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Difficult Airway Management using the Levitan Optical Stylet in an Emergency Cesarean Delivery

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Introduction

Case Report

Anesthesia-related death is the seventh leading cause of maternal mortality in the United States accounting for 1.6% of all pregnancyrelated deaths. Complications of airway management - difficult laryngoscopy, failed intubation, and inability to ventilate or oxygenate following induction of general anesthesia (GA) for cesarean delivery (CD) – are major contributing factors leading to maternal morbidity and mortality [1]. The incidence of difficult laryngoscopy and failed intubation in obstetric patients has not changed and is typically reported to be seven to eight times greater in obstetric patients compared to the general surgical population. Albeit an uncommon event, management of anaphylaxis in pregnancy with airway involvement can be catastrophic. It is vital that anesthesia providers master and maintain both basic and advanced airway management and supportive therapy techniques in order to avoid adverse patient outcomes in such cases.

The American Society of Anesthesiologists Task Force on Management of the Difficult Airway (ASA Task Force) describe difficult laryngoscopy when it is not possible to visualize any portion of the vocal cords after multiple attempts at conventional laryngoscopy. Laryngoscopy is also considered to be difficult when a grade III or IV laryngoscopic view is encountered. In this case, a non-reassuring, difficult airway assessment was made due to the presence of facial, pharyngeal, and laryngeal edema attributed to the patient's habitus, physiologic changes of pregnancy, and anaphylactic reaction to antibiotic (cefazolin) administration prior to operative delivery. Following a failed intubation attempt during urgent CD, subsequent laryngoscopy revealed a grade IIIB laryngoscopic view at which time the Levitan optical stylet was used to successfully achieve tracheal intubation. There is presently no other report of the successful use of optical lighted stylets in the setting of difficult airway management in obstetrical patients. Furthermore, this case report illustrates successful difficult airway management using an alternative airway device in an obese pregnant woman requiring emergent CD in the setting of anaphylaxis and non-reassuring fetal status.

Case Description

A 32-year-old term obese woman in active labor required urgent repeat CD #3 because of patterns of repetitive late fetal decelerations. Her medical history was unremarkable for any systemic disease. When questioned regarding known allergies, the patient stated: "I almost died after receiving pain medications years ago." Despite further interrogation, the patient was unable to provide further details regarding this concerning element of her medical history.

The patient's approximate height and weight were 63 inches & 100 kilograms respectively (BMI=39). Initial airway examination revealed a Mallampati IV classification with marginal thyromental distance. She had generalized body edema attributed to her pregnant state.

Plans were made to perform spinal anesthesia *without* opioids given the reported history. The patient was prepared for urgent CD in usual fashion including maternal and fetal monitoring, establishment of intravenous access, and administration of gastrointestinal prophylaxis (20 mg IV famotidine, 10 mg IV metoclopramide, and 30 cc po sodium bicitrate) and antibiotics (2 g IV cefazolin). As the patient was positioned for spinal placement, her baseline facial edema was visibly worsening and accompanied by complaints of tingling in her hands and throat. Simultaneously, non-reassuring FHR was noted which did not recover despite administration of supplemental oxygen, left lateral decutibus positioning, and confirmation of adequate maternal blood pressure. The urgent CD was then declared to be "stat", and the decision was made to perform general endotracheal anesthesia.

The patient was aggressively preoxygenated, optimally placed in sniffing position, and prepped for CD. In anticipation for a potentially difficult intubation, the Levitan optical stylet was prepared for use and the difficult airway cart equipped with fiberoptic bronchoscope, intubating laryngeal mask airway, and other supraglottic devices was brought into the operating room. Additionally, assistance was solicited from the trauma surgical team in case establishment of a surgical airway would become necessary. A rapid sequence induction with cricoid pressure was performed using thiopental 500 mg and succinylcholine 100 mg. Initial direct laryngoscopy with a conventional Macintosh 4 blade yielded a Grade IV view. A second attempt revealed a Grade IIIB view. With the laryngoscope blade in place, the Levitan optical stylet with a preloaded 6.0 cuffed endotracheal tube was introduced below the epiglottis. The use of the optical stylet enhanced visualization of the patient's edematous glottic opening. The 6.0 cuffed endotracheal tube was railroaded over the optical lighted stylet atraumatically into the trachea and correct position was then confirmed via auscultation of equal breath sounds bilaterally. Oxygen saturation was noted to be 98% upon intubation. Cesarean delivery proceeded uneventfully, and a healthy infant was born (Apgar scores: 8¹, 9⁵).

