Can Video Laryngoscopy Be considered As An Alternative Airway Management Strategy In Obese Patient For Thyroid Surgery With A History Of Failed Fiberoptic Intubation?

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Abstract

Expertise in managing the airway is the prime clinical skill that defines anesthesiologists. A 45 year old female, 110 kg with a BMI of 45, diagnosed with multinodular non-toxic goiter consults an anesthesiologist if she could be successfully intubated. Her elective thyroidectomy was cancelled twice because of difficult laryngoscopy and failure of endotracheal intubation despite the use of awake flexible fiberoptic laryngoscopy. Fiberoptic intubation of the spontaneously breathing patient is the current gold standard and technique of choice for the elective management of an anticipated difficult intubation. What should be done if the gold standard fails? According to the failed airway management algorithm, cricothyrotomy is the most rapid and accepted means of gaining access to the airways in a "cannot intubate, cannot oxygenate situation" [1][2]. How a surgical airway was circumvented will be discussed in this case report.

Keywords: Anticipated Difficult Airway, Management of Difficult Airway, Obese airway management, Anterior neck mass airway management

INTRODUCTION

Expertise in managing the airway is the prime clinical skill that defines anesthesiologists. An obese patient with a huge thyroid mass presenting with a history of two cancelled elective thyroidectomies in previous institutions consulted if she could be intubated without having to undergo surgical airway. Further history noted that flexible fiberoptic intubation was done in the second institution but there was difficulty in inserting the tube to the larynx due to the extreme deviation of the trachea.

Fiberoptic intubation of the spontaneously breathing patient is the current gold standard and technique of choice for the management of an anticipated difficult intubation. What should be done if the gold standard has failed? According to the airway management algorithm, the next step would be a surgical airway but it is not without problems especially among obese patients with huge goiters and unidentifiable landmarks.

Case Summary

Patient M.B is a 45 year old female with a weight of 110 kg, and a BMI of 47.6 kg/m^2. She is hypertensive maintained with Losartan 100 mg once a day and metoprolol 50 mg twice a day. She has no other disabilities, with good functional capacity and works as a teacher. Other Physical Exam findings were essentially normal. Airway assessment showed macroglossia, mallampati grade 4, small mouth opening, adequate length of mandible, short thyromental distance, submental fat pads, short thick neck with a palpable anterior neck mass approximately 10-12 cm and limited neck extension.

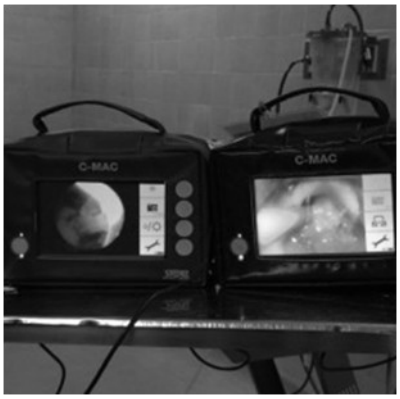
Four years prior to admission, she underwent open cholecystectomy. She was told that she was difficult to intubate and that her thyroid gland was enlarged. She had no assoicated symptoms until six months prior to admission when she started to have palpitations and heat intolerance, leading to a consult. On neck ultrasound, an enlarged right thyroid gland with diffuse parenchymal nodules were seen. CT scan also revealed the same finding and a left deviated trachea. Eight weeks prior to admission, she was admitted to undergo elective thyroidectomy at the 1st institution. On induction, after 5 attempts at intubation, they were not only unsuccessful but her right front tooth was fractured. Conventional laryngoscopy was not able to view her glottic opening thus surgery was cancelled. She was advised to transfer to another hospital with an available flexible fiberoptic intubating scope because it was not available at the initial institution. She was admitted at the 2nd institution where flexible fiberoptic scope was available however intubation was still not successful due to "softness" of the scope and the difficulty of advancing the tube through the vocal cords. The procedure was again cancelled. Distressed, she decided to consult another anesthesiologist. Consequently, she was admitted, for a third attempt to have her elective total thyroidectomy.

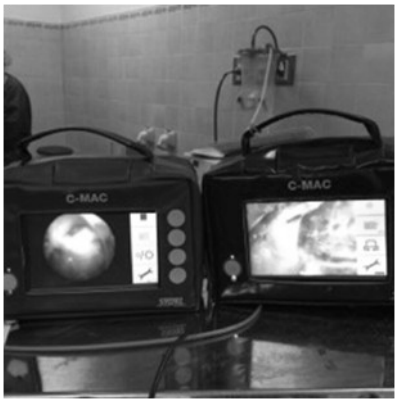
Upon admission at our institution, a thorough history and physical examination was done. CT scan result in the 2nd institution was studied with a radiologist revealing a narrowing at the level of the trachea. Further examination showed a 1 cm outer diameter endotracheal tube would fit this constriction. Due to the anticipated difficulty in intubation, she was appraised with the possibility of a surgical airway especially if a 'can't intubate, can't oxygenate' situation would ensue. She insisted against a surgical airway because of her profession. After a long explanation, she later consented reluctantly. An airway expert was called in to assist in the difficult airway management and the difficult airway cart was brought to the Operating Room. Preoperatively, she was given Pantoprazole 40mgIV and her due Metoprolol 50mg/tab as pre-op medications.

