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Evaluating Novel Technique of Blind Nasotracheal Intubation Using Ivory White Tube In Patients With Multiple Facial Fractures For Repair Using Thyroid Bulge As Landmark

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Abstract
Introduction: *As an anesthetist securing airway is the key in management of severe fractures of face and for this different techniques have been described. Blind nasal intubation is one of the technique for securing airway.*
Aim*: We share our experience of performing novel technique of blind nasotracheal intubation in airway management of 30 facial fracture patients planned for facial fracture repair. We evaluated a new thyroid bulge as landmark for guiding blind nasal intubation, its success rate and complications.*
Material and Method: *After taking patient consent total 30 patients posted for facial fracture repair requiring GA were enrolled for the study. Their age ranged from 16 to 50 yrs, weight ranged from 40 to 60 kg and they were belonging to ASA I and II. Conventional general anesthesia was administered in all cases. A well lubricated proper size Ivory tube was inserted through more patent nostril after decongesting it till tube reached oropharynx and was pushed to see bulge on one side of thyroid cartilage. After assessing distance between thyroid bulge due distal end of tube and chin, tube was withdrawn in oropharynx and rotated in opposite direction, directing it towards midline advancing in, till it entered glottis. Tube placement was confirmed by capnograph, auscultation & bilateral symmetrical chest expansion.*
Results: *We successfully intubated 60% patients in 1st attempt, 30% of patients in 2nd attempts, and 6% in 3 attempts and only one patient required Magill's forceps guided intubation. None of our patient had any major complications. Bleeding was noted in 3 cases only. Hemodynamics and SpO2 remained normal throughout procedure. The postoperative period was uneventful.*
Conclusion: *We successfully used this novel technique for blind nasotracheal intubation in elective facial fracture repairs. So this age old method of blind nasotracheal intubation is still very easy and successful in securing airway.*
Keywords: *Ivory tube, Blind nasotracheal intubation, Thyroid bulge, Facial fractures, General anesthesia.*

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I. Introduction

Securing airway is key in the management of severe fractures of face. Row Botham and Magill during World War I developed a technique of "blind" nasotracheal intubation use by anesthesiologists during operative procedure [1, 2]. Blind nasotracheal intubation is beneficial in patients who are spontaneously breathing and are having severe head injuries with and without possible spinal cord involvement, overdoses, primary respiratory distress, cerebrovascular accidents, and many less commonly encountered problems. Facial fractures usually presents with combination of multiple facial fractures including nasal bone fracture, mandibular fracture, maxillary fracture which may compromise airway. Nasotracheal intubation to secure airway in such patients facilitates surgery for fixation of fractures and also achieves interdental wiring fixation which is difficult with oral intubation. Upper airway foreign bodies, bleeding diathesis, bilateral large nasal polyps or abscesses, severe facial fracture, base of skull fracture, epiglottitis, CSF rhinorrhea, are relative contraindication for nasal intubation.[3,4] Improved intra-oral access that nasotracheal intubation provides, means that it should be considered for more widespread routine use in the majority of intra-oral procedures.[5] Nasotracheal intubation is a useful technique in patients in whom direct laryngoscopy and orotracheal intubation are impeded, for example, those with trismus due to previous radiotherapy, oropharyngeal infections, decerebrate rigidity or lower facial trauma [6]. Intubation may be performed safely using the same technique in patients with cervical spine instability due to trauma or fixed deformity of the cervical spine as a result of degenerative disease or previous surgery [7, 8].Here we undertook this preliminary study to evaluate ease of intubation with novel blind nasal technique, to assess failure rate, number of attempts required and associated complications in patients planned for surgical repair of traumatic facial fractures.