To treat the patient's suspected anaphylactic reaction to cefazolin, the following medications were given intravenously: epinephrine 10 mcg, hydrocortisone 100 mg, and diphenhydramine 50 mg. At the conclusion of the operative procedure, an endotracheal cuff-leak test was performed due to concern for laryngeal edema. In the absence of an audible air leak, the decision was made to transfer the patient to the intensive care unit intubated to preserve airway patency and allow for continuation of supportive cardiopulmonary care and close observation in the event that a biphasic reaction occur. After resolution of airway edema determined by serial cuff-leak tests and imaging, the patient was extubated on postoperative day #3. She fully recovered from

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this event and received extensive education regarding the importance of avoiding re-exposure to cefazolin, the presumed allergen, in order to prevent further events. She was given an epinephrine autoinjector upon her discharge home.

Discussion

Airway-related complications are amongst the leading cause of anesthesia-related morbidity and mortality in the obstetric population. The majority of deaths associated with general anesthesia are related to failed intubation and/or inability to oxygenate and ventilate [2]. The incidence of difficult airway in the pregnant population is reported to be between 1:249 and 1:300 compared to between 0.1% and 13% in the general surgical population [3]. There is no single responsible reason for the challenges often encountered during difficult-to-ventilate/difficultto-intubate scenarios in obstetrics. Pregnancy may cause excessive weight gain, edematous changes affecting the airway, engorgement and/ or friability of mucous membranes. These anatomic factors combined with physiologic changes such as hastened hypoxemia and increased aspiration risk make airway management more difficult in the pregnant population. Obesity further compounds airway-related adverse events. The Fourth National Audit Project (NAP₄) found that airway problems were twice as common in obese patients (BMI 30-35) and four times as common in morbidly obese (BMI>35) patients [4].

Anaphylaxis in pregnancy is uncommon and may be especially catastrophic in this setting where both mother and fetus are affected. An incidence of 2.7 cases per 100,000 deliveries is reported in at least one statewide epidemiologic study [5]. The immunologic mechanism of anaphylaxis is IgE-mediated and involves mast cell activation. Its etiologies during the first three trimesters of pregnancy are similar to those observed in the non-pregnant population (food allergens, insect venoms, medications, and natural rubber latex). Prophylactic injection of a penicillin or cephalosporin is the most common precipitant of anaphylaxis in the labor and delivery setting. Other medications that have been implicated include neuromuscular blockers, general anesthetics, oxytocin, local anesthetics, and prepping solutions. Diagnosis is based upon clinical presentation, rapid onset and progression, and recognition of characteristic signs and symptoms (fetal distress, preterm labor, uterine cramps, intense vaginal itching, urticaria, angioedema). Similar to its management in the general population, treatment of anaphylaxis in pregnancy includes: (1) prompt recognition and discontinuation of the triggering allergen; (2) treatment of life-threatening signs and symptoms; (3) administation of epinephrine; (4) and provision of other supportive care including oxygen, fluid resuscitation, antihistamines, corticosteroids, and other medications such as bronchodilators. It should be noted that immediate delivery of the fetus is often necessary in order to achieve successful maternal resuscitation [6].

It is recommended that anesthesia providers have a pre-formulated strategy for intubation of the difficult airway as repeated conventional intubation attempts may contribute to patient morbidity. The rate of airway-related complications (hypoxemia, regurgitation and/or aspiration of gastric contents, bradycardia, cardiac arrest) significantly increases as the number of laryngoscopy attempts increases (≤ 2 versus >2 attempts) [7-9]. Both the American Society of Anesthesiologists (ASA) and the UK Difficult Airway Society (DAS) have published developed guidelines regarding strategies for management of the difficult airway [10,11]. The recently revised ASA Difficult Airway Algorithm (DAA) now includes the use of alternative devices that can be used if the primary intubation approach fails. Alternative approaches to intubation include but are not limited to use of videolaryngoscopy, supraglottic airway, fiberoptic intubation, light wand, blind nasal or oral intubation,

