Original article

Experience of fiberoptic intubation in patients coming for general surgery in a tertiary care hospital

Khalid Javed[1], Sairah Adnan[2], Ch Tahir Mahmood[3]

[1]Professor, [2]Postgraduate Resident, [3]Associate Professor, Department of Anesthesiology, FJMU/SGRH, Lahore.
Correspondence to: Prof. Khalid Javed, Professor of Anesthesiology FJMU/SGRH, Lahore. E-mail: butfjmc@yahoo.com

ABSTRACT

Background: The fiberoptic bronchoscope is the most advanced device for successful oro-/nasotracheal intubation in patients with most difficult airway. The fiberoptic bronchoscope (FOB) is recently made available in general operation theatre Sir Ganga Ram Hospital (SGRH) Lahore. This study was conducted on patients undergoing general surgery requiring general anaesthesia and endotracheal intubation.

Objectives: The objectives of this study were to study the number of attempts and reasons for failure to achieve successful orotracheal intubation by anesthetists inexperienced in using this device during the learning curve in anesthetized paralyzed patients**.**

Patients and methods: This study was conducted on 249 patients, aged between 16-80 years coming for routine elective surgeries over a period of five months. Fiberoptic bronchoscope and all relevant equipment was prepared and checked before the start of procedure.

Results: A total of 249 patients were intubated with FOB, out of which 50 were male and 199 were female. Anticholinergics were given to 26 patients and 223 patients did not receive any anticholinergics medication. Suction was used to remove secretions in 25 out of 249 patients. Out of 249 attempts of intubation with FOB, 208 patients were intubated successfully in first attempt (83.93%); 31 were intubated in second attempt (12.44%); only 2 were intubated during third attempt (0.88%, <1%). Sixty-seven (27%) patients were intubated successfully within 30 seconds, another 167 (67.17%) were intubated within 60 seconds. Attempts to intubate with fiberoptic bronchoscope failed in 7 patients (2.81%). Hypoxia, increased secretions, blurred vision and failure to identify the anatomical landmarks were the main reasons for failed intubation.

Conclusion: Fiberoptic intubation can be achieved with reasonable success rates by the anesthetists not well experienced in using this device. Failure to identify anatomical landmarks, presence of increased amounts of secretions, blurred vision and desaturation due to repeated and prolonged attempts remain the commonest causes of failed intubation.

Keywords:
Fiberoptic bronchoscope, elective surgery, airway management, orotracheal intubation.

INTRODUCTION

Difficult intubation is a frequently encountered problem, the incidence varying from 1 to 18%.[1] The tools used to manage a difficult airway include supra-glottic devices, stylets, gum elastic bougies and different versions of videolaryngoscopes.[2] Fiberoptic bronchoscope (FOB), introduced in 1967, is an advanced airway management tool for intubation both in awake and sedated patients. It is the tool of choice in situations like intra-oral tumors, temporo-mandibular joint ankyloses, massive goiter and rheumatoid arthritis.[3-10]

Competing interest: The authors have declared no competing interests exist.
Citation: Javed K, Adnan S, Mahmood CM. Experience of fiberoptic intubation in patients coming for general surgery in a tertiary care hospital. J Fatima Jinnah Med Univ. 2018; 12(2): 46-49.

Fiberoptic bronchoscope is not available at Tehsil Headquarter and District Headquarter hospitals; it was not available even in tertiary care hospitals in Pakistan till recently. Nonetheless, learning the skill and practice of fiberoptic bronchoscopy is need of the hour, and every anesthesiologist should be proficient in its use owing to the increased frequency of difficult intubations encountered in situations like maxillofacial surgeries and morbidly obese patients.[1,11] Post graduate residents must be trained in its use for difficult intubation situations.[1,12] FOB was made available in Sir Ganga Ram Hospital Lahore one year ago; this led to an initiative for training the faculty in fiberoptic intubation. The objectives of this study were to study the number of attempts, time required to achieve successful orotracheal intubation by inexperienced operators in anesthetized paralyzed patients and causes of failure of intubation**.**

