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Outpatient Surgery

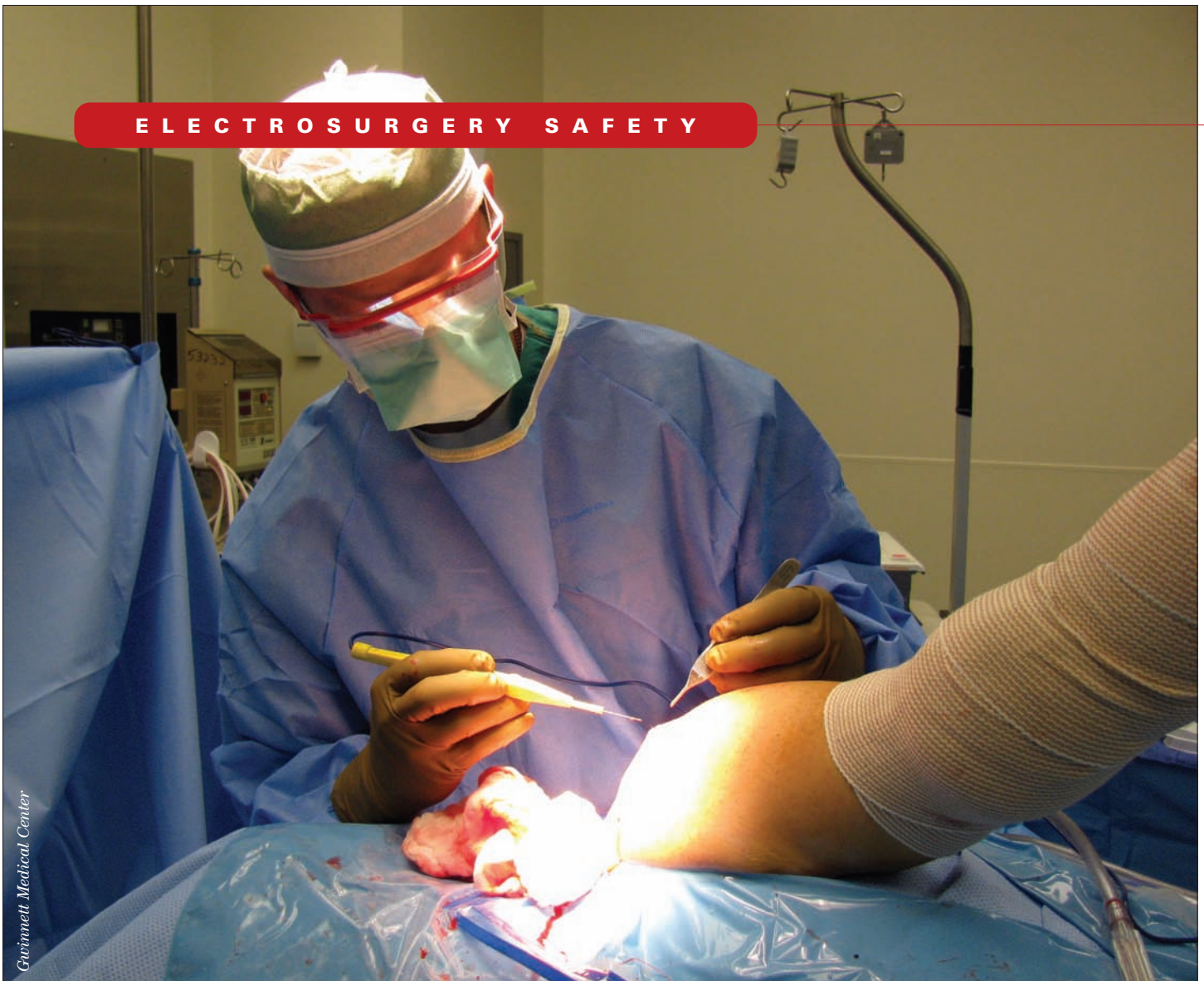
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2009-10 Manager's Guide to

Patient Safety



RAISING THE LEVEL OF PROTECTION IN YOUR ORs



Gwinnett Medical Center

Shield Patients and Staff From Stray Electrical Current

Knowing your electro-surgical equipment can help prevent patient burns and OR fires.

