Research Article

Awake fiberoptic intubation in patients of deep neck infections: experience at rural tertiary care hospital: case series

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Abstract

Background: Patients with deep neck infection (DNI) especially those with Ludwig's angina, may die as a result of airway management mishaps. Skill full airway management is critical but a safe method of airway control in these patients is yet to be established. Awake fiberoptic intubation under topical anesthesia may be ideal method to secure the airway in deep neck infection.

Objective: To study the effect and outcome of awake fiberoptic intubation in patients of deep neck infections.

Materials and Methods: The prospective observational case study of 30 patients with deep neck infection has been done over a period of January 2013 to December 2015 (36 month), who were subjected to awake fiberoptic intubation. Fiberoptic bronchoscopy for intubation under topical anesthesia has been done.

Result: The preintubation scopy gave proper assessment and preparation of airway. With redo scopy, all patients undergone intubation successfully without any complications.

Conclusion: In skilled and experienced hands fiberoptic intubation is a sophisticated and less invasive method of securing airway in patients with deep neck infections.

KEYWORDS: Redo fiberoptic intubation, deep neck infection

Introduction

Airway compromise has long been identified as cause of mortality in deep neck abscess. Distorted anatomy of the airway, tissue immobility and limited access to the mouth make orotracheal intubation with rigid laryngoscopy difficult.[1,2] Though trismus can overcome after administration of general anesthesia, it may precipitate complete airway closure, difficult face mask ventilation and intubation impossible,[3,4] thus necessitating emergency tracheostomy. Awake blind nasal intubation had its limitation because of high failure rate, accidental rupture of abscess aspiration of pus or may cause catastrophic bleeding intraorally, and laryngospasm.[5,6] Tracheostomy using local anesthesia was considered as gold standard for management of these patients in past.[7] However, tracheostomy in a patient with a compromised airway and distorted anterior neck anatomy can be very difficult or even impossible.[8–10]

The prospective observational study has been done for 30 patients having deep neck infections posted for surgical drainage. Awake fiberoptic intubation has successfully done due to meticulous preoperative counseling and adequate planning of the anesthesia and airway preparation. In all cases, the preintubation fiberoptic scopy has been done to assess the patency of airway, to check severity of inflammation, edema, bleeding, any draining pus, and also to assess the glottis edema and conditions of cords. It also helped us in proper suction of airway and spraying of topical anesthetic agent to airway tract and allowing anesthetic agent to act before intubation. Thus, all 30 patients with awake fiberoptic intubation were successfully managed.

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Materials and Methods

Study was approved by institutional ethical committee. Study is prospective observational. Total 30 patients in age group 20–60 years of both genders having deep neck infections posted for surgical drainage in emergency are included.

Selection criteria

The patients were admitted by ENT department of the institute with age group 20–60 years of both sex, signs and symptoms of facial and neck swelling, difficulty in breathing, difficulty in swallowing, inability to open the mouth (Trismus), fever and chills, tooth pain, patient willing to undergo study.

Exclusion criteria

Patients age less than 20 years and more than 60 years age, patients not given consent, and not willing to undergo study were excluded. Patient with stridor,SPO_2< 92% and who did not require surgical intervention were excluded.

Awake fiberoptic intubation was planned with tracheostomy as back up. PENTEX FB- 18V type fiberoptic bronchoscope (FOB) was used. The procedure of awake nasal intubation was explained to the patient and written informed consent was obtained for fiberoptic intubation as well as tracheotomy if needed in emergency situation.

The data recorded in each case regarding a) age, b) sex, c) duration of symptoms and signs in patients, d) difficulty in mouth opening in fingers, e) predisposing factors, f) type of neck swelling (A- submandibular + submental + sublingual, B- parapharyngeal, C- retropharyngeal, D- peritonsillar/quinsy E- multiple site), g) difficulty in negotiating FOB (nasal cavity, pharynx periglotic area, pus draining in oral cavity), h) periglotticedema, i) duration of first fiberoptic scopy (insertion of FOB from nostril upto the visualization and spraying of vocal cords), j) time of extubation, k) any complication, l) hospital stay, m) pus culture report.