PATIENTS AND METHODS

This study was conducted over a period of five months on 249 patients coming for routine elective general surgical procedure, such as cholecystectomy, modified radical mastectomy, thyroidectomy and laparotomy. It was a cross-sectional study including 249 patients with normal airway anatomy undergoing fiberoptic orotracheal intubations. Three consultants who had undergone 1 week of formal training in Fiberoptic intubation on mannikin under supervision of company experts, but with minimal experience for actual patients participated in the study. With secure intravenous access and pre-loading with 500 ml Ringer's lactate solution, minimal essential monitoring

was attached. The baseline values regarding SpO2, NIBP, heart rate, ECG were recorded. Anticholinergics (atropine/glycopyrrolate) were given only to 26 patients before intubation, while in 223 patients no anticholinergic agent was administered. After pre-oxygenation with 100% oxygen at the rate of 4-6 L/min, the patients were pre-medicated with midazolam 2mg IV and nalbuphine 6mg IV. Thereafter, the patients were put to sleep with propofol, 1.5-2.5 mg/ kg body weight and paralyzed with 0.5 mg/kg of atracurium.[13-15] Both the methods of tongue pull and jaw thrust were used for assistance, with tongue pull used in majority of cases.[14-16] Suction to remove secretions was required in 25 out of 224 cases. Fiberoptic bronchoscope and all requisite equipment was prepared and checked before the start of procedure. Endotracheal tube (ETT) was mounted on the scope and held with the endotracheal tube holder. After the patients were anesthetized and paralyzed, they were ventilated with intermittent positive pressure ventilation for 3-5 minutes. The head was extended and stabilized, and the tongue was pulled with gauze by a trained assistant. The tip of FOB cord was introduced in the midline in the mouth after lubricating the distal end of the cord with 2% lignocaine gel. The tip was advanced after visualizing the back of tongue. The epiglottis was visualized, and vocal cords were visualized as inverted V shaped pearly white cords. The tip of fiberoptic cord was advanced between the vocal cords and the tracheal rings were visualized. The FOB was advanced till the carina was visualized. Then the endotracheal tube was released from tube holder by the assistant and passed through mouth and vocal cords. FOB was removed, cuff of ETT inflated, and bilateral auscultation was done to confirm its placement in trachea, and tube was then fixed. Correct placement of endotracheal tube was also confirmed by visualizing end tidal CO_2 waveform. ETT was connected with breathing circuit and maintenance anesthesia was given.[15] Duration of intubation and number of attempts was recorded in each case. Reasons for failed FOB intubation were noted. Duration was defined as the time from the start of insertion of tip of FOB cord in the mouth in mid-line to the removal of fiberoptic bronchoscope after insertion of endotracheal tube into the trachea and was recorded in seconds. An intubation attempt was considered a failure if there was desaturation to 95% before completion of intubation or if the attempt took longer than 3 minutes.[17] Also the procedure was considered unsuccessful if the patient could not be intubated in 3 attempts.

RESULTS

A total of 249 patients, between 16 to 80 years of age, were intubated with FOB. There were 50 (20%) males and 199 (80%) females. Anticholinergic (atropine) was administered in 26/249 to decrease secretions and improve visualization. Suction was required to remove the secretions to improve the view in 25/249 (10%) patients. Out of 249 attempts of intubation with fiberoptic bronchoscope, 208 patients were intubated successfully in first attempt (83.93%); 31 were intubated during second attempt (12.44%); only 2 were intubated during third attempt (0.88%, < 1%). Attempts of intubation with fiberoptic bronchoscope failed in 7 patients (2.81%). Sixty-seven (27%) patients were intubated successfully within 30 seconds; 167 (67.17%) were intubated within 60 seconds; and only 14 (5.62%) intubations took 120 seconds or more (the time taken to re-ventilate the patient to prevent hypoxia). Main reasons for failed intubation were hypoxia, presence of copious secretions, blurred vision and non-identification of structures.