II. Material And Methods

After obtaining written informed consent, total 30 adult patients posted for surgery having pan facial fractures, Leforte's II/III, mandible and maxilla fractures were included. Their age ranged between 15 to 50yrs, weight ranged between 40 to 60 kg and they had ASA status I and II. Patients who had unstable cervical spine, coagulation disorders, and patients on anti-platelets, age < 16yrs, more than three weeks old fractures, bilateral condylar fractures, intranasal pathologies, severe nasal fractures and soft palate repair in the past were excluded for blind nasal intubation under general anesthesia.

Ivory tube:

This is single use nasal version of preformed tube made of soft non traumatic Ivory white polyvinyl chloride. It is used to facilitate surgery of head & neck. It has preformed bend which can be straightened for suctioning because of softness of tube. When it is put nasally it helps to reduce pressure on nares reducing mucosal injury and is directed towards patient's forehead (North Pole). These tubes are easy to secure and reduces accidental extubation. Curve allows breathing system to be placed away from surgical field. There is less stress response to nasal intubation than direct laryngoscope intubation. Disadvantage being difficulty in passing suction catheter and since they are designed for average patients, a tube may be too long or too short for a given patient. It is little expensive compared to preformed polyvinyl chloride tubes. For mechanical ventilation with nasal tube higher pressures are required due to small internal diameter and long length (Hagen-Poiseuille equation)

Pre Operative Assessment And Preparation:

Surgical plane for facial fractures is usually planed second week of trauma when patient is stabilized from acute trauma, emergency surgical procedures and settled down facial edema for better surgical outcomes. Delay in surgical correction of facial trauma more than four weeks can lead to surgical difficulty in open reduction, more blood loss, prolonged surgical time and more difficult airway for anesthetist and facial disfigurement. On preoperative assessment day prior surgery patient were assessed for history of type of trauma and different injuries like loss of consciousness due to head injury, nasal or ear bleed, ruled out cervical spine injury, type and extent of facial fractures, nasal blockade, severity of facial edema. On general examination ruled out pallor and dehydration, vitals like pulse rate, blood pressure, respiratory rate were checked and recorded. All systemic examination done especially central nervous system for any brain parenchymal injury and chest injury for pneumo-hemothorax.

Airway was assessed for mouth opening which is always compromised because of pain and muscle spasms due to injuries, neck extension may be restricted in case of cervical spine injury, and nasal patency may be affected by edema secondary to trauma. Patient were explained about surgical and anesthesia plan. Consent was taken for anesthesia, difficult airway including awake intubation and tracheostomy, postoperative ventilation and blood transfusion. For decongestion we can use topical 4-10% Cocaine or topical lidocaine 3-4% with 0.25-1% phenylephrine or oxymetazoline 0.05-0.1% or 10% lidocaine spray 30 mg in each nostril 3 min before induction of anesthesia [9, 10, and 11]. Patency of the nasal passages by occluding one naris and asking the patient to breathe deeply is not a reliable predictor of the best nostril for nasotracheal intubation [12]. Similarly, the use of anterior rhinoscopy pre-operatively has not been shown to be of benefit [13]. Pre-intubation flexible nasal endoscopy can identify asymptomatic intranasal abnormalities is recommended for the anesthetist experienced in the use of the fiber-optic laryngoscope [14].Graded nasopharyngeal airway dilatation has been advised to reduce nasal mucosal trauma[15]. In summary, it can be difficult to predict the better naris to choose on the basis of preoperative testing [16].On day prior surgery more patent nostril was selected using spatula test and was instilled with 0.1% Xylometazoline 2 drops in each nostril 12 hrly for decongestion of mucosa and nasal patency was confirmed by passing adequate size nasopharyngeal airway and recorded in preoperative sheet for selection of size of nasal tube during surgery.

Modern preformed nasotracheal tubes are made from synthetic materials of varying stiffness. Cuffed tubes have high-volume, low-pressure cuffs which, when deflated, are more likely to scratch the naris and cause bleeding than the outdated streamlined red rubber cuffed tube. Warming can make them more supple but at the expense of losing the manufacturer's curve. For this reason, many experienced anesthetists continue to use uncuffed tubes. Of the PVC tubes available, the Portex Ivory preformed cuffed tube is the most malleable for the nasal passage and yet retains the overall curve that is required for ease of laryngeal intubation [17]. The uncuffed version of this tube, made from polyurethane, is associated with a low incidence of severe nasal bleeding [18].