Upon arrival at the operating room, she was wide awake and had the following vital signs:

BP 140/80, HR 88, RR 18, SpO_2 97%. She was hooked to oxygen per nasal cannula and was placed on a semi-recumbent position. Lidocaine 2% using atomizer was sprayed liberally over the tongue and all around the laryngotracheal mucosa. With the patient awake,x` a CMAC blade 4 was inserted for a quick look, however, a cormack lehane 4 was the only view seen on the monitor. The airway team decided to use the Bonfils™. This time, CMAC D-blade was inserted gently, and a size 7 endotracheal tube preloaded Bonfil™ was inserted laterally into the mouth provided with a jaw thrust manuever. A better view of the glottic opening was seen on the monitor. The Bonfils™ was advanced into the glottic aperture but the tracheal tube could not be inserted into the trachea despite a good view of the vocal cords. She was reactively biting and became uncooperative. Since there was a good view with the bonfils™, she was given a slow bolus of 100 mg Propofol until she was sedated with spontaneous ventilation.

Oxygenation was continued this time with a facemask at 6 lpm. She was then given another 100 mg propofol slowly. With two hands trying to keep a tight fit and another anesthesiologist bagging, ventilation was possible. Still maintaining spontaneous ventilation, sevoflurane at 8% was administered. A nasal trumpet was inserted and then connected to the breathing circuit. On the second attempt, a gum elastic bougie was preloaded on the D-blade's suction port. Once the D-blade was in position and the glottis is in full view, the bougie was pushed towards the trachea. The endotracheal tube size 7 was then railroaded successfully through the trachea. Succinylcholine 150 mg/IV was given. The tube was secured at level 20. This was further verified with a positive $ETCO_2$ (30 mm Hg). A five-point auscultation was done to assure equal breath sounds bilaterally.





Intraoperatively, the patient was stable all through out with the following vital signs: BP 100-110/80-70, HR 80s, SpO_2 100, $ETCO_2$ 30-38. She was given diclofenac 75mg/IV and Tramadol 50 mg/IV on closing and reversal of the neuromuscular blocker was done using neostigmine 0.5 mg and atropine 0.5 mg intravenously. She was fully awake with spontaneous eye opening. After extubation, no difficulty of breathing, hoarseness or cardiopulmonary distress noted. Prior to removing the endotracheal tube, a ventilating tube exchanger was inserted to serve as a guide for possible reintuabtion. However, the patient did not tolerate the device so it was eventually removed. Post-operatively, patient was comfortable in the semi-recumbent position with minimal pain and was discharged stable, improved and thankful.

Discussion

Airway evaluation is one important aspect of pre-operative assessment especially on how to approach airway management. For a patient requiring tracheal intubation, an airway evaluation is performed primarily to help decide if intubation can be safely done after the induction of general anesthesia or with the patient awake[3].

Many factors can predict a difficult airway. The following variables were found in this patient: A thyromental distance less than 6 cm[4], fractured front tooth, inability to move the lower teeth in front of the upper teeth, inability to extend and flex the neck more than 90º, mallampati 4, neck circumference of more than 47 cm[5], short neck with limited extension [4] and the history of two failed endotracheal intubations. This patient is undoubtedly an anticipated difficult airway.[4.5.6]

The fundamental goal of airway management is ensuring alveolar oxygen delivery. Achieving this requires both a patent airway and a mechanism for delivering oxygen to the alveoli. Finding out if facemask ventilation can maintain and keep the patient's airways patent is valuable [8].

Obesity per se may not indicate a difficult airway, but anatomic changes associated with this condition may contribute to challenges in maintaining airway patency. For instance, neck circumference has been identified as the single leading predictor of problematic intubation in morbidly obese patients [9]. Genta et. al. (2014) revealed that upper airway collapsibility is associated with obesity (BMI, neck and abdominal circumferences) and hyoid position related to tongue length, volume, and pharyngeal length. A high BMI may not necessary predict a difficult airway, but a BMI more than 26 kg/m^2 is an independent predictor of difficult facemask ventilation. [7] It is also a predictor of extraglottic airway insertion failure[10]. Landmark identification can be hard in doing a cricothyrotomy or standard tracheostomy with a thick neck due to the failure of the cannula to reach the trachea[11]. Physiologic factors such as rapid oxygen desaturation and increased risk of aspiration, must be considered. Therefore, careful airway evaluation is warranted in the morbidly obese patient.

