Reducing the risk of surgical fires is a new 2005 National Patient Safety Goal for ambulatory care organizations, including ambulatory surgery centers (ASCs), accredited by the Joint Commission on Accreditation of Health-care Organizations. (The goal does not apply to hospitals.)

The goal has 2 elements:

- educating the staff, including licensed independent practitioners (such as physicians and anesthesia providers), about controlling heat sources and fuels
- establishing guidelines to minimize oxygen concentration under the drapes.

What is the hazard?

The greatest hazard leading to surgical fires is oxygen-enriched atmospheres under the drapes. Three out of 4 surgical fires are oxygen enriched from open oxygen sources, according to data from ECRI, a nonprofit health care research organization in Plymouth Meeting, Pa.

Oxygen-enriched atmospheres are common in ambulatory surgery because an increasing number of procedures are performed under monitored anesthesia care (MAC) with the frequently perceived need to provide supplemental oxygen.

“Whenever you deliver 100% oxygen through a tube to the face, you run the risk of creating a hazardous oxygen-enriched atmosphere under the drapes,” says Mark Bruley, ECRI’s vice president for forensic investigation, who has investigated surgical fires for 25 years.

The high oxygen levels under the drapes can seep to the area of the fenestration, reaching the surgical site where energy sources like electrosurgery or lasers are being used.

High oxygen concentrations are especially hazardous in head and neck or upper chest surgery because the heat sources are near where oxygen is flooding the patient’s face.

“When concentrations reach 40% to 50% or higher, they can create conditions for an oxygen-enriched flash fire—with the fire being easily ignited on the surgical towels, the patient’s hair, and the surgical drapes, in most cases.”

Bruley outlined practical ways to meet the safety goal based on ECRI’s research.

Establish guidelines

To meet the goal’s requirement to minimize oxygen concentration under the drapes, he suggests that ASCs develop a policy and procedure. (He added that even though JCAHO did not make preventing surgical fires a 2005 National Patient Safety Goal for hospitals, hospitals still need to be proactive in reducing the risks of surgical fires.)

A good reference is ECRI’s free 8 1/2 x 11 in poster, Only You Can Prevent Surgical Fires. A new edition was issued in July.

The poster addresses specific steps for reducing fire risk:

- at the start of surgery
- with open delivery of supplemental oxygen
- during oropharyngeal surgery
- when using electrosurgery, electrocautery, or lasers.

The poster notes that the recommendations need to be considered individually for each patient.

“Everything that needs to be written into a policy and procedure is in the bullet points in this poster,” Bruley says. “It summarizes more than 25 years of investigation and teaching on surgical fire prevention.”
In fact, he says, the policy and procedure could simply refer to the poster, stating: “We have incorporated the following guidelines to be employed by the surgical, anesthesia, and nursing staff.” The poster could then be attached to the policy.

The poster is on the OR Manager web site at www.ormanager.com under the OR Manager Toolbox. Large, colorful versions of the poster are available for purchase from ECRI at www.ecri.org

**Provide education**

Meeting the goal’s requirement for education needs to be an interdisciplinary effort, Bruley points out.

Areas to emphasize in education:

- The guidelines and the policy for minimizing oxygen concentration.
- Fuels, including alcohol-based prep solutions. The team needs to make sure alcohol-based prep solutions are completely dry before the patient is draped, Bruley notes. Among preps that contain alcohol are DuraPrep, ChloraPrep, and Prevail, as well as alcohol straight from the bottle.
- Heat sources, such as electrosurgery, electrocautery, lasers, and fiberoptic light sources. In 68% of surgical fires, the ignition source is electrosurgery.
- Ophthalmic lasers do not appear to be an ignition source in fires, however. “We have never heard of a fire involving an ophthalmic laser,” Bruley says. The energy level in these lasers is low, and the beam is restricted.

Be sure to document attendance at education sessions in case surveyors ask to see evidence that education was conducted.

**Encourage collaboration**

Education has to involve all disciplines, Bruley stresses.

That includes encouraging surgeons and anesthesia providers to collaborate in minimizing oxygen concentration under the drapes. “That has been the most difficult fire prevention issue in my experience,” Bruley says.

ECRI advises that, in general, during head and neck surgery, open oxygen delivered to the face should be at concentrations of 30% or less.

Anesthesia providers typically want to give 100% oxygen for supplementation. But Bruley questions whether that’s always necessary. For example, is it needed for a 19-year-old boy who is having a piece of pencil lead removed from his forehead, or is it even needed for a healthy patient in her 40s having head-and-neck surgery? Would medical-grade air do just as well?

