Learning From Others:

A Case Report From the Anesthesia Incident Reporting System

Anesthesia Quality Institute
ANESTHESIA INCIDENT REPORTING SYSTEM (AIRS)

Detailed review of unusual cases is a cornerstone of anesthesiology education. Each month, the AQI-AIRS Steering Committee will abstract a case and provide a detailed discussion based on a submission to the national Anesthesia Incident Reporting System. Feedback regarding this item can be sent by email to **r.dutton@asahq.org**. *Report incidents to* **www.aqiairs.org**.

Case 2013-10: Knife or Needle – A Need to Act!

A 71-year-old female with severe obesity and CPAP-dependent sleep apnea presented to the O.R. for gynecologic surgery. She had previously undergone two cesarean sections and a colectomy without any anesthetic complications. Induction was smooth and uneventful with intravenous fentanyl, lidocaine and propofol. Ventilation by mask was easy. Rocuronium was administered. Direct laryngoscopy with a Miller 2 blade yielded a grade 3 glottic view. Mask ventilation was reinstated and a video laryngoscope was requested. Although this instrument provided a grade 1 view, the intubation attempt with a 7.0 endotracheal tube (ETT) failed. Mask ventilation was reinstated while a curved elastic bougie was obtained, and this time the video laryngoscope yielded a grade 2 view. Intubation was again unsuccessful. The team decided to let the patient emerge from anesthesia. However, mask ventilation became increasingly difficult. The effectiveness of ventilation worsened, until air exchange ceased. The anesthesiologist attempted to combine video laryngoscopy with a fiberoptic scope, which yielded a grade 4 view and no ability to pass the bronchoscope through the vocal cords. Placement of a supraglottic airway was attempted but ventilation was not possible. ENT surgical support was requested, but was not immediately available. The cricothyroid membrane was not readily palpable or accessible secondary to the patient's obesity and neck habitus. The anesthesiologist incised the neck and successfully placed a 5.0 mm tube in the trachea. Subsequent surgical exploration confirmed a tracheostomy between the first and second rings. The patient recovered uneventfully.

Discussion

Although the need for an anesthesiologist to establish a surgical airway is fortunately rare, the "can't intubate, can't ventilate" (CICV) situation requires immediate decisive action to prevent death, brain injury or other adverse outcomes. Although the ASA Difficult Airway Algorithm is not new, opportunities for practice are rare and there is limited scientific evidence to suggest whether needle cricothyrotomy or a surgical airway is the most appropriate last step. Recently, there has been some debate over whether a "needle first" or "knife first" technique is preferred.

Incidence of CICV

In a 2009 review of more than 53,000 anesthetics, Kheterpal et al. reported only four cases of impossible ventilation.[1] The Royal College of Anaesthetists and Difficult Airway Society (NAP4) reported a calculated incidence of emergency percutaneous airway of one in 12,500-50,000 general anesthetics.[2] Stephens, reporting on more than 32,000 emergency intubations from a major U.S. trauma center, reported a total of 31 surgical airways.[3] The ASA Closed Claims Project database contains 466 difficult intubation-related claims.[4] An analysis of these cases reveals that difficult airways arose throughout the perioperative period: 67 percent on induction, 15 percent during surgery, 12 percent on extubation and 5 percent during recovery. In this compilation of lawsuits resulting from airway emergencies, persistent intubation attempts were associated with death or permanent brain damage. Importantly, the laryngeal mask airway (LMA) was not an effective rescue technique in some cases in which multiple, prolonged attempts at conventional intubation were made. Multiple attempts at airway manipulation, as in the case described above, can change a "can ventilate" situation into a CICV due to edema, blood and trauma.

Needle vs. Knife Technique: Which Approach Should Be Used?