Another factor that may have contributed to the difficulty of airway management is the presence of a huge neck mass. Thyroid swelling has been considered a risk factor for difficult direct laryngoscopy, intubation and respiratory complications. The incidence of difficult endotracheal intubation defined as inadequate exposure of the glottis by direct laryngoscopy has been shown as 5.3% and 8.5% by Bouaggad A. et. al. (2006) to as high as 10%, Rios et al (2007) and 11.1% by Amathieu R et al (2008). Sedation may precipitate complete airway closure and make mask ventilation and tracheal intubation almost impossible. The use of muscle relaxants may also cause collapse of the airway because of pressure of the huge neck mass.

In formulating the airway strategies, we need to know what was done in the two institutions and why their airway management may have failed.

In the first institution, intubation employed conventional rigid laryngoscopy. There was difficulty viewing the glottic opening because in conventional laryngoscopy, the upper airway anatomy needs to be distorted in order to bring the glottis in a straight line. The thyroid mass and the obese airway may make this necessary distortion impossible. Furthermore, anesthesiologist looks through a "keyhole" while keeping this line of sight straight. Delivering the endotracheal tube to the glottic opening may even make this "keyhole" view narrower. Thus, she was advised to transfer to an institution with a flexible fiberoptic scope for intubation.

Awake flexible fiberoptic intubation is the gold standard for management of anticipated difficult tracheal intubation. This does not require an unobstructed straight view from the upper incisors to the larynx. Anatomic abnormalities such as a limited mouth opening, a huge neck mass and redundant pharyngeal tissue would be better managed with a flexible fiberoptic scope. In the 2nd institution, they did several attempts, both nasal and oral. They were able to see the glottic opening but could not advance the tube pass the glottic aperture. A surgical airway was then suggested to the patient but she refused.

With these in mind, the team formulated different plans on how to intubate a patient with a previous history of a failed flexible fiberoptic intubation.

Plan A

Considering the patient's history, an awake intubation with combined videolaryngoscope aided by the bonfils™ was contemplated.

Awake airway management remains a mainstay of the ASA's difficult airway algorithm. An awake approach can potentially confer a safety benefit by having the patient maintain airway patency, gas exchange, and protection of the airway against aspiration of gastric contents or blood during the intubation process [3]. It also provides the assurance that the patient would have no interruption in alveolar oxygen delivery. Nevertheless this needs cooperation and good communication between the physician and the patient[12].

Video laryngoscopy provides an electronically projected image on a monitor from a video chip set at the distal end of a conventional-like laryngoscope blade, but with a wider angle of view (60°). The operator therefore "sees" at a position behind the tongue, and displacement as with direct laryngoscopy may not be necessary. The C-MAC was employed because Gaszynski (2014) found it improves laryngeal view in morbidly obese patients, and allows a fast endotracheal intubation [13]. It has a better clinical performance in normal [14] and difficult airways [15] and less need for adjuncts (e.g. stylet). Also, less force on the upper teeth was noted during intubation using CMAC videolaryngoscopy compared to conventional laryngoscopy [16].

An adult Bonfils™ fiberscope is a rigid 40 cm long endoscope with 40˚ distal curved end. A tracheal tube with an internal diameter of at least 5.5 mm can be loaded[17]. The Bonfils fiberscope's rigid body can lift up large epiglottises and push away airway masses to gain access to the glottis[18]. It allows easy routing through the oral cavity, and will be able to displace collapsed soft tissues and other obstructions. Railroading the endotracheal tube using a Bonfils™ will be more straightforward than railroading the tube through a flexible fiberscope[19,20]. It is especially useful in patients who have limited or no neck mobility. For failed fiberoptic intubation, the Bonfils fiberoptic would be very appropriate.

The flexible fiberoptic bronchoscope may provide a good view but it may be too pliable to advance the endotracheal tube in the desired direction. C-MAC videolaryngoscopy can be used to achieve the best possible view of the space of the laryngeal inlet. The Bonfils™ would serve as a stylet for the insertion and easy maneuvring of the Bonfils™ -pre-loaded-endotracheal tube [11] to facilitate insertion of the tube through the glottic opening.

Plan B

CMAC-D blade, bougie assisted

D-blade was used in our patient. Compared with a regular macintosh video laryngoscopy, the D-blade's 40˚ angle (macintosh blades angulated at 18˚) conferred an even better glottis visualization [21]. It also has a suction port providing a channel for the bougie for easier passage of the endotracheal tube past the glottic opening.

The gum elastic bougie is a reliable adjunct for difficult endotracheal intubation. It can be used for direction control or when the laryngeal inlet cannot be seen. In this case, because the bougie is less rigid than the bonfils, this allowed it to be directed deeper. It is also steadier than a flexible fiberoptic scope which supported the force of the endotracheal tube.