Ivory tube one size smaller than routinely used orally for nasotracheal intubation i.e. 6.00mm to 7.00mm for females and 7.0mm to 8.0mm internal diameter for males. However we have always used smaller possible tube to prevent nasal mucosal injury. Patient was hydrated overnight with normal saline or ringer

lactate as they were not able to take adequate orally and usually underhydrated. Normal saline nebulization with few drops of adrenaline to decongest nasal mucosa, oral antiseptic gargles for oral hygiene were given.

Anesthesia And Airway Management:

After confirming consent, fasting status, cross match of blood and rechecking of vital parameters, all the patients were pre-medicated with intramuscular Inj. Glycopyrrolate 4mcg /Kg in 30 min prior to induction. After preparation of operating theatre and keeping difficult airway cart ready patient were taken for surgery. All routine monitors like electrocardiogram (ECG), noninvasive blood pressure (NIBP), pulse oximetry (SPO2) and temperature were attached. Inj.Midazolam 30mcg/kg, Inj.Fentanyl 2mcg/kg intravenously were given and infusion of dexmedetomedine at 0.5mcg/kg/hr started 5mins prior to induction. Preoperatively checked size nasopharyngeal airway was inserted in decongested patent nostril.

After pre-oxygenating patient for 5 min, general anesthesia was induced with Inj.Propofol 2.0 mg/kg intravenously till loss of eyelash reflex. After adequate depth of anesthesia and confirming face mask ventilation check laryngoscopy was done to rule out difficult intubation. Inj.Vecuronium 0.1 mg/kg was given for muscle relaxation. Anesthesia was maintained with Isoflurane +Oxygen + Nitrous oxide during procedure.

Method Of Tube Insertion *:(R Ds Technique)*

The nare which was most roomy, decongested and dilated by nasopharyngeal airway was selected. Ivory tube was lubricated with 2% lignocaine water soluble jelly. Tube used was one size smaller than required for orotracheal intubation. After lubrication with bevel of tube facing towards nasal septum tube was inserted through selected nare till it reached oropharynx. Tube was pushed ahead so as to see bulge on the side thyroid cartilage from outside (Fig.1 and Fig.2A). Distance between bulge and chin assessed and tube was withdraw for same distance and it was rotated in clockwise or anticlockwise direction, directing it towards midline and advanced further without resistance till it entered glottis (as shown in Fig.2B,2C). During blind introduction we can see tube going in trachea by movement in pretracheal area, clicks of tracheal rings while advancing the tube and tachycardia on monitor as it enters the trachea. Endotracheal placement of tube was confirmed by bilateral symmetrical chest expansion, auscultation and capnographic trace of end tidal carbon dioxide monitor.

Intraoperative monitoring in addition to routine monitors urine output and blood loss was monitored. At the end of surgery before putting interdental wiring hemostasis was confirmed, throat pack removed, thorough oral and nasal suction done and airway edema was ruled out by direct laryngoscopy. Once patients starts spontaneous breathing, reversed with Inj. Neostigmine 50 mcg/kg and Inj. Glycopyrrolate 8 mcg/kg. As nasal tube is well tolerated by conscious patients, when patients became conscious well oriented, following command, regains coughing and swallowing reflex extubation done keeping wire cutter beside the patient in case of need of reintubation.

