Learning From Others:

A Case Report From the Anesthesia Incident Reporting System

Anesthesia Quality Institute
ANESTHESIA INCIDENT REPORTING SYSTEM (AIRS)

Review of unusual patient care experiences is a cornerstone of medical education. Each month, the AQI-AIRS Steering Committee abstracts a patient history submitted to the Anesthesia Incident Reporting System (AIRS) and authors a discussion of the safety and human factors challenges involved. Real-life case histories often include multiple clinical decisions, only some of which can be discussed in the space available. Absence of commentary should not be construed as agreement with the clinical decisions described. Feedback regarding this article can be sent by email to Heather Sherman: **h.sherman@asahq.org**. Report incidents or download the AIRS mobile app at **www.aqiairs.org**.

Case 2016-2: Surgical Flash Fire

Patient to undergo an eyelid procedure. Initially attempted with spontaneous ventilation and propofol infusion. Nasal cannula to administer supplemental oxygen to maintain adequate saturations. Patient at the beginning of the procedure either apneic or moving. Decision made to place LMA. LMA inserted without difficulty and propofol infusion continued. Nasal cannula oxygen was not turned off and when cautery was used on the wound a spark caused the eyelashes of the right eye to burn. No burn to conjunctiva or eyelids. Only loss of approximately 1/3 of the length of upper and lower eyelashes. Oxygen to nasal cannula turned off and case concluded without further events.

Discussion:

Burns due to a fire sparked by surgical electrocautery are one of the most devastating perioperative injuries. The resultant disfiguring injuries may require extensive treatment and may lead to lifelong disability. The case above describes a small procedure on the head or neck under sedation, with supplemental oxygen supplied via nasal cannula. Fortunately, there appeared to be little injury, but this case highlights several classic points about O.R. fires. Most specifically, patients are at increased risk of surgical fire during procedures on the head, neck and upper chest where the required elements of the fire triad are frequently in close proximity (see figure below).

Oxygen and nitrous make potent oxidizing agents. Surgical drapes and alcohol-based skin preparation solutions are flammable. Every package of alcohol-based topical antiseptics carries boldfaced warnings of flammability. The labeling for alcohol-based surgical prep sticks specifically state that large-volume applicators are not to be used on the head or neck under any circumstance. Further, no draping or use of ignition source should occur until the skin is dry, which takes three minutes for hairless skin and up to one hour in hair. Any pools of antiseptic should be soaked up with sterile gauze. While the skin preparation for the eyelid procedure in this case was not described, it could be that an alcohol-based solution was used that wet the eyelashes and failed to dry. Finally, the electrocautery and lasers, both frequently used on the head, neck and airway, are potent sources of heat. Because of the risks, some departments have taken the draconian step of prohibiting supplemental oxygen in any head or neck case performed with sedation.

The change in anesthetic plan is an important contributing factor in this case. Deviation from the usual course of anesthesia sets the stage for complications later on. In this case, the team had difficulty maintaining anesthesia using propofol infusion with a nasal cannula, so an LMA was inserted. The nasal cannula was attached to a separate oxygen output on the anesthesia machine, allowing oxygen to continue to pour into the surgical field even though it was no longer necessary.

Even if the case could have been continued with sedation, the use of a decreased concentration of oxygen via the nasal cannula might have been considered. Patients without significant cardiac or pulmonary disease usually need no more than 30 percent oxygen delivered via nasal cannula. The Anesthesia Patient Safety Foundation recommends that an oxygen blender or the common gas outlet be used to maintain a safe oxygen concentration within the surgical field.[1] If a higher concentration of oxygen is required for safe anesthesia, an endotracheal tube or supraglottic device should be used.

