FLEXIBLE FIBREOPTIC BRONCHOSCOPE AND THE DIFFICULT AIRWAY: A CASE REPORT

Edubio MN[1], Mohammed RI[2]

1.Department of Anaesthesia, University of Uyo/University of Uyo Teaching Hospital,Uyo
2.Department of Anaesthesia, Ahmadu Bello University/Ahmadu Bello University Teaching Hospital, Zaria

ABSTRACT

BACKGROUND: Management of the difficult airway will always confront the anaesthetist. This is one area of the practice that the anaesthetist is required to develop divers skills suited for each clinical situation. The ability to use the flexible fibreoptic bronchoscope (FOB) presents the anaesthetist with an addition tool to conduct endotracheal intubation when faced with a difficult airway.

OBJECTIVE: *To demonstrate the effectiveness of the flexible fibreoptic bronchoscope in the management of the difficult airway.*

CASE REPORT: *A 21-year old male farmer who presented with a 2-year history of a slowly increasing left-sided jaw swelling. The swelling was painless with protrusion into the oral cavity. There was limited mouth opening but no history of trauma. Examination revealed a clinically ill-looking patient who was not in respiratory distress. Interincisor distance was less than 3cm with associated dental anarchy and a large tumour mass in the oral cavity. Cardiorespiratory findings were within normal limits. Radiology revealed translucency of the mandible with multiloculated "soap bubble" appearance. Histology showed typical characteristics of ameloblastoma of the plexiform type.*

The flexible FOB was checked before the patient was bought into the theatre. An intravenous access was established and a multi-parameter monitor was attached to the patient. Baseline vital signs were within normal limits. Premedication was with intravenous atropine, diazepam and fentanyl.

Using a combination of inhalational and airway anaesthesia, with patient breathing spontaneously, flexible FOB was used to effect right nasotracheal intubation with a size 7.0mm cuffed endotracheal tube. The cuff was inflated and the tube secured with adhesive tape. Anaesthesia was augmented with sodium thiopentone and pancuronium bromide was given to achieve muscle relaxation. Left-hemimandibulectomy was done with disarticulation of the left temporomandibular joint. The patient was extubated fully awake after suctioning and reversal of residual relaxation. Postoperative analgesia was with intramuscular pentazocine and diclofenac. The patient was discharged home after ten days.

CONCLUSION: *The use of the flexible FOB can be very effective in the management of the difficult airway and the modern anaesthetist must strive to acquire the necessary skill needed to use it.*

Keywords*: ameloblastoma, difficult airway, fibreoptic bronchoscope*

Corresponding Authors: Edubio Mark N,
Department of Anaesthesia, University of Uyo Teaching Hospital, Uyo, Akwa Ibom State, Nigeria.
E-mail: markedubio@yahoo.com

INTRODUCTION

Ameloblastoma is a rare, benign tumour of odontogenic epithelium much more commonly appearing in the mandible than the maxilla[1]. These tumours are rarely malignant or metastatic. They progress slowly and the resulting lesion can cause severe abnormalities of the face and jaw. This can lead to difficulty in airway management.

A difficult airway may be defined as the clinical situation in which a conventionally trained anaesthetist experiences difficulty with facemask ventilation of the upper airway, difficulty with tracheal intubation, or both[2]. Difficulty in managing the airway is the single most important cause of major

anaesthesia-related morbidity and mortality[3]. The ability of the anaesthetist to adequate manage the difficult airway will therefore significantly reduce this disturbing finding. Successful management of a difficult airway begins with recognizing the potential problem and acknowledging the limitations of one's ability.

The versatility of the anaesthetist regarding the use of the different tools available for managing the difficult airway will go a long way in reducing respiratory-related morbidity and mortality. One of these tools is the flexible fibreoptic bronchoscope (FOB).
The case report seeks to demonstrate the effectiveness of the FOB in the management of the difficulty airway.

CASE REPORT

The patient was a 21-year old male farmer who presented with a 2-year history of a slowly increasing left-sided jaw swelling. The swelling was painless with protrusion into the oral cavity. There was associated loss of dentition and limited mouth opening. The patient was eating poorly with associated weight loss. There were no respiratory or ophthalmic symptoms. There was no associated fever. There was no history of trauma and no member of his family had a similar illness.