Pre-operative preparation

Meticulous preoperative counseling regarding procedure of each patient had done. Every patient received nebulisation with 2 ml 4% lignocaine half hour before surgery. Difficult airway cart and emergency tacheostomy kit were kept ready. Surgeons were standby for tracheostomy. Each patient was premedicated with Inj. glycopyrrolate 0.2 mg, Inj. Ranitidine 50 mg, Inj. Ondensetron 4 mg and Inj. Dexamethasone 8 mg IV as per protocol.

In the operating room, standard monitoring was started which include pulse Oxymetry, NIBP, ECG. Nostrils were checked and nasal decongestion was accomplished using Xylometazoline nasal drops. Lignocaine jelly 2% was used to anesthetize the nasal mucosa. Nasal passage gradually dilated with warm nasal airway.

Patient had given 10–15 degree head up position. Skilled anesthesiologist standing at the head end of the patient kept ready for fiberoptic intubation. The fiberoptic bronchoscope was checked and biopsy port of FOB connected to oxygen port so that as FOB entered in airway passage continuous O_2 insufflations done to avoid hypoxia. Fiberscope was inserted into patient's nostril (usually right). 2% lignocaine total 2–3 ml (spray as you go) was sprayed during fiberscopy. In some cases difficulty was encountered as pus was draining internally and periglottic edema present, so simultaneously suction with FOB done. An orally placed suction catheter however made the fiberoscopy easier. As FOB approaches to glottis area, sprayed the vocal cords with 2 ml of 2% lignocaine and FOB taken out.

Then FOB loaded with 6–7.5 mm ID ETT, reinserted after 2 min and the tracheal intubation was done as first fiberoscopy had given guidance of airway tract. After confirmation of tracheal intubation by fiber-optic viewing of tube tip inside the trachea, the fogging and $EtCo_2$, anesthesia was induced with Inj. propofol 2 mg/kg BW + Succinylcholine 2 mg/kg BW. Anesthesia was continued with Inj. Atracurium N_2O + O_2 and sevoflurane with Bain's circuit.

Intra-operatively vitals were stable. Incision and draining were performed by the surgeon. At the end of the procedure residual NMB was antagonized using Neostigmine 0.05 mg/kg BW and Glycopyrrolate 10 ug/kg BW. In each case pus was send for culture and sensitivity testing.

In view of periglottic edema, patients were not extubated immediately and moved to PACU with ETT *in situ* and placed on T piece with O_2 @ 5 Lt/min. After 12–24 h when edema was considerably subsided, thorough oral suctioning done and trachea were extubated. Post-extubation recovery in each case was uneventful. Patients shifted to general ward on post operative day 2. All the patients were discharged within 3–5 days post-operatively except in 2 cases one of which had evidence of sepsis and other pneumonia was discharged on post operative day 10.

Result

The present study is prospective observational study of 30 patients over a period of 3 years. Of the 30 patients 19 (63.34%) are male and 11 (36.66%) are female. Ages ranged from 20 to 60 years, more common in fourth (46.6%) and fifth (26.66%) decade. Incidences are less in early and late age group (Table1).

Symptoms and signs duration ranged from 2 days to 15 days with average duration being 6 days. Twenty patients had history of dental problems suggesting as most common predisposing factor (66.66%). Other causes of infection are submandibular + sublingual sialadenitis in 5 patients (16.66%), tonsillitis in 3 patients (10%), cold abscess in 1 patient, and thyroglossal cyst in 1 patient (Table 2).

Submandibular, submental, and sublingual site involvement were observed in 18 patients (60%) as most common presentation (Table 3). Five patients had parapharyngeal abscess while 2 patients had retropharyngeal and 2 had peritonsillar abscess. Three patients with long duration history of 12–15 days had multiple sites involvement. Of which one has right side cheek abscess with widespread submandibular,

Table 1: Sex and age distribution

	Sex distribution		Age distribution			
	Male	**Female**	**20–30**	**31–40**	**41–50**	**51–60**
No. of patients	19	11	6	14	7	3
Percentage (%)	63.34	36.66	20	46.66	23.33	10