Vangie Dennis, RN, CNOR, CMLSO | Duluth, Ga.

No group of surgical instruments is used as frequently, yet understood as poorly, as electro-surgical units. Because electro-surgery employs high-frequency, high-density electrical current to produce the desired tissue-cutting and -sealing effect, this technology poses a significant safety hazard if staff fail to take the proper precautions. Let's review the basic features of your electro-surgery units and the accompanying devices, products and practices that can help shield patients and staff from stray electrical current.

▲ CONTROLLED CURRENT The active electrode's high current density is contained and protected by a coating of insulation around the conductive shaft.



▲ **WHAT'S THE CONNECTION?** Ensure that all electrode cords are securely plugged into the ESU.

Elements of the ESU

In monopolar electrosurgery, the radiofrequency electrical current generated by your basic electrosurgical unit is conducted through 4 elements: the generator, the active electrode (including insulated cables and delivery device, whether it be a pencil or some other type of tip), the patient and the return electrode. In bipolar electrosurgery, a pair of forceps acts as both the active and return electrode, a method that reduces the risk of electrical current straying as it travels from the patient's tissue (held between the active forceps) back to the generator.

The generator is an isolated system; the electrical current is isolated from the ground in a manner similar to the third-ground wiring in our electrical outlets. This shields the current from other conductors to minimize alternate site burns. While you can often use a generator from 1 manufacturer with electrodes supplied by another manufacturer, compatibility can become an issue in the event of a burn or fire, as you'll have to deal with 2 separate entities to determine where the malfunction occurred.

Every brand of generator has proprietary waveforms, but they're very similar. The ESU will have a

cut entity and coagulation entity, with different components underneath each. It's important for your staff to understand how these waveforms work and how their duty cycles differ. For example, coagulation waveforms have a higher voltage, therefore your staff must be aware of extraneous energy or sparking of the current to nearby tissue. A higher voltage may be ideal for certain types of surgeries, such as a liver resection, but potentially dangerous for others, such as a head or neck procedure where the ESU delivery device is located close to the oxygen supply. Knowing the tissue effects of the different waveforms helps staff anticipate

what types of electrosurgery safety issues are likely to occur during a case and plan care accordingly.

Active electrode safety

Most safety issues associated with the ESU have to do with either the active or return electrode. The active electrode is the delivery device (pencil or instrument) for the electrosurgical current. It has a high current density that is contained and protected by a coating of insulation surrounding the conductive shaft. Potential safety hazards associated with the active electrode include inadvertent tip-to-tissue contact, insulation failures, capacitive coupling (electrical current is induced by means of capacitance to other instruments or tissues) and device interference. In laparoscopic surgery, electrosurgical injuries can result in bowel perforations, excess bleeding, damage to non-target tissue and other complications.

Research shows that 10% to 15% of laparoscopic injuries can be prevented with shielding and continuous monitoring of electrosurgical active electrodes. Closely monitor your instruments' duty cycles and establish replacement plans for your reusable electrodes so you're not caught off guard

when an instrument has run its course. When purchasing laparoscopic electro-surgical devices, make sure the cords and active electrodes have adequate insulation. Single-use electrodes can still have a break in the insulation from shipping defects and can be damaged during the procedure. Reusable electrodes can degrade over time due to wear and tear and reprocessing issues. The manufacturer that supplies your reusable instruments should provide the following information (per the FDA's 510(k) on reusable instruments) to help you properly care for these devices:

- comparison to similar products;
- explanation of how the device meets American Society for Testing and Materials' standards and what test was done;
- validation of sterilization method;
- description of testing;
- sterility assurance level;
- results of ETO by-products/residue;

- detailed instructions that include drawings, disassembly and assembly; and
- the maximum number of sterilization cycles the device can undergo.