Examination revealed a clinically ill-looking patient, not in respiratory distress, afebrile but mildly pale. He was anicteric and not dehydrated. His interincisor distance was less than 3cm. There was dental anarchy with a large tumour mass in the oral cavity. The "egg shell cracking" or crepitus sign was positive. The respiratory rate was 18cycles/min and the chest was clinically clear. The pulse rate was 90beats/min, blood pressure was 120/70mmHg and heart sounds were S1 and S2 only. There was no organomegaly. Radiology revealed translucency of the mandible with multiloculated "soap bubble" appearance. Heart and lung shadows were normal. Histology showed typical characteristics of ameloblastoma of the plexiform type. Electrolytes, creatinine and urea were within normal limits. The patient was classified as class II, according to the ASA (American Society of Anesthesiologists) physical health status classification. An informed consent was obtained from the patient, while two pints of whole blood were ordered grouped and cross-matched.

The anaesthetic machine, ventilator and the working condition of the flexible FOB were checked before the patient was bought into the theatre. Anaesthetic drugs were drawn and labelled. An intravenous access was established with a size 16G cannula. One litre normal saline was set up to run slowly. A multi-parameter monitor measuring pulse oximetry, non-invasive blood pressure, temperature, ECG and capnometry was attached to the patient. A urinary catheter was inserted to monitor urine volume. Baseline vital signs were within normal limits. Intravenous atropine 0.6mg, diazepam 5mg and fentanyl 60ug were administered as premedication.

The patient was preoxygenated with 100% oxygen for 5minutes. An inhalational induction was performed using halothane at incremental concentration of 0.5% every 4 – 5 breaths up to 3.5%. When the patient was sufficiently anaesthetized, two puffs of 4% lidocaine plus 0.05% oxymetazoline nasal spray were delivered into each nostril. After about 3minutes, a well-lubricated size 36F nasopharyngeal airway was passed down the left nostril to the nasopharynx. This was then connected to the Bain circuit and the anaesthetic machine. Patient was allowed to breath spontaneously through the nostrils. The mouth was closed to prevent leakage of gas. A size 7.0mm, cuffed and lubricated, endotracheal tube was then inserted through the right nostril to the nasopharynx.

The lubricated end of the FOB, with light source turned on, was passed down the endotracheal tube to the nasopharynx. The

epiglottis was visualised and lifted with the tip of the FOB to expose the vocal cords. After a few attempts the tip of the FOB was successfully passed through the glottis opening into the trachea. Visualisation of the tracheal rings confirmed the position of the tip of the FOB. With the aid of an assistant the endotracheal tube was railroaded into the trachea. The FOB was then withdrawn and the endotracheal tube connected to the ventilator circuit through a mainstream capnometer. Correct tracheal placement was confirmed by the tracing of the capnograph and by auscultation. The cuff was inflated and the tube secured with adhesive tape. The nasopharyngeal airway was then withdrawn. Halothane was reduced to 0.6%. Immediate vital signs after intubation were stable.

Intravenous sodium thiopentone 250mg was given to augment anaesthesia, as patient became light, while intravenous pancuronium bromide 5mg was given to achieve muscle relaxation. Respiratory frequency on the ventilator was set at 12cycles/min; oxygen flow at 5L/min and tidal volume at 400ml. Left-hemimandibulectomy was done with disarticulation of the left temporomandibular joint. The surgery lasted 2hours 30minutes. A total of 9mg of pancuronium bromide and 150ug of fentanyl were used. Total blood loss was approximately 1000ml and the patient made 750ml of clear urine. He was transfused with two pints of whole blood and had 1500ml of normal saline. The patient was extubated fully awake after suctioning and reversal of residual relaxation. Supplemental oxygen with a facemask and monitoring was continued in the post anaesthesia care unit. Postoperative analgesia was with intramuscular pentazocine and diclofenac. These were continued in the ward with antibiotics. Patient was discharged home without complications after ten days.

DISCUSSION

Airway management is fundamental to the practice of anaesthesia and tracheal intubation is frequently required to ensure adequate airway control while providing optimal operating conditions. However, in the presence of certain anatomical variants or airway pathologies, visualization of the glottis by direct laryngoscopy can be difficult or impossible[4]. Difficult laryngoscopy can usually be predicted on physical examination, but unexpected difficult laryngoscopy can occur. If intubation fails and ventilation is inadequate, then a surgical airway is immediately necessary[4]. If difficult laryngoscopy is anticipated, or occurs unexpectedly following induction of general anaesthesia and mask or spontaneous ventilation is adequate, then alternative techniques for intubation include blind nasal, retrograde, lightwand assisted, and fibreoptic intubation[4]. Despite extensive attention in the literature since its initial description in 1967, fibreoptic intubation has not achieved widespread utilization and continues to be approached with trepidation by many physicians who regularly manage the airway[4]. Manual dexterity with the FOB is essential to ensure successful fibreoptic intubation. Manipulation of the instrument must be second nature before intubation of a patient is attempted[4].

