

Lap Burn

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<https://psnet.ahrq.gov/web-mm/lap-burn>

The Case

A woman was scheduled for an elective diagnostic laparoscopy for dysfunctional uterine bleeding. After accessing the abdomen with the trocar without complication, the surgeon inserted the laparoscope but found that she needed to reposition the trocar. She removed the laparoscope and placed it on the tray in front of her. After adjusting the trocar, she picked up the laparoscope and noticed the drapes were melted where the distal tip of the scope had been placed. The drapes had been covering the patient, and examination revealed a second-degree burn of the thigh. The burn healed without any scarring.

The Commentary

The patient suffered only a minor burn and had no long-term sequelae; fortunately, the burning drapes were recognized quickly. However, this case highlights both a specific risk of laparoscopic surgery and an associated, more general risk of serious patient harm or extensive damage from fires in the operating room.

The popularity of minimally invasive procedures continues to grow, with over 2.3 million laparoscopies being performed each year in the United States.⁽¹⁾ The many complications of laparoscopic surgery include internal bleeding, infection, and pain from gas distention. Patient burns, though less common, are clearly a morbid complication, accounting for about 5% of laparoscopic injuries.⁽²⁾ Although most laparoscopic burn injuries result from stray electrosurgical current released inside the abdomen, the less common complication of external burns is, as this case demonstrates, a potential hazard.

Surgical suites offer a host of conditions that create risks of fires and patient burn injuries. Most patients are given supplemental oxygen as part of anesthesia. Fuel is present in the form of surgical drapes, sponges, plastic instruments, prepping solutions, and other flammable materials. Heat is provided by electrosurgical devices, lasers, and even light sources for laparoscopic illumination. The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) has recognized the risk of surgical fires and burns and estimates that with approximately 60 million surgical procedures being performed annually, roughly 100 surgical suite fires will occur, causing approximately 20 serious injuries and 1 to 2 deaths.⁽³⁾

Fires or burns related to laparoscopy, such as the one in this case, usually are caused by either instrument malfunction or individual clinician errors. Laparoscopic surgery requires a complex illumination system to provide adequate visualization of an enclosed body cavity. There are two major components to the system: the light source and the light cable. A variety of light sources provide different quality of light and different temperatures. Although these variables depend upon the lamp used, all of them have safety mechanisms in place to minimize the heat generated by the light source.(4) Within the light source is a heat filter to help remove the excess heat produced by the infrared light waves and by the heat buildup resulting from the obstruction within the pathway of the light. Also, light source fans are used to dissipate the excess heat energy while light cable connectors also help disperse the heat.

The light cable is another key component of the illumination system. Laparoscopic light cables are available as fiberoptic or gel-filled. The fiberoptic cables consist of bundles of fragile tiny glass fibers that optically transmit the light through internal reflections. The gel-filled cables consist of a clear liquid optical gel that is capable of transmitting 30% more light than optic fibers.(5) These cables can be more hazardous than fibers, since they transmit more heat.

Given the complexity of the illumination system, instrument or component malfunction can lead to excessive heat generation and result in fires or patient burns. For example, high temperatures may be produced if any of the heat minimizing devices fail within the light source, if different connectors or components are used, or if the light source or light cable is defective. Moreover, heat dissipation may not be effective if different brands of connectors are used. Careful inspection of all instruments and equipment before use is critical and proper maintenance can ensure the equipment is in good working order.

Even when all the heat-dissipating mechanisms are in place and are functioning correctly, the temperature at the distal end of the light cable can reach levels well above the ignition temperature of most surgical drapes. Thus, as in this case, it is clinician mishandling of the laparoscope that often leads to fires and patient burns during laparoscopy. Recognizing this inherent risk in the procedure, experts have offered suggestions specific to the handling of the laparoscope to minimize this risk. For example:

- The light source should not be turned on before the cable is connected to the endoscope because the end of the cable becomes hot and could ignite dry combustibles.(6)
- If the cable is disconnected from the endoscope during surgery, then the cable end should be held away from the drapes or placed on a moist towel to prevent burns and fires.(7)
- Keep illuminated endoscopic light cords away from drapes, patient's skin, personnel's skin, or any flammable material.(8)

All surgeons who perform minimally invasive laparoscopic procedures should be aware of these guidelines, and physicians-in-training should be educated on the importance of handling the laparoscope safely. As well, institutions can implement system changes to minimize the risk of patient burns and fires associated with laparoscopy. Recommendations include labeling all light sources with the following: "Warning: High-intensity fiberoptic light sources and cables can ignite drapes and other materials. Complete all fiberoptic cable connections before activating the light source."(9) Electrosurgical instrumentation that is not being used can be placed in holsters to protect from fires or burns if accidentally activated.(8) Unfortunately, there are no holsters available for laparoscopes at the present time.

The burn in this case was related to individual mishandling of the laparoscope. When the surgeon removed the laparoscope from the body and placed it on the surgical drapes, she should have handed it to the scrub nurse/tech or the first assistant to hold away from the patient and drapes. Another option would have been to turn off the light source when the laparoscope was placed on the drapes. This would have eliminated the light and, therefore, the heat being emitted at the distal tip. Also the light cord could have been disconnected from the scope and held away from the drapes when the laparoscope was removed from the body. Fortunately, the drapes only melted when exposed to the high temperatures; they could have easily been set on fire. These types of complications can be avoided by a few simple measures. If the heat source (the laparoscope or light cable) is kept away from the fuel (the patient or the drapes) within the oxygen-rich environment of the operating room or laparoscopic suite, fires and burns can be eliminated.

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