Table 2: Predisposing Factor for DNI

Causes	Odontogenic	Sialadenitis	Tonsillitis	Cold abscess	Thyroglossal cyst
No of patients	20	5	3	1	1
Percentage (%)	66.66	26.66	10	3.33	3.33

Table 3: Type of neck swelling and difficulty in mouth opening

	Site of neck swelling				
	Submandibular + sublingual + submental (A)	**Parapharyngeal (B)**	**Retropharyngeal (C)**	**Peritonsillar abscess/ Quinsy (D)**	**Multiple space involvement (E)**
No of patients	18	5	2	2	3
% of patients	60	16.67	6.67	6.67	10
Mouth opening in different abscess of DNI					
Mouth opening in (no of patients)					
< 1F = 3(10%)	<1 F = 0	< 1F = 0	< 1F = 0	<1F = 0	<1 F = 3
1 F = 19 (63.33%)	1 F = 16	1F = 1	1F = 0	1 F = 2	1F = 0
2 F = 8 (20.66%)	2 F = 2	2F = 4	2 F = 2	2 F = 0	2F = 0

(F- finger breadth)

submental involvement. One patient had bilateral submandibular, sublingual and parapharyngeal spread. And third one had parapharyngeal, peritonsillar, and retropharyngeal spread. Trismus present in all patients with varying severity i.e. 3 patients had <1 finger mouth opening (10%). Patients having widespread involvement involving multiple sites, 19 patients had 1 finger mouth opening (63.33%), and 8 patients had 2 finger mouth opening (26.66%) indicates the severity of infection and difficulty in direct laryngoscopy (Table 3). Patients with decreased mouth opening (<1F) had severe infection with multiple neck sites involvement. While patients with limited deep neck infection had less severe trismus.

The difficulty in negotiating FOB at different levels was observed because of soft tissue edema and distorted anatomy with average duration of fiberoscopy 3–5 mins. In nasal cavity, the congestion and hypertrophied turbinate made fiberoscopy difficult in 10 patients. In pharynx edema and inflammation of lateral pharyngeal wall, anterior visceral neck space and posterior pharyngeal wall was present in 16 patients (53.33%) which made fiberoscopy difficult. Periglottic edema present in 14 patients (46.66%), pus draining in oral cavity present in 18 patients (60%) of which 10 had submandibular + sublingual + submental infection, 3 had parapharyngeal infection, 2 had peritonsillar abscess and 3 had widespread multiple site involvement. First fiberoscopy attempted successfully in 12 patients in 3 mins (40%), in 10 patients in 4 mins (33.33%) while 8 patients required slightly longer time 5 mins (26.66%) (Table 5).

Out of 30, 16 patients were successfully extubated without periglottic edema after 12 h (53.33%). And 14 patients who had periglottic edema were extubated after 24 h when edema was subsided (46.66%). No patients had intra-operative or post-operative complications. 28 patients discharged on day 3–6 with average on day 4 (93.33%). While 2 patients discharged on day 10 who had severe infection.

The pus culture report found *Streptococcus viridians* as most common organism cultured in 14 patients (46.66%) followed by *Staphylococcus epidermidis* in 7 (23.33%) patients, *Staphylococcus aureus* in 6 (20%). Two patient had *Streptococcus pneumonie* (6%), and 1 patient had *Mycobacterium tuberculli* on Zeel- nilson stain (3%).

Discussion

Airway compromise has long been identified as cause of mortality in deep neck abscess. Deep neck spaces are region

Table 4: Difficulties in negotiating FOB at different levels of airway

	Nasal cavity	Pharynx	Glottic area	Pus draining in oral cavity
No of patients	10	16	14	18
Percentage (%)	30.33	53.33	46.66	60

Sum of percentage exceed 100 as 25 patients had difficulty at more than one levels.

