

CHUBB®

Surgical Fires:

Three Steps Toward Reducing
Clinical Risk and Impact



As the use of high-tech and high temperature devices in oxygen-rich settings proliferates, hospitals and ambulatory surgical centers are keenly focused on the risk of flash fires. Each year as many as [650 fire events](#) in operating rooms (ORs) are reported across the U.S.

When they occur, organizations can face reputational damage and significant liability exposure for patient injury, including death in the rare case. In fact, according to one recent study of 139 lawsuits involving operative burns and surgical fires, 60 of the incidents resulted in a plaintiff settlement or verdict, with [damage awards as high as \\$518,000 and a median payout of \\$215,000](#). With the current litigation environment returning “[nuclear](#)” verdicts aided by social inflation, damage awards have the potential to increase substantially.

Given the clinical and financial impact of fire incidents, the Joint Commission requires accredited organizations to report their occurrence under its [Sentinel Event policy](#), which defines the risk exposure as:

“Fire, flame, or unanticipated smoke, heat, or flashes occurring during direct patient care caused by equipment operated and used by the organization. To be considered a sentinel event, equipment must be in use at the time of the event; staff do not need to be present.”

Of note, since the onset of incident tracking by the Commission in 2015, [fire occurrences have been steadily on the rise in healthcare settings](#), increasing annually for the last five consecutive years.

The marked and upward trend in fire events serves to spotlight the necessity of fire awareness and prevention in ORs and procedural suites. This Chubb publication examines the source of fires and focuses on three central components of a successful fire prevention strategy, including staff education, adoption of fire prevention and response protocols, and pre-procedure risk assessment.



The Fire Triad

The occurrence of a surgical fire requires the simultaneous presence of three hazards. Known as the “fire triad,” they are:

- **Fuel**, including alcohol-based antiseptic skin preparations, surgical drapes and linens, patient gowns, wound dressings and bodily hair.
- **Oxidizer**, including oxygen administered to patients, as well as nitrous oxide and ambient air.
- **Ignition**, including electrosurgical devices, electrocautery units, high speed drills, lasers and fiber-optic light devices and other spark producers.

The most common anatomical locations for burns are the patient’s head, face and airway. Patients with surgical site incisions above the xiphoid are at greatest risk, as well as those receiving supplemental oxygen via a cannula or face mask.

For a checklist of clinical actions that surgical team members can take to minimize the threat of fire hazards, see “Mitigating the Fire Triad” on page 3.

Key Prevention Steps

1. Increase Staff Awareness

Staff education and training programs are critical to reducing the fire hazards posed in oxygen-rich surgical and invasive procedure settings. Documented annual programs for physicians, CRNAs, OR nurses and surgical technicians should emphasize, at a minimum, the following “how-to” safety points:

- scavenge excess levels of O₂ with monitored anesthesia care procedures,
- turn off anesthetic gases,
- deactivate ventilation and electrical systems,
- activate a fire alarm and the clinical response sequence,
- operate a fire extinguisher, and
- manage an airway fire.

Several professional organizations have issued evidence-based practice guidelines that can supplement staff educational curriculum, including these:

- **Anesthesia Patient Safety Foundation:** [Surgical Fire Prevention: A Review](#).
- **Association of periOperative Registered Nurses (AORN):** [Evidence-based Guideline Essentials](#), including guidelines in the areas of Laser Safety, Electrosurgery Safety and Environment of Care, among others.
- **AORN:** [Fire Safety Tool Kit](#). (AORN Membership required to access).
- **ECRI:** [Surgical Fire Prevention](#).
- **Society of American Gastrointestinal and Endoscopic Surgeons:** [a video on OR Fires and Prevention](#).