Plan C

Awake Flexible fiberoptic intubation

Awake fibreoptic intubation is still regarded by many as the gold standard technique for a difficult airway. The ability to maintain spontaneous ventilation and bypass an upper airway obstruction, such as a neck mass, are the main advantages of awake fiberoptic intubation. An adult flexible fiberoptic intubation would still be attempted on this patient even if the two earlier plans would fail. A scope that will provide a smaller gap (not greater than 1.5 mm) between the scope shaft and the tube will less likely allow the tube to be caught on the arytenoids[22,23] or the tracheal mass.

Plan D

Surgical Airway

According to the ASA difficult airway algorithm, in the event that intubation, xawake or not, has failed after multiple attempts, the next step is to cancel the case or do invasive airway access. However our patient specifically requested that invasive surgical airway be not done due to her livelihood.

Tracheostomy under local anesthesia by the surgeon is the last option in case the airway strategy and the back up plans fail. However, this shall be decided upon early on before airway is compromised. All attempts at securing the airway shall be limited to three attempts. Considering her obesity and its associated anatomical changes, this procedure may be difficult and not without adverse effects. Tracheostomy would require the patient to lie flat for at least 30 minutes, which may make her very uncomfortable. Not only will it leave an unsightly hole in the throat, but it may also render the patient aphonic. Pain, bleeding, infection, airway obstruction, dislodgement, pneumothorax, recurrent laryngeal nerve injury, and persistent percutaneous fistula are also some of its complications [24]. These are the reasons why surgical airway was not the first management considered.

Intraoperative Management

Initially, a "quick look" with a CMAC videolaryngoscope was done awake, in an adequately topicalized patient to see if the glottic opening can be viewed through the monitor. Laryngeal viewgrade 4 was appreciated. The airway team proceeded to plan A but the patient became uncooperative while doing laryngoscopy with CMAC and bonfils. Thus, she had to be sedated. Despite sedation, difficulty was still noted with the advancement of the tube through the opening even if there was a perfect view. The airway team then proceeded to the next plan. With the D-Blade providing the best view of the glottic opening and the bougie guiding the insertion of the endotracheal tube, the trachea was successfully intubated, and succinylcholine was administered to make sure laryngospasm does not occur.

Extubation

Lastly, extubation in patients with difficult airway should be an integral part of overall airway management. Decisions has to be made regarding the following: awake extubation versus extubation before the return of consciousness, factors that may affect ventilation after the patient has been extubated, management plan if patient is not able to maintain adequate ventilation after extubation, and a device that can serve as a guide for expedited reintubation.[25]. Mort (2008) suggested the following strategies to manage extubation in a difficult airway patient: a. standard extubation; b. extubation and evaluation via a fiberoptic bronchoscope; c. extubation followed by a placement of an extra-glottic device; and d. extubation over an airway exchanger[26]. For this patient, a ventilating airway exchange catheter was left inside the tracheal lumen after extubating awake in the postanesthesia care unit (PACU). The patient kept coughing on the presence of the catheter and verbalized her desire to have the catheter removed. With all airway management tools ready, the airway exhange catheter was removed. She was spontaneously breathing with a mask on, with no episodes of desaturation at the PACU.

Lastly, other considerations that may have helped in the management of this difficult airway: Firstly, adequate local topicalization is important most especially in awake intubation. Sedation cannot substitute a poor topicalization because this might cause an airway obstruction. Secondly, limit airway interventions to 2 attempts, more attempts would increase complications previously mentioned, and that succeeding attempts can produce more secretions, blood and swelling from trauma and injury.

Conclusion and Recommendations

There is one skill above all that an anesthesiologist should exhibit and that is to maintain the airway. The most compelling effort among anesthesiologists should be to reduce the frequency and severity of complications. Preparedness, assessment, planning, communication, teamwork, skill with multiple techniques, and situational awareness are key factors in reducing airway complications. The focus

should be on alveolar oxygen delivery at all times in order to prevent the patient progressing to the point of critical oxygen desaturation. To make the gold standard work, Anesthesiologists must train and be updated in the constantly developing tools because airway interventions should "First Do No Harm".

A successful induction of anesthesia and intubation heavily relies on good pre-operative assessment and planning, alongside teamwork. But it is also important to note that the anesthesiologist should be comfortable with the techniques and instruments he uses. They should always anticipate failure and know the next necessary step should the first attempt at airway management fail. Doing the same things that didn't work the first time may cause more complications. With the right attitude, right preparation, right state of mind and attention to the continuing innovations in airway devices anaesthesiologists can now choose from, an anticipated difficult airway can no longer be as stressful as they used to be.

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