The ideal technique should be easy to master, rapid to perform and readily available, with high success and low complications. Thus far, the literature is insufficient to demonstrate the superiority of any one technique; speed and success rates vary widely. No randomized clinical trials exist or are likely to be performed.[5] The minimum number of practice attempts for basic proficiency has been suggested to be five, or demonstration of success time <40 seconds.[6,7] Simulation is likely to be a key avenue for practice, whether on a plastic mannequin model, or using porcine or cadaver tissues. A simulator study has demonstrated greater proficiency in residents than in experienced clinicians.[8]

Although most anesthesiologists endorse familiarity and more confidence in narrow-bore or needle-based techniques,[9] Frerk and Cook recently reported a success rate of only 37 percent for narrow-bore, cannula-over-needle cricothyrotomy, 57 percent for wide-bore cannula techniques, and 100 percent for surgical cricothyrotomy.[2] Familiarity with finding and penetrating the cricothyroid membrane can be gained by

making trans-tracheal block a routine part of topical airway anesthesia for awake fiberoptic intubations.

Following needle cricothyrotomy, a high-pressure ventilation technique must be used to achieve adequate tidal volumes, and gas egress must be ensured via the upper airway. As such, this technique requires specialized equipment that may not be readily available. Kinking or malposition of the airway catheter is common and may result in tension pneumothorax when high-flow oxygen is directed into the paratracheal tissue. Moreover, this technique is not suitable in cases of physical airway obstruction. There are many reported failures, severe complications and deaths as a consequence of the emergency use of high-pressure ventilation via narrow-bore cricothyrotomy. It is not clear whether this is due to an inherently higher risk associated with high-pressure ventilation, or whether due to poor technique and lack of training.[8]

Wide-bore cricothyrotomy may be achieved via a cannula or tube with a >4.0mm ID. This technique has the advantage of allowing gas egress via the cannula and also permitting adequate volumes via a traditional breathing system. A cuffed tracheal cannula or tube is required to guarantee reliable oxygenation and ventilation.

Surgical cricothyrotomy may be achieved by a rapid, four-step procedure: palpation and identification of landmarks, vertical incision through skin and subcutaneous tissue, horizontal incision through the cricothyroid membrane, insertion of a tracheal hook or Miller laryngoscope blade and passage of a small-caliber endotracheal tube. Endobronchial intubation should be expected and tube position adjusted once gas exchange is confirmed. When ventilation is stabilized, an appropriate surgical consult should be obtained for "cleaning up" the wound and conversion to formal tracheostomy (if indicated). Although some bleeding is normal, life-threatening hemorrhage is exceptionally rare and can normally be controlled after re-oxygenation.[6] In one study by Kanji using emergency medicine physicians and a porcine simulator model comparing an "incision-first" (IF) modification to the standard "needle first" (NF) cricothyrotomy, all study participants found the IF hybrid approach easier compared to the NF method.[10] Additionally, the NF technique was significantly faster (median = 53 seconds, interquartile range [IQR] = 45.0 to 86.4 seconds vs. median = 90 seconds, IQR = 55.2 to 108.6 seconds; $p < 0.001$).

Perhaps the most important problem encountered in CICV is a delay in recognition or institution of emergency airway management. This human factors problem is illustrated in the video "Just a Routine Operation" **www.youtube.com/watch?v=JzIvgtPIof4** by Laerdal Medical, in which two anesthesiologists and an ENT surgeon persisted with traditional airway management attempts and failed to act decisively, resulting in the patient's death in an otherwise apparently routine and simple case. While someone clearly needs to make the decision to obtain a surgical airway, both the surgeons and the anesthesiologist may feel uncomfortable in this role. Retrospective studies, including closed claims analysis, demonstrate that most patients are already in cardiac arrest before emergency invasive airway attempts are performed. While decisive and timely action is clearly needed, the decision to pursue a surgical airway is not an easy one; both the surgeons and the anesthesiologist are vulnerable to psychological and human factors barriers that cause them to pause. This delay may be due to a variety of factors, including overconfidence ("I'm sure I can get this… just one more try"); anchoring (inability to shift attention from laryngoscopy attempts to an alternate technique); poor situation awareness (failure to recognize the gravity of the patient's clinical status or the amount of time passed); denial, uncertainty and delay in action due to fear of failure; and (somewhat ironic) subsequent damage to reputation or litigation. In fact, there is little legal risk from a surgical airway attempt – no matter how messy – if the patient survives, but enormous liability if the procedure is not attempted.

References:

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