IV. Observation and results

We have observed following outcomes –

- Ease of intubation with blind nasal technique.
- No. of attempts required
- Failure rate (max. 3 attempts)

All patient undergone surgical correction of facial fractures under general anesthesia with blind nasotracheal intubation using this thyroid landmark technique in first or second week of trauma. Majority patients had pan facial fractures (46%) with difficult in mouth opening due to pain, trauma and trismus (Table.1). Post induction of anesthesia and relaxation all patients had adequate mouth opening for direct laryngoscope intubation. Intraoperative all were hemodynamically stable with no major blood loss none requiring blood transfusion. Interdental wiring for post-operative fracture stabilization was done in 60% patients. None had base of skull fracture contraindicating nasal intubation.

Almost in 90% patient's intubation was successful in two attempts, two patient required three attempts and one required four attempts (Table2). In 60% patient's intubation was successful in first attempt which was comparable to other studies [25, 27].

Fractures	No. out of 30	% of cases
Lefrorte's type II & III	4	13.2
Leforte's type III	1	3.3
Mandible	5	16.5
Pan facial	14	46.2
Zygomatic-Maxillary complex	6	19.8

Table.1- Distribution of type of facial fractures

No. of intubation attempt	Total patients	% of cases
1	18	60%
2	9	30%
3	2	6%
4	1	3%

Comlications: (Table .3)

Epistaxis:

Damage to Kisselbach's plexus in Little's area in the anterior part of the nasal septum causes nasal bleeding [12]. This occurs with the use of an oversized tube, use of excessive force or repeated unsuccessful attempts and is cases of inadequate vasoconstriction [5]. If bleeding does occur on insertion of the tube, it is suggested that intubation should be completed, provided it can be accomplished quickly as tube tamponades the bleeding and protect the airway. If tracheal intubation is not satisfactorily achieved in time and there is brisk bleeding, the tube may be withdrawn so that the balloon is positioned in the postnasal space, where it can be inflated to prevent blood passing into the oropharynx while at the same time acting as a nasopharyngeal airway [12].

Other complications:

Traumatic avulsion of nasal structures like turbinates, polyps or tumours causing bleeding or airway obstruction. Bacteremia, pharyngeal wall laceration, necrosis of nasal ala, edema around maxillary sinus ostium, Eustachian duct resulting in middle ear or maxillary problems, trauma to laryngeal structures or esophagus etc.

Complication	Number
Bleedings	3(10%)
Accidental extubation	Nil
Failed intubation	Nil
Other complications like avulsion of intranasal structures or edema of surrounding tissue, tube blockade etc.	Nil

Table.3 Different complications of blind nasal intubation.

V. Figures

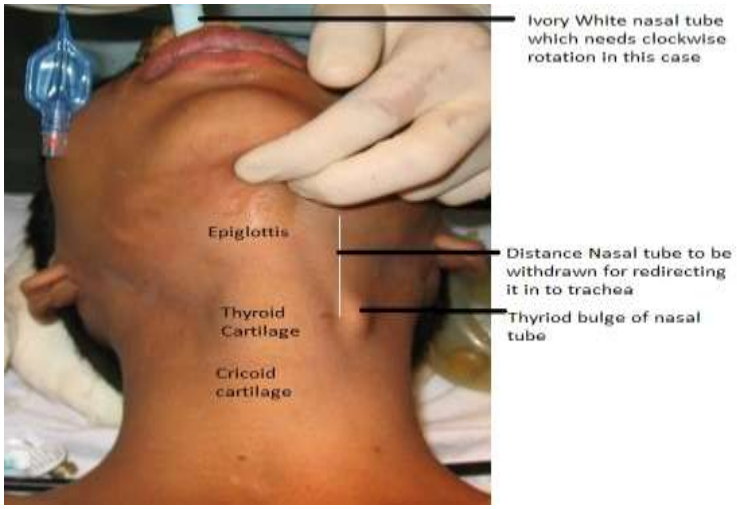
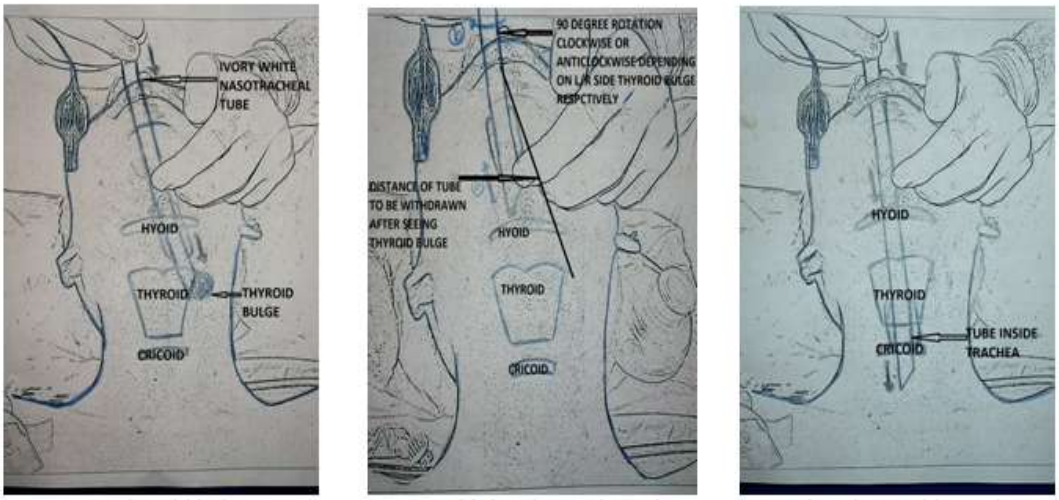


