

Preventing Surgical Fires

Surgical fires, while not a common occurrence, are extremely dangerous events that can result in significant patient burns, disabilities and potentially death. Over 200 surgical fires occur each year and most, if not all, are preventable. Surgical fires are caused by combining an ignition source, a fuel and an oxidizer. Ignition sources are things that produce heat, such as electrosurgical units, electrocautery devices, lasers, fiberoptic cables, light sources, drills, saws, and defibrillators. Fuel sources are items that are flammable such as sheets, gowns, hair and drug products including aerosol adhesives, alcohol, degreasers, numbing agents (ethyl chloride), skin preps with alcohol (70% or greater such as ChloroPrep, DuraPrep, Prevail-FX), wound dressings containing tincture of benzoin (with 74-80% alcohol) or collodion, eye lubricants and ointments containing petrolatum (petroleum jelly), and white wax. Oxidizers found in the hospital include oxygen and nitrous oxide.

Fires commonly occur in electrosurgical units that utilize lasers, oxygen-rich atmospheres, and alcohol-based surgical preps. Alcohol-based prep solutions need to dry completely, or fully evaporate, before draping to prevent risk of fire. However, a drape, gauze, or other source may very easily serve as the fuel source as well. One recently reported fire involved the use of Gebauer's Ethyl Chloride spray, a numbing agent. The label includes a small flame symbol on the front as well as buried text on the side label stating it should never be used near an open flame or electrical cautery equipment. Another report involved the use of Chloraprep One-Step with Tint (2% chlorhexidine gluconate, 70% isopropyl alcohol), an antiseptic surgical skin prep solution. In this case, the solution may have dripped onto the patient's hair. Drapes and ignition sources such as cautery should be avoided until the solution is completely dry which can take a minimum of three minutes on skin without hair and up to one hour in hair. In addition, the 26 mL applicator should not have been used for this head and neck surgery and the anesthesiologist should have stopped the flow of oxygen while the electrosurgical unit was in use.

The following recommendations may help prevent surgical fires:

- Inventory all flammable pharmaceutical products (i.e. surgical preps and ointments) used in procedural areas such as operating rooms, physician offices, clinics and ambulatory surgery centers.
- Evaluate the need for each flammable pharmaceutical product and look for safer alternatives, particularly for topical anesthetics.
- Raise awareness for all healthcare providers about the dangers of flammable pharmaceutical products and the possibility for burns if the products are used with an ignition source and oxidizer.
- Utilize auxiliary labeling on packages prior to dispensing to warn about flammability and directions for proper use, particularly if the manufacturers' warning labels are not prominent.
- Select appropriately sized prefilled applicators of alcohol-based surgical skin prep solutions for the area to be covered to reduce excess prep.
- Avoid pooling, spilling or wicking of flammable skin prep during or after application.
- Ensure the skin prep has adequate time to dry before applying drapes or surgical barriers or beginning the procedure. Most alcohol-based skin preps need at least three minutes to dry. If applied to hairy skin or body folds, it may take up to one hour to dry. Protect the patient's hair

References

1. Institute for Safe Medication Practices. (2018). *Nurse Advise-ERR*. Retrieved from Institute for Safe Medication Practices: <http://www.ismp.org/newsletters/nursing/issues/NurseAdviseERR201804.pdf>

from alcohol-containing solutions. Include drying times on safety checklists to enhance communication between the surgical team.

- Clean up spilled or pooled skin prep agents and remove excess flammable prep solutions or ointments from the room prior to the use of any ignition source. Dispose of unused flammable skin prep properly to decrease risk of fire.
- Limit the routine use of supplemental oxygen if the patient can maintain a safe oxygen saturation. If the patient cannot maintain a safe oxygen saturation without supplemental oxygen, secure the airway with a laryngeal mask airway or tracheal tube. If open oxygen delivery is needed, administer the minimum concentration required to maintain an appropriate saturation.
- Contemplate including a “Surgical Fire Risk Assessment Score” to the preoperative time-out process that obligates the surgical team to identify any flammable materials, oxidizers, and ignition sources that will be used during the procedure. The checklist should help assess the risk of a surgical fire and facilitate a plan to reduce risk.
- Provide annual training including:
 - Information on causes, prevention, and methods to extinguish surgical fires.
 - Directions for use for all flammable surgical skin preps and ointments.
 - Instructions on controlling ignition sources, managing fuels, and minimizing oxygen- and nitrous oxide-enriched settings.
 - Required attendance at an annual training program for all staff who work in procedural areas including nurses, nurse practitioners, surgical assistants, anesthesia providers and physicians.
 - Surgical fire drills after training to assess effectiveness.

References

1. Institute for Safe Medication Practices. (2018). *Nurse Advise-ERR*. Retrieved from Institute for Safe Medication Practices: <http://www.ismp.org/newsletters/nursing/issues/NurseAdviseERR201804.pdf>