Mitigating the Fire Triad

Fuel	Does the circulating nurse or surgical technician...	Yes/No
	Confirm that the patient was instructed preoperatively to refrain from applying lotions, creams, cosmetics and other potentially flammable products to the skin prior to surgery?	
	Allow alcohol-based antiseptic skin preparations to dry for a minimum of three minutes, and verify that there is no residual pooling before draping the patient?	
	Assess draping to ensure there is no tunneling between an oxygen source and the surgical field?	
	Prepare saline soaked sponges, gauze and towels for the surgical/procedural field?	
	Verify ready-access to sterile water or saline solution?	
	Place fiber-optic light sources in an “off” position and away from a fuel source when not in use?	
	Secure electrocautery units in an appropriate holster in between use?	
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Oxidizer	Does the anesthesiologist or CRNA...	Yes/No
	Inspect surgical draping to ensure the risk of oxygen accumulation is reduced?	
	Avoid the use of nitrous oxide in procedures involving the head, neck or face, when clinically appropriate?	
	Evaluate the need for supplemental oxygen and titrate levels to the minimum concentration required to maintain adequate oxygen saturation?	
	Consider the use of an endotracheal tube or face mask in the event an oxygen concentration exceeds 30 percent?	
	Reduce or discontinue oxygen one minute prior to the use of an ignition source, when clinically appropriate?	
	Capture leaking oxygen in low-lying levels with a suction apparatus?	
	Utilize a cuffed endotracheal tube for airway surgery, when appropriate?	

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2. Implement Fire Prevention and Response Protocols

Detailed policies that delineate the roles and responsibilities of surgical team members help to mitigate fire risk and are integral to a fire safety program. Each team member should be authorized to halt a procedure if unsafe conditions arise and, in the event of a flash fire, activate a formal response protocol that directs members to take the following immediate actions to minimize patient injury:

- a. Stop the flow of breathing gases.
- b. Extinguish and remove all burning materials.
- c. Apply sterile water to affected bodily areas.
- d. Provide first aid.
- e. Evacuate the OR, if required.

Written protocol also should instruct staff to save burned materials and damaged equipment for subsequent investigation and formal event debriefing.

In addition, regularly scheduled fire drills — held in close collaboration with local fire departments and the state fire marshal — are an essential fire response strategy. Mock scenarios present an ideal opportunity to assess staff members’ competencies, including their appropriate use of safety supplies, knowledge of where to locate and operate emergency equipment, and how to report a surgical fire to the appropriate internal and external authorities. For a review of the Joint Commission’s fire drill requirement, see Pratt, C. “[Hospital Fire Drill Requirements for Surgical Areas](#)”, posted on March 31, 2022.

3. Perform Pre-procedure Fire Risk Assessments

Fire prevention requires the surgical team to verify the safety-readiness of a procedural environment prior to the start of the event. Standard and digitized risk assessments are becoming common practice in general ORs, as well as other settings where surgical and/or invasive procedures are performed, including endoscopy suites, obstetrical ORs, special procedure units and ambulatory surgical centers. The assessment protocol may vary by setting, but typically consists of documented responses to the following basic inquiries, among others:

- Is the procedure being performed above the xiphoid process or in the oropharynx?
- Is an alcohol-based skin antiseptic or other flammable solution being used preoperatively?



Mitigating the Fire Triad

Ignition	Does the surgeon...	Yes/No
	Document the safe functionality of surgical equipment that may give rise to ignition?	
	Consider alternative ignition sources for head, neck and upper chest surgery when O2 concentrations exceed 30 percent?	
	Communicate to the surgical team before the use of an energy source?	
	Activate electrocautery instruments only when the tip is visible?	
	Use high temperature devices at their lowest effective setting?	
	Assess all surgical instruments pre-procedure for evidence of insulation failure (e.g., loose wires, frayed connections)?	
	Place ignition sources in a location safely away from the patient or in the "off" position when not in use?	
	Irrigate the surgical site when using drills and saws?	



- What are the fuel, oxygen and ignition sources present in the procedural environment?
- Does selected surgical equipment reflect an up-to-date preventive maintenance sticker, confirming its recent inspection for safe functionality and compliance with electrical safety requirements?
- Is open oxygen or nitrous oxide being administered?
- Is an electrosurgical device, laser or fiber-optic light being used?
- Is there ready access to saline solution?
- Has the surgical team identified and discussed known risks, and devised interventions to prevent a fire?

For a sample assessment tool and fire prevention assessment protocol from the AORN, see [Fire Prevention Assessment Tool](#) and [Fire Prevention Assessment Protocol](#). (AORN Membership required to access).

Any invasive procedure contains the inherent risk of a flash fire when the triple threat of fuel, oxidizer and ignition are present. Routine staff educational initiatives on fire safety principles and the adoption of established safety protocols play an important role in minimizing fire-related errors. By proactively assessing the environment for hazards, carrying out procedures in a safety-conscious manner, and communicating clearly and frequently, surgical teams can help protect patients from injury while minimizing exposure to allegations of negligence.

Resources

Jones, T. et al.
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“[Surgical Fire Safety](#).”
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