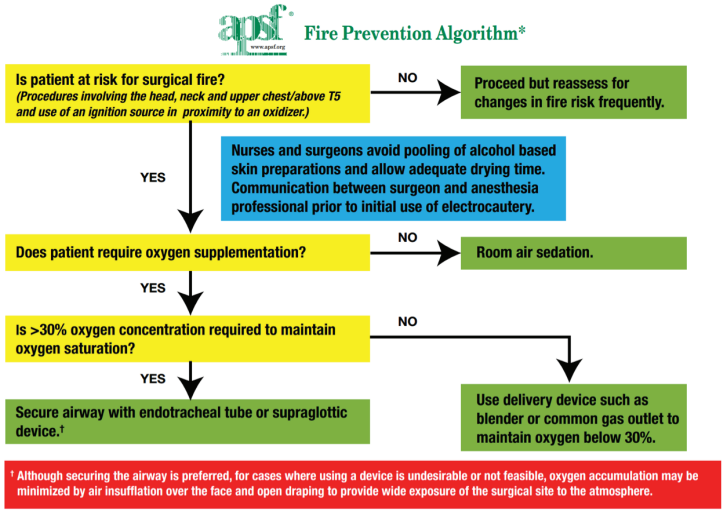
Surgical fire is considered a "sentinel event" by The Joint Commission and a Serious Reportable Event (also known as a "never event") by the National Quality Forum. Although the incidence of O.R. fire is unclear, based on extrapolation of data published by the Pennsylvania Patient Safety Authority in 2012, the ECRI Institute estimates that 200 to 240 fires occur within the United States each year. Others have placed the estimate as high as 650 cases, which would make them as common as wrong-site surgery.[2] A 2013 analysis of the ASA Closed Claims Project database found 103 O.R. fire claims since 1985. Electrocautery was the ignition source in 90 percent of claims, and oxygen was the oxidizer in 95 percent of those fires.[3]

A recent retrospective analysis of the FDA's Manufacturer and User Facility Device Experience (MAUDE) database examined 20 years of reports on surgical energy-based device complications. Of the 178 deaths and 3,553 injuries, 8 percent of complications were fire and 63 percent were burns. Fires were most common with monopolar electrocautery used in head and neck operations.[4]

Despite multiple alerts and increased education of anesthesiologists, surgeons and perioperative staff, surgical fires continue to happen regularly. Communication remains an important and effective intervention to reduce O.R. fires. The risk of fire should be explicitly discussed preoperatively and as part of the procedure time out.[5] It is likely that most of us do not do this routinely. The time out was created specifically to decrease the risk and rate of wrong-site surgery (a goal that has yet to be achieved). There is no national standardized pre-procedure communication to prevent fires. The time out period, though, provides an opportunity to continue the communication between the anesthesia and surgical teams, especially when electrocautery is used and the concentration of supplemental oxygen may change. It also allows for the applied antiseptic to dry.

In addition to good communication, surgical drapes should be arranged to minimize accumulation of oxygen and nitrous oxide near the surgical site. Intraoperative monitors should be used to assess the oxygen concentration in and around the nasal cannula or trachea. If it is absolutely necessary to provide open oxygen delivery, the minimum concentration required should be used and the flow stopped prior to electrocautery. Head and facial hair can be coated with surgical lubricating jelly to reduce flammability.[6] The above recommendations for prevention must be reinforced with regular educational activities, including simulation drills, training videos and online courses.

Of note, this topic has reached the lay press, including the "Today" show and NBC news. Anesthesia and surgery personnel should be prepared to reassure concerned patients about the risk of fire, especially before high-risk procedures.[7,8]



Conclusion

The injury this patient sustained was serious, but could have been far worse. Once the fire was identified, the anesthesia team shut off the supplemental oxygen and avoided a larger burn. The patient and anesthesiologist were both lucky. Even if little or no injury occurs, the event can be terrifying to the patient and the clinicians involved. The "second victims"[9] of an O.R. fire are often anesthesiologists, some of whom focus on surgical fire education to prevent another patient from being harmed. It is up to you, the anesthesiologist, to prevent surgical fires.

References:

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