



Sentinel Event Alert

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Preventing surgical fires

In the fire triangle—heat, fuel and oxygen—each element must be present for a fire to start. And, though the incidents are significantly under-reported, too often all three elements come together in a hospital's surgical suite, yielding disastrous consequences. Though they are considered rare occurrences in the health care environment, surgical* fires are certainly one of the most frightening and devastating experiences for everyone involved. While exact numbers are not available, of the more than 23 million inpatient surgeries and 27 million outpatient surgeries (1), (2) performed each year, estimates—based on data from the Food and Drug Administration (FDA) and ECRI, an independent nonprofit health services research agency—indicate that there are approximately 100 surgical fires each year, resulting in up to 20 serious injuries and one or two patient deaths annually. (3)

Root causes identified

To date, two cases of operating room* fires have been reported to the Joint Commission for review under the Sentinel Event Policy, each resulting in serious injury to the patients. In nearly all cases studied by the FDA, ECRI and JCAHO, the cause of the fire can be attributed to activities relating to a side of the fire triangle. ECRI's recent analysis of case reports reveals that the most common ignition sources are electrosurgical equipment (68 percent) and lasers (13 percent); and the most common fire location is the airway (34 percent), head or face (28 percent), and elsewhere on or inside the patient (38 percent). An oxygen-enriched atmosphere was a contributing factor in 74 percent of all cases. (3)

A host of flammable materials are found in the surgical suite, from the wide range of alcohol-based prepping agents and linens such as drapes, towels, gowns, hoods and masks; to the multiple types of dressings, ointments and equipment and supplies used during surgery. Common ignition sources found in the OR are electrosurgical or electrocautery units (ESUs, ECUs); fiberoptic light sources and cables; and lasers. In addition, ESUs, lasers and high-speed drills can produce incandescent sparks that can fly off the target tissue and ignite some fuels, especially in oxygen-enriched atmospheres.

Risk reduction strategies

"The basic elements of a fire are always present during surgery and a misstep in procedure or a momentary lapse of caution can quickly result in a catastrophe," says Mark Bruley, vice president, Accident and Forensic Investigation, ECRI. "Slow reaction or the use of improper fire-fighting techniques and tools can lead to damage, destruction or death." Bruley notes that virtually all surgical fires are preventable and that their impact can be lessened through an understanding of fire and how to fight it. "Each member of the surgical team—the surgeon, the anesthesiologist, and the nurses—controls a specific side of the triangle and by properly managing their technique and part of the equation, surgical fires can be avoided," says Bruley.

ECRI offers a free poster entitled *Only You Can Prevent Surgical Fires* that summarizes preventative recommendations based on the organization's more than 25 years of research and publication on surgical fires. The poster is available at http://www.mdsr.ecri.org/static/surgical_fire_poster.pdf. These recommendations include:

- Staff should question the need for 100 percent O₂ for open delivery during facial surgery and as a general policy, use air or FiO₂ at <30 percent for open delivery (consistent with patient needs).
- Do not drape the patient until all flammable preps have fully dried.
- During oropharyngeal surgery: Soak gauze or sponges used with uncuffed tracheal tubes to minimize leakage of O₂ into the oropharynx, and keep them wet; and moisten sponges, gauze and pledgets (and their strings) so that they will resist igniting.
- When performing electrosurgery, electrocautery or laser surgery: Place electrosurgical electrodes in a holster or another location off the patient when not in active use; and place lasers in STANDBY when not in active use.

Also, ECRI recommends that staff should participate in special drills and training on the use of fire-fighting equipment; proper methods for rescue and escape; the identification and location of medical gas, ventilation, and electrical systems and controls, as well as when, where, and how to shut off these systems; and use of the hospital's alarm system and system for contacting the local fire department.

Joint Commission recommendations

Joint Commission recommends that health care organizations help prevent surgical* fires by:

1. Informing staff members, including surgeons and anesthesiologists, about the importance of controlling heat sources by following laser and ESU safety practices; managing fuels by allowing sufficient time for patient prep; and establishing guidelines for minimizing oxygen concentration under the drapes.
2. Developing, implementing, and testing procedures to ensure appropriate response by all members of the surgical team to fires in the OR*.
3. Organizations are strongly encouraged to report any instances of surgical fires as a means of raising awareness and ultimately preventing the occurrence of fires in the future. Reports can be made to Joint Commission, ECRI, the Food and

Drug Administration (FDA), and state agencies, among other organizations.
Resources

ECRI offers a clinical website called "Medical Device Safety Reports" where published articles and educational posters on surgical fires are available free of charge; go to <http://www.mdsr.ecri.org/> and enter "fires" into the Search Terms line.

Bibliography

1. Hall MJ, Owings MF. 2000 National Hospital Discharge Survey. Advance data from vital and health statistics; No 329. Hyattsville, Maryland: National Center for Health Statistics. 2002.
2. Hall MJ, Lawrence L. Ambulatory surgery in the United States, 1996. Advance data from vital and health statistics; no. 300. Hyattsville, Maryland: National Center for Health Statistics. 1998.
3. ECRI. A clinician's guide to surgical fires: how they occur, how to prevent them, how to put them out [guidance article]. Health Devices 2003; 32(1):5-24. To purchase a copy, contact ECRI at (610) 825-6000, ext. 5888.

* The terms surgical and operating room include all invasive procedures and the locations where they are done.

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