding was noticed at the puncture site during intubation. Each technique has some complaints from 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: simple and useful technique in LMO patients especially when blind nasal intubation fails and expensive equipment fibroscope is not available,^{2,7} minimal requirement of equipment, laryngeal inlet does not have to be identified or negotiated⁷ 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 18 patients with LMO less than 2 cm undergoing oral and maxillofacial surgery. It was found that most patients had excellent satisfaction and adds 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.

Authors contribution

Ashwant Kumar Vadepally: Conception and design of study; Acquisition of data: laboratory or clinical/literature search; Final approval and guarantor of manuscript.

Ramen Sinha: Analysis and interpretation of data collected.

A.V.S.S.Subramanya kumar: Drafting of article and critical revision.

Ethics statement/confirmation of patient permission

All patients gave informed consents for regional anaesthesia of airway, retrograde nasotracheal intubation and clinical images for publication

Conflict of interest

We have no conflict of interest.

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