DISCUSSION

Historically, rigid fiberoptic bronchoscope was first used by Gustav Killian in 1887 for removal of a foreign body from a farmer's respiratory tract.[18] Shigeto Ikeda of Tokyo, Japan introduced the first flexible fiberoptic bronchoscope during 9th International Congress on the Diseases of Chest held in Copenhagen in 1966.[19] The fiberoptic intubation can be done in fully awake patients with little sedation and local anesthesia of upper airway tract or in anesthetized but spontaneously breathing patients.[14,20,21] Learning any new technique or procedure is difficult and slow due to fear of complications and lack of confidence.[6,20] Smith and colleagues suggested that during awake intubation, time to perform fiberoptic intubation is not limited by apnea; a safety feature for patients with difficult airway.[14] Episodes of desaturation (SpO_2<90%) have also been reported during this technique in 30% cases with expected difficult airway.[1] Second technique is intubation under general anesthesia with spontaneously breathing and adequately anesthetized patient, or patient anesthetized and paralyzed with muscle relaxant but well oxygenated with 100% O_2 before the start of fiberoptic intubation. In this technique one has limited time because of chance of hypoxia but the technique is most suitable and appropriate because patient is anesthetized and paralyzed. Cole and friends found that the anesthetized and paralyzed patients are the best subject for learning FOI because about 50% of difficult intubations are not predictable by history and examination. Furthermore, use of intermediate acting muscle relaxant facilitates the learning of FOI.[13] The experience and results of this study are similar to the evidence provided by review of Koerner and Brambrink, who recommended to practice FOI in apneic paralyzed patients through orotracheal route. They also mentioned that orotracheal FOI is the best method for teaching FOI to residents, as FOI can be accomplished without compromising patient safety.[22] Our findings also confirms the findings of Erb and coauthors who compared the duration of FOI between two groups.[15] One group comprised of anesthetized spontaneously breathing patients and the other consisted of apneic and paralyzed patients. They found that duration of FOI was increased in spontaneously breathing patients

because of 60s time needed to apply local anesthetics and wait for the desired effect of drug. The learning of FOI through orotracheal route is also recommended because of less severe hemodynamic response. [23,24] In learning FOI in this study, all successful intubations were completed within 180 seconds. During this time period, the patient remained stable hemodynamically and did not develop hypoxia. This finding is consistent with the study performed by Naik and group, where they accomplished intubation and confirmation of correct ETT placement within allotted 210 seconds.[20] In present study, novice consultants completed 67.17% of intubations within 60 seconds which is consistent with the studies done by Smith and colleagues, where the experts completed nasotracheal intubation within 60 seconds but with the help of Macintosh laryngoscope.[25,26]

There are two routes for FOI, oro-tracheal or nasotracheal. Proponents of nasotracheal FOI emphasize that nasotracheal is easy route because of in-line alignment of posterior nares and larynx (glottis).[21] However, orotracheal route is a curved path and difficult. Nevertheless, in present study, the authors performed FOI using orotracheal route, and found it easier and quicker way of intubation because of less chance of bleeding and damage to surrounding structures, as compared to the nasotracheal route.[22] Delaney and Hessler performed emergency fiberoptic nasotracheal intubations in 60 patients and measured duration of intubation as function of practitioner experience.[3] This is similar to present study as the practitioners in both studies have been consultants with minimal experience in FOI. However, Delaney and Hessler performed 60 nasotracheal FOIs on awake spontaneously breathing patients in emergency settings, whereas the authors performed 249 orotracheal FOIs on apneic paralyzed patients undergoing elective general surgery procedures. Delaney and Hessler accomplished 50% nasotracheal intubations within a minute, but the authors in this study successfully intubated 67.17% patients through orotracheal route within same duration of time. However, Delaney and Hessler reported six minutes to perform 27% intubations whereas the authors in present study performed all intubations in less than three minutes. Failed FOIs were 13% in Delaney and Hessler's study, in contrast to our study where only 2.81% FOIs were failed.[3] These differences are significant in that ease of performing orotracheal FOIs in apneic paralyzed patients in elective settings may be considered as compared to nasotracheal FOIs in awake patients in emergency settings, especially during learning curve of FOI. However, the difference may be due to the reason that the authors in this study included only patients with normal airway anatomy, where Delaney and Hessler included patients with difficult airways as well. Evidence shows that hypoxia is the predominant cause of failed FOI in paralyzed and apneic patients.[27,28] This is consistent with findings of present study where hypoxia was the major reason behind abandonment of FOI. However, the cause of abandonment in Delaney and Hessler's study was patient's agitation followed by vomitus and plenty secretions in airway, hence blurring the view. The second commonest cause of failure of FOI in present study is also copious secretions (not vomitus) in the airway.