Fig.1-Photograph showing thyroid bulge, nasal tube in right nostril with bulge on left side of thyroid needing clockwise rotation for redirecting it in laryngeal inlet.



A. Thyroid bulge B. Withdrawing and rotation C. Tube advanced in trachea

Fig. 2 (A, B, C) - Diagram showing novel technique of blind nasal intubation (R Ds technique)

V. Discussion

Blind nasotracheal intubation appears promising approach where facilities for fibreoptic intubation is not available & other invasive methods of intubation like tracheostomy, submental intubation can be avoided. Also it offers an advantage of being technically simple, gives better access to surgical field (oral cavity) & better endotracheal tube tolerance where airway patency to be maintained compared to orotracheal tube. So many authors insist that anesthetist should be well versed with blind nasal intubation technique. In this study of 30 patients undergoing facial fracture repair. Blind nasal intubation done using Ivory White nasal tube one size smaller than that is routinely indicated in conventional techniques i.e. 6.0mm to 7.0mm for females & 7.0mm to 8.0mm for males. It was lubricated adequately before insertion & was put through wider and decongested nostril which was determined by spatula test. Various methods are described for blind nasal intubation like listening to breath sounds directly through the tube or via an extension tube and earpiece [19], inflation of the tracheal cuff [20], the use of stylets / suction catheters [21, 22] and end tidal carbon dioxide monitoring [23] and inflation of nasotracheal tube cuff in pharynx for guiding tube towards laryngeal inlet [20, 24].. Rosen et al and Wolfe RE reported that presence of facial fractures does not appear to be contraindication for nasotracheal intubation [25].Even Joseph E Arrowsmit and Robertshaw H J recommended that basilar fracture of skull should not be considered as contraindication to nasal intubation [26].

Thyroid cartilage was used as landmark to guide tube. In this study we have not used any assisting device while endotracheal tube placement rather we used thyroid cartilage as our landmark. In our study, we successfully intubated all 30 facial fracture patients through blind nasotracheal techniques, first attempt in 60%

of cases which were comparable to other studies [25, 27].Most of these intubations were done by post graduate residents, under supervision of experience anesthesiologist.

VI. Conclusion

Blind nasotracheal intubation is simple, cost effective technique & does not require any special device. In this study all patients were intubated without any major complications using novel technique of blind nasal intubation using thyroid cartilage as landmark. It provides a secure airway in less possible time and can be mastered easily with little skill & effect. So every anesthetist should well versed in this life saving intubation technique.

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