and intubating lighted stylets (such as the Levitan optical stylet used successfully here). In our pre-formulated strategy for this case, the lighted optical stylet with a preloaded tracheal tube was ready for use in the operating room in anticipation of a difficult airway. Additionally, the difficult airway cart equipped with fiberoptic bronchoscope, intubating laryngeal mask airway, and other supraglottic devices was brought into the operating room and assistance was solicited from the trauma surgical team in case establishment of a surgical airway would become necessary. At the time of this case, videolayngoscopy was not available in our institution.

Recognition of difficult intubation based on the laryngoscopic view and immediate availability of appropriate alternative airway devices can circumvent airway catastrophes. Recent survey from the United Kingdom (UK) showed that the Eschmann gum elastic bougie with a 30° angle coude tip is a universally accepted device to facilitate difficult intubations [12]. The laryngoscopic view is considered "easy" when the laryngeal inlet is visible and suitable for intubation with direct vision. This includes all Grade I and easier Grade II views. The view is considered "restricted" when the posterior glottic structures (posterior commissure or arytenoid cartilages) are visible or the epiglottis can be lifted. Based on a classification proposed by Cook (Figure 1), Grade III view as defined by Cormack and Lehane is further subdivided into Grades III A and III B. Grade III A is when the epiglottis is visible and can be lifted; Grade III B is when the epiglottis is closely approximated to the posterior pharyngeal wall. A "difficult" view is when the epiglottis cannot be lifted or when no laryngeal structures are visible and includes the more difficult Grade III B and all Grade IV views. Some "restricted" views are likely to benefit from indirect methods such as the Eschmann introducer/gum elastic bougie. "Difficult" and some "restricted" views are likely to require more specialized methods for intubation [13]. Rather than using an Eschmann bougie when a grade IIIB or IV laryngoscopic view is encountered, the optical stylet can be placed around the corner, below, and behind the epiglottis as a useful guide to visualize the glottic opening. When using the optical stylet, it is not critical to have alignment of the three airway axes because tracheal intubation can be accomplished without establishing the "line of sight". Recent studies have highlighted the usefulness of optical stylets in the facilitation of rapid and successful intubation particularly in Grade III B and Grade IV laryngoscopic views [14]. The success rate has also been shown to be significantly higher with optical stylets compared to the Eschmann introducer when a Grade III laryngoscopic view is encountered [14]. Optical stylets are useful not only in visualizing the glottic structures beyond the vocal cords but also in confirming the placement of the tracheal tube. This case illustrates the important role of the Levitan optical stylet in facilitating rapid tracheal intubation in an emergency CD when a "difficult" Grade IIIB laryngoscopic view was encountered after an initial failed intubation.

Conclusion

Difficult airway management remains one of the most important



Figure 1: Illustration drawn from Cook TM (2000) A new practical classification of laryngeal view. Anaesthesia 55: 274-279.

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patient safety issues in both non-obstetric and obstetric populations. Failure to appropriately do so in the obstetrical setting may result in 200% (mother and neonate) morbidity and mortality. Suresh and colleagues recommend a simple, logical, and linear 5-step approach on how to manage unanticipated difficult tracheal intubation during rapid sequence induction of anesthesia in the obstetric patient (Figure 2) that is based on ASA DAA and UK DAS guidelines and includes use of alternative airway devices [3]. Finally, the following statements adapted from the Practice Guidelines for Obstetric Anesthesia are offered to help ensure optimal patient outcomes when managing the obstetrical airway [15]:

- 1. Recognize factors that are associated with difficult intubation and/or ventilation.
- 2. Have a pre-formulated plan.
- 3. Have appropriate equipment for dealing with difficult intubation in the labor and delivery suite including difficult airway carts that are equipped with optical stylets, videolaryngoscopes, laryngeal mask airways, and other advanced airway tools.
- 4. Acquire advanced airway management skills and maintain these skills through routine practice on non-difficult airways.
- 5. Have a rescue plan for failed intubation and failed ventilation.

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