Important learning points from experience of authors in this study are: the duration of apnea for FOI should be less than one minute; If it takes more than one minute, then one should try to: ventilate with O_2 before trying, perform pharyngeal suction before starting intubation and try to remain in mid-line, keep on identifying structures like back of tongue, epiglottis, glottis, arytenoid cartilage, tracheal rings and carina. Once glottis is entered, keep fiberoptic cord tip in the center of tracheal lumen so that view of whole trachea remains visible. Care is needed during this procedure as endotracheal tube's tip can stuck at the back of tongue, arytenoid cartilage or vocal cord. Friction should be avoided by applying gel at the cuff, tip of endotracheal tube and cord of fiberoptic bronchoscope. Once the tube is passed through vocal cords, remove FOB and inflate the cuff through balloon, attach breathing circuit; and ventilate the patient. Confirm appropriate placement of ETT by bilateral auscultation and $ETCO_2$ monitoring. Then fix the tube. Even very little secretions at tip of FOB cords can blur the vision and make intubation difficult or even failed. The authors suggest that more studies are required to gain experience in fiberoptic intubation under topical anesthesia in awake patients with difficult airways.

CONCLUSION

This study shows that fiberoptic intubation can be achieved with reasonable safety and success rates by the senior anesthetists with little or no experience in using this device. Failure to identify anatomical landmarks, presence of increased amounts of secretions, blurred vision and desaturation due to repeated and prolonged attempts remain the commonest causes of failed intubation.

REFERENCES

1. Dawson AJ, Marsland C, Baker P, Anderson BJ. FOI skills among anesthetists in New Zealand. Anesth Intensive Care. 2005:33:777-83.
2. American Society of Anesthesiologists Task Force on Obstetric Anesthesia. Practice guidelines for obstetric anesthesia: an undated report by the American Society of Anesthesiologists Task Force on Obstetric Anesthesia. Anesthesiology 2007; 106:843-63.
3. Delaney KA, Hessler R. Emergency flexible fiberoptic nasotracheal intubation: a report of 60 cases. Ann Emerg Med.1988; 17:919-26.
4. Murphy P. A fiberoptic endoscope used for nasal intubation. Anesthesia. 1967; 22:489-91.
5. Calder I. When the endotracheal tube will not pass over the flexible fiberoptic bronchoscope. Anesthesiology. 1992; 77: 398.
6. Asai T, Shingu K. Difficulty in advancing a tracheal tube over a fibreoptic bronchoscope: incidence, causes and solutions. Br J Anaesth. 2004; 92: 870-81.
7. Henderson JJ, Popat MT, Latto IP, Pearce AC. Difficult airway society guidelines for management of the unanticipated difficult intubation. Anesthesia. 2004;59(7):675-94.