In almost all of the fires ECRI has investigated, it has found high oxygen levels were given leading up to the fire, with the patient’s pulse oximetry reading at 98% or 99%. But even after the oxygen is turned off, and the patient is breathing only room air, pulse oximetry readings are still at 97% to 99% throughout the remainder of the surgery, suggesting that high levels of oxygen supplementation aren’t always needed.

Most anesthesia machines have the capability of mixing oxygen with medical-grade air to give an oxygen concentration low enough to avoid a flash-fire hazard (at or below 30%), he says.

Probably the most effective safety practice is for surgeons and anesthesia providers to talk to one another during the procedure. For example, during head and neck surgery when open delivery of supplemental oxygen is being used, the surgeon might ask before using electrosurgery, “How much oxygen are we delivering to this patient?” If the level is high, he might wait at least 1 minute while the anesthesia provider stops the supplemental oxygen, if possible, for that patient.

Bruley says he thinks the new Patient Safety Goal “demands that anesthesia providers and surgeons talk to each other about minimizing oxygen concentrations under the drapes.”

**Responding to fires**

Though the focus should be on fire prevention, every facility should have a response plan as part of its safety program, Bruley says.
The Joint Commission in “compliance tips” for meeting the goal recommends that facilities for fire response:

- Implement and test procedures to ensure appropriate response by all members of the surgical team to OR fires.
- Make sure staff is trained in preventing and extinguishing fires. This includes being able to locate and use the fire extinguishers.
- Staff should be prepared for risks for each type of surgery they participate in.

The compliance tips are in a special report on the 2005 National Patient Safety Goals in the September Joint Commission Perspectives on Patient Safety.

The July AORN Journal has articles on fire education and preparedness.

Bruley emphasizes key points about fire response:

- ECRI does not recommend use of fire blankets for surgical fires.
  
  “We believe fire blankets provide a false sense of security in the operating room,” he says. “In a fire where the patient’s hair and OR table drapes are involved, you will likely have only a few seconds to react before the patient is seriously burned.” There is not enough time to get the fire blanket off the wall, unfold it, and apply it to the patient.

  The best approach to extinguishing a drape fire, he says, is to immediately turn off the flow of gases to the patient, pull the drapes and other burning materials off the patient, and extinguish the fire on the floor, either by stamping it out or with a CO₂ fire extinguisher if indicated.

  Other problems with fire blankets are that the blanket may trap oxygen being delivered to the patient that also is feeding the fire, and the fire can continue to burn, Bruley says. Typical wool fire blankets may burn themselves if the oxygen is still flowing to the patient, adding fuel to the fire. The blanket also can cause further injury by displacing sharp instruments left in the sterile field. Another issue is fire blanket packaging, which is not consistent among manufacturers. It may take extra time to figure out how to get the package open.

  For fire extinguishers, ECRI recommends a 5 lb CO₂ fire extinguisher in each operating room.

  “We do not recommend water, dry chemical, or water mist extinguishers,” Bruley says.

  The CO₂ extinguisher should be mounted inside the OR near the entrance.

  A CO₂ extinguisher can extinguish small OR fires on cloth, plastic, or paper as well as any burning liquid or electrically energized fires. CO₂ extinguishers will work in an oxygen-enriched environment. Equally important, CO₂ extinguishers don’t leave a residue and won’t harm the patient, staff, or equipment.

  Fire extinguishers are rarely needed in OR fires.

  “Extinguishers have been used in only 3 or 4 of the hundreds of OR fires ECRI has investigated,” he says.

Resources

ECRI. Only You Can Prevent Surgical Fires. Free poster available at www.ecri.org. Click on green Patient Safety Center logo, then scroll down left side.

ECRI. A clinician’s guide to surgical fires: How they occur, how to prevent them, how to put them out. Health Devices. 2003;32(1):5-24. This article also rates 8 OR fire safety videos, finding 3 worth consideration. Check to see if your facility subscribes or to purchase a copy, call 610/825-6000 ext 5888. The article has been formally accepted by the National Guideline Clearinghouse administered by the federal Agency for Healthcare Research and Quality. The guideline is available at www.guideline.gov/summary/summary.aspx?doc_id=3688&nbr=2914.

Fast facts on surgical fires

At least 50 to 100 surgical fires take place in the US each year.
• 10% to 20% result in serious patient injury.
• One or two are fatal, usually from tracheal tube fires.
• 78% are oxygen enriched from open oxygen sources on the patient’s face.

Ignition sources:
• 68%: Electrosurgery
• 13%: Lasers
• 19%: Other sources such as hot-wire cautery, light sources, and bur sparks

Locations on body:
• 34%: Airway
• 28%: Face, head, neck, chest
• 24%: Elsewhere on body
• 14%: Elsewhere in body