Table 5: Duration of first fiberopticscopy (insertion of FOB into nostril up to visualization and spraying of vocal cords)

Duration in min (approximate)	3mins	4mins	5mins
No of patients	12	10	8
Percentage (%)	40	33.33	26.66

of loose connective tissue filling the areas between the 3 layers of deep cervical fascia. The fascial layers may limit the spread of infection. However, the spaces of the neck communicate with one another forming avenues by which infections may spread over large area.[11]

The term Ludwig's angina was first described by German surgeon Wilhelm von Ludwig in 1836 as rapidly progressive and frequently fatal gangrenous cellulitis and edema of soft tissues of the neck and floor of the mouth.[12] It is a bilateral inflammation of sublingual, submental and submandibular spaces. The disease spread by continuity rather than lymphatic spread. It typically originates from an infected or recently extracted tooth most commonly from the lower second and third molars. It has also been reported as a result of mandibular fracture, submandibular sialadenitis, peritonsillar abscess, epiglotitis, and oral malignancies. Predisposing factors include dental caries, recent dental treatment, otitis media, diabetes mellitus, malnutrition, alcoholism, compromised immune system.[1,13,14] Early recognition of disease is of paramount importance. Painful neck swelling, tooth pain, dysphagia, dyspnea, fever, and malaise are the most common complaints.[12] Swelling of floor of mouth, trismus, edema, and abscess formations may occur leading to loss of the airway and asphyxia.[14] Stridor, difficulty in managing secretions, anxiety, cyanosis, and sitting posture are late signs of impending airway obstructions and immediate artificial airway.[15] Other complications may include spread of infection to medistinum, carotid sheath, skull base, meninges reaching a mortality rate of 20–50%.[13] Another common cause of death is acute loss of airway during interventions to control the conditions.[1]

In the present study, of the 30 patients 19 (63.34%) are male and 11 (36.66%) are female suggesting more incidence in male. DNI more common in fourth (46.6%) and fifth (26.66%) decade were found. Incidences are less in early (20%) and late age group (10%). In review of literature, article published by Gupta et al.[16] also show 58.9% male occurrence and 53% in their fourth or fifth decade of life. While Boscolo-Rizzo and Da Mosto[17] found near about similar incidence in male (51.95%) and female (48.1%). Odontogenic infection was the commonest etiological factor observed in 20 (66.66%) patients. Gupta et al.[16] found 76.47% odontogenic infection. While, other study had odontogenic origin in 46.9% patients.[17] Other causes of infection are submandibular + sublingual sialadenitis in 5 patients (16.66%), tonsillitis in 3 patients (10%), cold abscess in 1 patient and thyroglossal cyst in 1 patient (Table 2).

Submandibular, submental, and sublingual site involvement were observed in 18 patients (60%) as most common presentation (Table 3). Five patients had parapharyngeal abscess while 2 patients had retropharyngeal and 2 had peritonsillar abscess. Three patients with long duration history of 12–15 days had multiple sites involvement. Of which one has right side cheek abscess with widespread submandibular, submental involvement. One patient had bilateral submandibular, sublingual, and parapharyngeal spread. And third one had parapharyngeal, peritonsillar, and retropharyngeal spread. In the study they found submandibular space was primary site of involvement in 68 patients out of 81.[17]

In the present study difficulty in mouth opening present in all patients but of varying severity. In 3 patients mouth opening were less than 1 finger (10%). These patients had widespread involvement with multiple sites. Nineteen patients had 1 finger mouth opening (63.33%), and 8 patients had 2 finger mouth opening (26.66%) indicates the severity of infection and difficulty in direct laryngoscopy(Table 3). The reason for getting trismus in every patient with varying severity, as this regional zone is a tribal and mostly they had delay in approaching the proper consultant for the medical management. As unsuspecting physician may underestimate an initially localized infection, which could shortly present as airway collapse or descending mediastinitis.[17]

Airway management of DNI presenting for surgical drainage is a challenging task for the anesthesiologist. The suggested methods include conventional laryngoscopy and intubation after administration of muscle relaxant, awake blind nasal intubation, treacheostomy and awake fiberoptic intubation. Decompression of Ludwig's angina under cervical block has also been reported.[18]

The first successful fiberoptic nasotrachaeal intubation in a patient was reported in the year 1974.[19] However, subsequent reports of fiber optic intubation were associated with

frequent failures: two of three in one report.[14,20] Ovassapian et al.[1] in year 2005 reported 100% success in 25 attempted intubation with fiberoptic bronchoscopy in patients with deep neck infection. Fiberoptic intubation either oral or nasal can be extremely difficult because of anatomic distortion, erythema, tissue edema, and immobility. However, failure to intubate is usually due to inadequate preparation, poor quality FOB, and inadequate expertise to perform procedure.[18,20,21] Application of adequate topical anaesthesia prior to instrumentation can prevent complications like laryngeal spasm and airway loss.[21]