Although fibreoptic intubation can be done in the unconscious patient, it is particularly suited to the awake patient. With proper technique it produces minimal discomfort while maintaining a wide margin of safety. Meticulous attention must however be paid to local anaesthesia of the airway. Loss of consciousness is associated with a loss of tone in the submandibular muscles that directly support the tongue and indirectly the epiglottis. Posterior movement of the tongue and epiglottis can then obstruct the airway at the level of the pharynx and larynx respectively[4]. The depth of unconsciousness is also a factor. Induction of general anaesthesia in the presence of suspected difficulty intubation may be followed by airway compromise and difficult mask ventilation. Furthermore, in

the unconscious individual reduction of the pharyngeal lumen makes fibreoptic visualization more difficult[4].

It is however practically more difficult for the inexperienced to conduct fibreoptic intubation in a conscious patient[5]. Sedation and airway anaesthesia are needed to facilitate awake fibreoptic intubation. Opioids, or a combination of opioid and a sedative can be given in ASA I and II patients for awake intubation. Opioids such as fentanyl produce adequate analgesia and depress airway reflexes, facilitating oropharyngeal instrumentation in a conscious patient. Fentanyl (1 – 2ug/kg) and midazolam (30ug/kg) combination have been used successfully for awake fibreoptic intubation[5, 6]. We used diazepam and fentanyl in the case reported and achieved a good result. Dexmedetomedine, an alpha agonist, with low-dose ketamine have been reported to provide adequate sedation and analgesia for awake fibreoptic intubation[7].

We used a combination of 4% lidocaine with 0.05% oxymetazoline nasal spray to achieve airway anaesthesia after premedication with atropine. Lidocaine is probably the local anaesthetic most frequently used for topical anaesthesia of the airway. Lidocaine 2 – 4% applied to mucous membranes produces anaesthesia in about one minute. The peak effect occurs within two to five minutes and the duration of action 30 – 50minutes. The maximum safe dose has generally been considered to be 3 – 4mg/kg, although some recommend up to 6mg/kg[4]. Alternatively, cooperative patients can gargle 30ml of lidocaine 2 – 4% in two to three stages, to achieve anaesthesia of the posterior aspect of the oral cavity.

If lidocaine or tetracaine is used for airway anaesthesia for nasal intubation, a vasoconstrictor is helpful to reduce mucosal bleeding. Phenylephrine (0.005 – 1%), oxymetazoline (0.05%), or xylometazoline (0.05 – 0.1%) can be used. Even with local vasoconstriction, some bleeding occurs in up to 69% of nasal intubations[4]. In the case presented bleeding from the nostrils was minimal. Secretions dilute local anaesthetics topically applied to the airway and interpose a mechanical barrier between the anaesthetic and the mucosa. Antisialogogues are invaluable adjuncts but must be given at least 30min before airway manipulation to permit adequate drying of the mucous membrane to occur. Both atropine and glycopyrrolate are effective[4].

Cocaine is the only local anaesthetic that inhibits reuptake of norepinephrine and thereby produces vasoconstriction; hence its popularity for nasal procedures. Following topical application, surface anaesthesia is essentially immediate, whereas vasoconstriction occurs after a latent period of 5 – 10min[4]. The anaesthetic effect persists for 30 – 90min and concentrations of 4 – 10% are effective. The maximum safe dosage is general considered to be 1 – 3mg/kg, although toxic reactions have been reported after nasal administration of as little as 20 – 30mg[4]. Cocaine can be mixed with lidocaine Moffatt solution) and given intranasally. The use of cocaine with halothane anaesthesia can however predispose the patient to intraoperative arrhythmias[8].

