Patient Safety Tip of the Week

October 1, 2013

Fuels and Oxygen in OR Fires

A new study on flammability of surgical drapes and materials raises some new points but reinforces much more strongly some old ones. Researchers assessed the flammability at various oxygen concentrations of surgical drapes, gowns, towels, and other materials commonly found near patients in the OR (Culp 2013). As expected, they found that the ignition times and total burn times decreased as the oxygen concentration increased. Some materials, such as utility drapes and surgical gowns, did not support combustion in room air. As such, they would meet Consumer Product Safety Commission (CPSC) standards. However, at 50% oxygen concentrations they would readily burn and would not meet CPSC standards for consumer wear. They did find some difference in flammability of materials based on characteristics of the material. For example, laparotomy sponges, which are woven, burned more readily than blue operating room towels even though both are made of 100% cotton. They speculate that the open weave of the laparotomy sponge allows for more exposure to oxygen. However, they also noted that flash fires (rapidly moving flames that appear to be almost instantaneous and may or may not lead to a base material burn) were seen on the blue operating room towels and laparotomy sponges in oxygen-enriched environments.

They note that such flash fires occur so rapidly that operating room personnel could not possibly respond effectively. Hence, efforts at fire prevention are crucial.

And while the authors recommend that further research should be undertaken to identify materials that are less flammable, they restress the importance of supplemental oxygen in surgical fires. That is also the gist of the accompanying editorial (Eichhorn 2013). Eichhorn points out that many anesthesiologists fail to recognize the great risks caused by open supplemental oxygen (nasal cannulae or perforated facial masks used with 2 or 3L/min oxygen flow) during monitored anesthesia care (MAC). That is certainly supported by the malpractice claims study we highlighted in our June 25, 2013 Patient Safety Tip of the Week "Update on Surgical Fires". In that study (Mehta 2013) 99% of cases involved procedures known to be high risk for fires (head, neck, or upper chest surgery), electrocautery was the ignition source in 90%, and oxygen was the oxidizer in 95%. The vast majority of claims were for fires that occurred during monitored anesthesia care rather than general anesthesia and in the vast majority of claims involving monitored anesthesia care the oxygen was delivered by an open delivery system. There

has been a trend for surgical/OR fires to be seen more often in relatively minor surgery (eg. plastic procedures, removal of skin lesions, temporal artery biopsies, etc.), done under sedation or monitored anesthesia care where there is open delivery of oxygen.

Eichhorn notes that **eliminating open delivery of supplemental oxygen during upper body MAC procedures** has been a focus of the Anesthesia Patient Safety Foundation. He notes that supplemental oxygen is overused and in many cases is unnecessary. Though he does discuss some less reliable strategies to mitigate the oxygen risk, he stresses that the patient who truly needs oxygen should receive it via a laryngeal mask or endotracheal tube. The recently updated ASA Practice Advisory for the Prevention and Management of Operating Room Fires (Apfelbaum 2013) also stresses that.

Eichhorn also notes that residual alcohol-based prep solutions will also burn faster and more intensely in higher oxygen concentrations. We discussed the role of alcohol-based skin preps or other volatile substances in our April 24, 2012 Patient Safety Tip of the Week "Fire Hazard of Skin Preps, Oxygen" and our June 25, 2013 Patient Safety Tip of the Week "Update on Surgical Fires".

After a patient suffered burns to the neck and shoulders from a fire during an emergency surgical procedure, one hospital (Natt 2013) recently implemented a policy prohibiting alcohol-based skin preps in any emergency surgery that does not allow sufficient drying time (usually 3 minutes or longer). Instead they have gone back to non-alcohol-based preps like Betadine for such emergency cases.

While we still recommend every organization perform drills on how to respond to OR fires, we concur with Culp and colleagues and Eichhorn that the focus needs to be on prevention. We've emphasized in the numerous columns below the need to include a fire risk assessment in your pre-procedure "huddle" and include this in your Surgical Safety Checklist. Eichhorn points out that our training in anesthesiology residency programs (and inservicing and continuing medical education for previously trained anesthesiologists) must focus on the need to avoid open delivery of oxygen in procedures done under MAC.

Our prior columns on surgical fires:

Patient Safety Tips of the Week:

- December 4, 2007 "Surgical Fires"
- April 29, 2008 "ASA Practice Advisory on Operating Room Fires"
- December 13, 2011 "Surgical Fires Again"
- April 24, 2012 "Fire Hazard of Skin Preps Oxygen"
- June 25, 2013 "Update on Surgical Fires"

What's New in the Patient Safety World columns:

- November 2009 "ECRI: Update to Surgical Fire Prevention"
- January 2011 "Surgical Fires Not Just in High-Risk Cases"
- March 2011 "APSF Fire Safety Video"
- November 2011 "FDA Initiative on Preventing Surgical Fires"
- April 2013 "Reminder: Hand Sanitizers Are Flammable"

Update: See our Patient Safety Tips of the Week for August 12, 2014 "Surgical Fires Back in the News" and December 16, 2014 "More on Each Element of the Surgical Fire Triad".

References:

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