Visually inspect active electrodes before, during and after every procedure for impaired insulation. Some devices come with a brightly colored layer of insulation beneath the black top layer to help the naked eye easily identify holes or cuts. Insulation integrity testers detect full-thickness breaks in insulation, but can't detect non-full-thickness breaks or capacitive-coupling leakage current. Use this technology to aid — but not replace — visual inspections of insulation integrity.

Active electrode monitoring is the ultimate protection against both insulation failure and capacitive coupling. This technology senses when there is a primary insulation failure or capacitive coupling and eliminates the threat by shutting down the current from the generator to the active tip. AEM also

6 Pad Placement Pointers

Here are some rules of thumb for the proper placement of quality monitoring pads:

1. Evaluate skin integrity before and after pad placement. The following factors can increase the risk of burns: excessive hair, scar tissue, adipose tissue, bony prominences, fluid invasion, adhesive failure, tattoos, areas distal to tourniquet sites or pressure points and close proximity to an active electrode tip.

2. Make sure the equipment manufacturer validates the pad's compatibility with your ESU.

3. Don't cut, modify or resize the dispersive electrode. Replace it if it gets wet.

4. Assess the conductive gel and the integrity of the plate. Do not pre-open the plate or use it if the conductive gel is dried up.

5. The placement site should be clean, dry and shaven. Be aware that jewelry or piercings located between the active tip and the plate can pose a heightened burn risk. Ideal pad placement sites are well-vascularized with a large muscle mass (the anterior thigh, buttocks, flank, posterior thigh, abdomen or upper arm, for example).

6. Orient the electrode with the long axis of the pad toward the operative site (manufacturer dependent). The entire conductive surface should cover the skin.



▲ **SPOT CHECK** Assess the conductive gel and the integrity of the grounding plate before every case.

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— Vangie Dennis, RN, CNOR, CMLSO



▲ **SHOW ME** Have your staff demonstrate that they can safely use any new electrosurgery device.

Emerging Challenge: New Electrosurgical Devices

A new electrosurgery safety challenge is applying all the knowledge and experience we have with traditional delivery systems to newer electrosurgical devices. These devices, which include radiofrequency ablation systems, monopolar and bipolar orthopedic coagulating devices, new vessel sealing and cutting technologies and the argon beam coagulator, pose many of the same risks that your standard ESU unit does, plus some additional concerns. For example, some of the newer ablation systems have extremely high-wattage delivery, and all of these devices have their own characteristics of waveform delivery and software safety mechanisms.

Don't assume that your staff can transfer the knowledge that they have on the standard operating room ESU to a completely different model. That goes for both new devices and standard ESUs from different manufacturers. Train all users on every new electrosurgical device according to manufacturer specifications so that they can demonstrate their competency and understanding of the safety procedures specific to each device.

— **Vangie Dennis, RN, CNOR, CMLSO**

ensures that capacitively coupled energy travels safely back to the generator through the protective shield and that energy is delivered only to the surgeon's intended site.

In addition to checking the insulation, have your staff ensure proper equipment connections (for example, where the electrode cord plugs into the ESU and where the tip connects to the pencil), use a low-voltage cutting waveform when possible, avoid open-circuit activation (activating the tip before touching tissue) and place active electrodes in safety holsters when they're not being used. Your electrosurgical units should also have audible activation indicators to help prevent active electrodes from inadvertently coming into contact with the patient and other devices.

Keeping patients grounded

There are 2 types of return electrodes: quality conductive return electrodes and capacitive return electrodes. With quality conductive return electrodes, the current passes through the return electrode to the generator. With capacitive return electrodes, the current doesn't pass through the electrode but is instead dispersed evenly.

A quality pad monitors the current density to the skin. If the concentration of the energy becomes too great — for example, from the gel drying up or the pad detaching from the patient — sensors will cause the ESU to stop the current flow. This safety mechanism is characteristic of almost all ESU equipment. When training your surgical team in electrosurgery safety, emphasize the safety characteristics of the type of pads used in your facility. For example, with a capacitive grounding pad, a break in the integrity can potentially let 100% of the energy pass through the defect. Pads may need to be retired after 25 to 30 uses, so staff should visually inspect pads between cases for tears and be mindful of those limited lifespans. **OSM**

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