The use of EMLA (eutectic mixture of local anaesthetics) cream or amethocaine gel to provide topical anaesthesia for awake oral and nasal tracheal intubation has been reported[9]. EMLA cream has the disadvantages of delay in achieving adequate anaesthesia and postoperative nasal discomfort. Methaemoglobinaemia was not noted as a side effect[9]. Other techniques available for providing airway anaesthesia include superior laryngeal nerve block, and transtracheal or cricothyrotomy injection of local anaesthetic[9]. Coughing is normally brief, lasting 6 – 8sec, but helps to spread the LA towards the larynx[9, 10]. This technique has

been found to be 92 – 95% successful, especially after fentanyl and diazepam premedication[11]. We had no access to either cocaine or EMLA cream. Our choice of airway anaesthesia was base on familiarity with the technique used.

Apart from the FOB, other devices have been employed in achieving tracheal intubation in patients with difficult airway. Retrograde intubation was first described in Nigeria for the intubation of patients with cancrum oris[12]. This involves the passage of a flexible guide wire via cricothyrotomy into the larynx, and then into the mouth or nostril. The tracheal tube is then railroaded over the guide wire into the tracheal. Nasal intubation is however more technically difficult to achieve through this means, as it is often difficult to pass the guide wire through the nostril[12].

The lightwand can be used to pass a tracheal tube blindly by introducing the device through the endotracheal tube. Illumination of the anterior neck guides the ETT into the trachea. Intubation with the use of the lightwand is associated with less cardiovascular changes in normotensive patients than the flexible FOB[13]. Blind nasal intubation has, in some cases, proved useful in the management of the difficult airway. The addition of adjunct like gum elastic bougie has increased the success rate of blind nasal intubation[14]. An alternative method of establishing an airway in patients who require maxillofacial surgery but do not require long-time ventilatory support is to perform submental tracheal intubation[15]. This provides a secure airway and allows unimpeded surgical access to the oral cavity and midface, while avoiding the potential complications associated with nasal intubation and tracheostomy[15].

The laryngeal mask airway (LMA) is another important device in the management of the difficult airway. The intubating LMA can be used to guide oral intubation in difficult cases. It is not useful in nasal intubation and in situations where mouth opening is very limited. The presence of a large intraoral tumour, like in the case presented, will make the use of the intubating LMA impossible.

In the event of a failed FOB a tracheostomy is sometimes one of the few options left especially in an emergency situation. In the case presented, the operating surgeon was scrubbed and gown, and a tracheostomy set was made available in the event of an emergency. The management of a tracheostomy is not without problems in our environment. The incidence of tracheal stenosis is high as a consequence of dry weather, improper humidification, lack of skilled nurses for effective tracheostomy care and infection[16]. Transtracheal jet ventilation (TTJV) can also be used in difficult airway management. TTJV can be life-saving in this situation but could be associated with some complications in an inexperience hand. These complications include subcutaneous emphysema, pneumothorax, oesophageal perforation, bleeding and haemoptysis[17].

Fibreoptic intubation under general anaesthesia is usually accomplished with the patient breathing spontaneously or by a relaxant technique[5]. The two important disadvantages of the relaxant technique are the time limitation imposed by the apnoeic patient and the fact that the tongue and pharyngeal tissues lose their tonicity and close down the pharyngeal space, blocking visualization of the larynx[4]. These reasons made us decide on general anaesthesia with spontaneous ventilation. Fibreoptic nasal intubation is easier than the oral route because of the sharp curvature from the oral cavity into the larynx. This makes it difficult for the tracheal tube to be railroaded into the larynx, even when the fibrescope is already in the trachea[18].

Patients with massive facial injury, complete upper airway obstruction, apnoea, severe hypoventilation, or profuse

upper airway bleeding are almost never appropriate candidates for flexible FOB. Relative contraindications to nasal intubation include nasal fracture and haemostatic disorders. Nasal obstruction may preclude nasal intubation and basal skull fractures raise the possibility of inadvertent intracranial penetration. Transient bacteraemia has also been reported with nasal intubation[4].

Perioperative monitoring in the case presented included a pulse oximeter, a non-invasive blood pressure monitor, an ECG, an axillary thermometer, a capnometer and a urethral catheter. Blood loss was estimated. An invasive blood pressure monitor would have been helpful as it is important when surgery is expected to be associated with significant haemodynamic changes. Mohammed et al[19] found a significant decrease in both end tidal carbon dioxide ($EtCO_2$) and SpO_2 during flexible fibreoptic bronchoscopy for various diagnostic and therapeutic procedures. Though these changes were not seen to this same extent in the case presented, they still justify the monitoring of these parameters. Capnography is also important in detecting failed tracheal intubation and inadvertent extubation.