In the present study, successfull awake fiberoptic intubation was done due to meticulous preoperative counseling and adequate planning of the anesthesia and airway preparation. In all cases, preintubation fiberoptic scopy was done to assess the patency of airway, to check severity of inflammation, edema, bleeding, any draining pus, and also to assess the glottis edema and conditions of cords. Properly suction of airway and spraying of topical anesthetic agent to airway tract and allowing anesthetic agent to act.

During insertion of FOB through airway passage, there was difficulty at different levels (Table 4). In nasal cavity congestion of nasal mucosa, deviated nasal septum and hypertrophied turbinates made FOB scopy difficult in 10 patients. In pharynx edema and inflammation of lateral pharyngeal wall, anterior visceral neck space and posterior pharyngeal wall was present in16 patients (53.33%) which made fiberoscopy difficult. Pus draining in oral cavity present in 18 patients (60%) of which 10 had submandibular + sublingual + submental infection, 3 had parapharyngeal infection, 2 had peritonsillar abscess and 3 had widespread multiple site involvement. Because of continuous pus drainage and salivary secretions due to inability to swallow, make visibility of pharyngeal and laryngeal structures limited. The difficulties with thorough suctioning by FOB suction port and orally placed suction catheter, change in neck position and manipulation of FOB were not there. Periglottic edema present in 14 patients (46.66%) hence intubated with small size ETT than recommended. As they were oxygenating the airway with O_2 supply connected to the biopsy port of FOB, hypoxia was avoided. But sometimes it made view hazy by bubble formation. It was cleared by proper thorough suctioning of tract. First fiberoscopy attempted successfully in 12 patients in 3 mins (40%), in 10 patients in 4 mins (33.33%) while 8 patients required slightly longer time 5 mins (26.66%)(Table 5).

Then redo scopy with loaded cuffed endotracheal tube according to conditions and sizes of vocal cords after 2 mins. Time for redo scopy was maximum 2–3 mins. With such type of redo scopy method good cooperation and acceptance was achieved to the scopy and easy ETT intubation without complications. Karkos et al.[22] and Allan[23] also supports that fiberoptic guided awake endotracheal intubation is considered more appropriate procedure for many anesthesiologist faced with treating a patient with an upper airway obstruction. It is operated dependent and relies on the adequate preparation of the patient. Although distorted anatomy, edema, and secretions may contribute to difficulty with fiberoptic intubation, in skilled and experienced hands, flexible fiberoptic nasal intubation is a preferred method of airway management and has high rate of success.[12,5]

Out of 30, 16 patients were successfully extubated without periglottic edema after 12 h (53.33%). And 14 patients who had periglottic edema were extubated after 24 h when edema was subsided (46.66%). Timing of extubation is a clinical decision based on the course and physical findings at that time.[24] 28 (93.33%) patients were discharged on day 3–6 with average on fourth day. Two patients were discharged late on day 10 as they had sepsis and pneumonia.

The pus culture report found *Streptococcus viridians* as most common organism cultured in 14 patients (46.66%) followed by *Staphylococcus epidermidis* in 7 (23.33%) patients, *Staphylococcus aureus* in 6 (20%). Two patient had *Streptococcus pneumonie* (6%). In one patients pus gram stain shows gram negative bacilli and gram positive cocci in chains but no growth on aerobic condition. Same sample inoculated in thioglycolete broth media used for anerobic group of organism shows growth of gram negative bacilli hence infection in this patient is because of anerobic group of organism. These organism responded well to intravenous penicillin G, clindamycin, metronidazole and third–fourth generation cephalosporin group of antibiotics.[5,24]

Conclusion

Fiberoptic intubation is a sophisticated and less invasive method of securing airway in patients with deep neck infections and in skilled and experienced hands, flexible fiberoptic nasal intubation is a preferred method of airway management. It should now replace the gold standard tracheostomy in managing these patients. Use of tracheostomy should be reserved for more dire and emergency situations.

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