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Modern Surgical Technology and the Danger of Operating Room Fire

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Most people are aware of some of the common risks of surgery, and hospital informed consent forms routinely warn of the danger of infection, pain, anesthesia complications, blood clots and the like. With the increase in the use of technology like electrocautery and surgical lasers, however, a new danger is beginning to garner attention: operating room fires.

A recent study determined that surgical fires rank third among the most common types of technology hazards in the OR, and researchers estimate that surgical fires occur between 550 and 650 times each year in the United States. Unfortunately, these fires regularly have catastrophic consequences because the most common sites of fires are the head, face, neck, and upper chest areas. Some patients recover with scarring and emotional damage. Others, however, are not so lucky. Every year, 20 to 30 patients suffer serious, disfiguring burns resulting in one or two deaths. Interestingly, despite these numbers many surgeons and anesthesiologists remain unaware of this potentially devastating surgical complication.

The reason that surgical technology like electrocautery and lasers can be so dangerous is that they are an ignition source, and so form one part of the “fire triangle.” As discussed below, the other two parts of the triangle – oxygen and fuel – are routinely present during most surgeries. When all three elements combine, disaster can result.

An oxidizer-enriched environment occurs when there is an increase in oxygen concentration above room level, and/or with the presence of a concentration of nitrous oxide. Oxygen sources usually include oxygen from nasal cannulae, nebulizers, and oxygen cylinders. Because oxygen is heavier than air, it can accumulate under a drape and serve as an oxidizing source. As such, doctors are encouraged to use the least amount of oxygen possible. Almost eighty-five percent of reported OR fires occur during sedation for head and neck surgery while using supplemental oxygen.

When it comes to fuel, the OR is full of options. Paper and cloth drapes, antiseptic skin agents, endotracheal tubes, unshaved hair, masks, and a whole host of other supplies can ignite if proper precautions are not taken. Cloth and paper drapes are implicated most often as fuels in OR fires because they are extremely combustible.

In addition to an oxidizer and a fuel source, for an OR fire to start there must also be an ignition source. There are many potential ignition sources in the OR. As mentioned previously, electrocautery devices are the most common source. The temperature at the tip of a cautery instrument can reach several hundred degrees, which is sufficient heat to ignite a fire. Other ignition sources include lasers, overhead and fiberoptic light sources, drills, and burrs. About seventy percent of OR fires are ignited by electrocautery devices, twenty percent are ignited by hot wires, light sources, burrs or defibrillators, and about ten percent are ignited by lasers.

Lasers are a particularly effective ignition source for OR fires. Lasers create small areas of intense heat that can burn through almost anything. Lasers have been reported to ignite throat packs, swabs, tracheal and tracheotomy tubes, clothing, and even patient hair. In addition, a laser may be reflected by metallic surgical equipment, creating fire hazards in other, unexpected areas around the OR.

Preventing OR Fires

There is little doubt that OR fires can easily be prevented. To minimize the risk of these potentially catastrophic fires, hospitals must establish OR fire protocols which educate healthcare professionals regarding the potential of OR fires, require OR fire drills, train healthcare providers to recognize high risk procedures and what must be done to prevent fires during these procedures, and instruct healthcare providers on what must be done to manage an OR fire once one ignites. To be sure, careful coordination and continuous training for all healthcare professionals is required to minimize the possibility of OR fires.

To improve fire safety awareness, anesthesiologists and surgeons must be trained to understand the concepts of fire potential and use techniques to minimize oxidizer-enriched atmospheres, safely manage ignition sources, and safely manage fuel sources. Good communication between surgeons and anesthesiologists regarding the timing and use of the electrocautery or other ignition sources is crucial to allow adequate time for excess oxygen to be eliminated from the surgical field.

The modern OR has a dizzying array of technology that can make surgery more efficient and effective. Without proper precautions, however, that technology can lead to disaster. Fortunately, if all of the members of the health care team work together, operating room fires can be prevented.