8. Heidegger T, Gerig HJ, Henderson JJ. Strategies and algorithms for the management of the difficult airway. Best Pract Res Clin Anesthesiol. 2005;19(4):661-74.
9. Drolet P. Management of the anticipated difficult airway-a systematic approach: continuing professional development. Can J Anesth. 2009;56:683-701.
10. Apfelbaum JL, Hagberg CA, Caplan RA, Blitt CD, Connis RT, Nickinovich DG, et al. Practice guidelines for management of the difficult airway: an updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology. 2013;118 (2): 251-270.
11. Wood PR, Dresner M, Lawler PGP. Training in fibreoptic intubation in the north of England. Br J Anaesth. 1992; 69:202-3.
12. Laeeq K, Pandian V, Skinner M, Masood H, Stewart CM, Weatherly R, et al. Learning curve for competency in flexible laryngoscopy. Laryngoscope. 2010;120:1950-53.
13. Cole AFD, Mallon JS, Rolbin SH, Ananthanarayan C. FOI using anesthetized, paralyzed, apneic patients. Anesthesiology. 1996;84:1101-6.
14. Smith JE, Jackson APF, Hurdley J, Clifton PJM. Learning curves for fibreoptic nasotracheal intubation when using the endoscopic video camera. Anesthesia. 1997;52:101-6.
15. Erb T, Hampl KF, Schurch M, Kern CG, Marsch CU. Teaching the use of FOI in anesthetized, spontaneously breathing patients. Anesth Analg. 1999;89:1292-5.
16. Durga VK, Millns JP, Smith JE. Manoeuvres used to clear the airway during FOI. Br J Anaesth. 2001; 87(2):207-11.
17. Wheeler M, Roth AG, Dsida RM, Rae B, Seshadri R, Sullivan CL, et al. Teaching residents pediatric FOI of the trachea. Anesthesiology. 2004; 101:842-6.
18. Burkle C, Zepeda Z, Bacon D, Rose SH. A historical perspective on use of the laryngoscope as a tool in anesthesiology. Anesthesiology. 2004; 100: 1003-6.
19. Ikeda S, Yanai N, Ishikawa S. Flexible bronchofiberscope. Keio J Med. 1968; 17: 1-16.
20. Naik VN, Matsumoto ED, Houston PL, Hamstra SJ, Yeung RYM, Mallon JS. Fiberoptic orotracheal intubation on anesthetized patients. Anesthesiology. 2001;95:343-8.
21. Machata AM, Gonano C, Holzer A, Andel D, Spiss CK, Zimpfer M, et al. Awake nasotracheal FOI: patient comfort, intubating conditions, and hemodynamic stability during conscious sedation with remifentanil. Anesth Analg. 2003;97:904-8.
22. Koerner IP, Brambrink AM. Fiberoptic techniques. Best Pract Res Clin Anaesthesiol. 2005; 19: 611-21
23. Ng WS. Pathophysiological effects of tracheal intubation. In: Latto IP, Vaughan RS, eds. Difficulties in Tracheal Intubation, 2nd edn. London: W.B. Saunders, 1997: 13–27.
24. Stoelting RK. Circulatory changes during direct laryngoscopy and tracheal intubation: influence of duration of laryngoscopy with or without prior lidocaine. Anesthesiology. 1977; 47:381–3.
25. Smith JE, Mackenzie AA, Sanghera SS, Scott-Knight VCE. Cardiovascular effects of fiberscope-guided nasotracheal intubation. Anesthesia. 1989; 44: 907-10
26. Smith JE, Grewal MS. Cardiovascular effects of nasotracheal intubation. Anesthesia 1991; 46: 683-6
27. Wrigley SR, Black AE, Sidhu VS. A fiberoptic laryngoscope for pediatric anesthesia: a study to evaluate the use of the 2.2mm Olympus (LF-P) intubating fiberscope. Anesthesia. 1995;50:709-12.
28. Smith M, Calder I, Crockard A, et al. Oxygen saturation and cardiovascular changes during FOI under general anesthesia. Anaesthesia 1992;47:158-61.