Flexible FOB may be associated with arrhythmias, which can quickly be detected by an ECG. Alan et al[20] found a correlation between hypoxaemia and increased frequency of cardiac arrhythmias during fibreoptic bronchoscopy. This underlines the need for continuous ECG monitoring during this procedure. Halothane was used for inhalational anaesthesia instead of isoflurene. Halothane has a pleasant smell and is less irritating to the respiratory tract. Intraoperative muscle relaxation was with pancuronium. Vecuronium would have been a good alternative.

CONCLUSION

The flexible FOB is an effective tool in the management of the difficult airway. The modern anaesthetist will do well to acquire the skill to use this useful device. This will certainly go a long way in reducing the cases of morbidity and mortality associated with poor management of the difficult airway.

REFERENCES

1. Reichart PA, Philipen HP, Sonner S. Ameloblastoma: biological profile of 3677 cases. Eur J Cancer B Oral Oncol 1995; 31B: 86 – 99
2. Caplan RA, Benumof JL, Berry FA, Blitt CD, Bode RH, Cheney FW, 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 2003; 98: 1269 – 77
3. Benumof JL. Management of the difficult adult airway. With special emphasis on awake tracheal intubation. Anesthesiology 1991; 75: 1087 - 1110
4. Morris IR. Fibreoptic intubation: Continuing Medical Education. Can J Anaesth 1994; 41: 996 – 1008
5. Ovassapian A. Fiberoptic tracheal intubation. In: Ovassapian A. *Fiberoptic Airway Endoscopy in Anesthesia and Critical Care.* New York: Raven Press, 1990; 57 – 78
6. Morris IR. Fibreoptic intubation. Can J Anaesth 1994; 11: 10 – 11
7. Scher CS, Gitlin MC. Dexmedetomidine and low-dose ketamine provide adequate sedation for awake fibreoptic intubation. Can J Anaesth 2003; 50: 607 – 610
8. Berclay EM, O'Sullivan E. System Absorption of Cocaine during Fibreoptic Bronchoscopy. Br J Anaesth 1999; 46: 3 – 5
9. Larijiani GE, Cypel D, Gratz I,

Mroz L, Mandel R, Afshar M, et al. The Efficacy and Safety of EMLA cream for Fibreoptic Endotracheal Intubation. Anesth Analg 2000; 91: 1024 – 6

10. Adekeye EO. Ankylosis of the mandible: Analysis of 76 cases. In J Oral Max Surg 1983; 4: 12 – 15
11. Walts LF, Kassity KJ. Spread of Local Anaesthetic after upper airway block. Arch Otolaryngol 1965; 81: 77 – 79
12. Waters DJ. Guided blind endotracheal catheter. Br J Anaesth 1963; 18: 158 – 160
13. Nikishawa K, Kawamata M, Wamiki A. Lightwand Intubation is associated with less haemodynamic changes than fibreoptic intubation in normotensive, but not hypertensive patients over the age of 60. Can J Anaesth 2001; 48: 11 – 14
14. Arora MK, Karamchandani K, Trikha A. Use of a gum elastic bougie to facilitate blind nasotracheal intubation in children: a series of three cases. Anaesthesia 2006; 61: 291 – 294
15. Hernandez AF. The submental route for endotracheal intubation – a new technique. Journal of Maxillofacial Surgery 1986; 14: 64 – 5
16. Ffoulkes-Crabbe DJO. Some etiological consideration in Tracheal Stenosis following Tracheostomy in Nigerians. Nig J Med 1975; 5: 328 – 330
17. Ames N, Venn P. Complications of the transtracheal catheter. Br J Anaesth 1998; 81: 825 – 826
18. Ovassapian A, Yelich SJ, Dykes MHM, Brunner EA. Fibreoptic Nasotracheal Intubation; Incidence and Causes of Failure. Anesth Analg 1983; 62: 692 – 695
19. Mohammed TA, Fawaz KA, Jafar AA. End-Tidal Carbon Dioxide Monitoring During Flexible Fiberoptic Bronchoscopy. Pak J Med Sci 2006; 22: 149 – 153
20. Alan KS, Eric ML, Jesse S, Fred HD. Cardiac Arrhythmias Frequency During Fiberoptic Bronchoscopy and Correlation with Hypoxemia. Arch Intern Med 1981; 141: 603 - 606