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GUIDELINE FOR **ELECTROSURGICAL SAFETY**

The Guideline for Electrosurgical Safety was approved by the AORN Guidelines Advisory Board and became effective as of July 29, 2020. The recommendations in the guideline are intended to be achievable and represent what is believed to be an optimal level of practice. Policies and procedures will reflect variations in practice settings and/or clinical situations that determine the degree to which the guideline can be implemented. AORN recognizes the many diverse settings in which perioperative nurses practice; therefore, this guideline is adaptable to all areas where operative or other invasive procedures may be performed.

Purpose

This document provides guidance to the perioperative team for the safe use of electrosurgical units (ESUs), **electrocautery** devices, and argon-enhanced coagulators.

An ESU includes a generator, an electrical cord and plug, and accessories. The accessories include the active electrode with tip(s), **dispersive electrode**, foot switch with cord (if applicable), adapters, and connectors.[1] The electrosurgical generator performs three functions. First, it converts the low-frequency alternating **current** received from the electrical circuit in the wall, which is at 60 Hertz, to approximately 500,000 Hertz (ie, **radio frequency**). The second function enables adjustment of the power setting. The third function controls the proportion of time over which a waveform is produced (ie, the **duty cycle**). These waveforms are known as *cut,* which is heating of the cellular water that leads to the cell bursting; *coagulation,* which causes a temperature rise in the cells leading to cellular dehydration and shrinkage; and *blend,* which is a modulated form of cut that results in an output with a higher voltage than cut at the same power setting.[1,2] The radio-frequency energy produced is transferred to the patient by various modalities, including monopolar, bipolar, advanced bipolar, bipolar ligating-cutting, and tripolar (ie, plasma knife) devices and **argon-enhanced coagulation** (AEC). These modalities are used to cut, coagulate, dissect, ablate, and shrink tissue.

The monopolar modality transfers the energy to the patient through an active electrode that usually has only a single tip. The intended current flow is from the generator through the active electrode cord to the active electrode tip, through the patient to the dispersive electrode, and then through the dispersive electrode cord back to the generator. The monopolar modality requires both an active and a dispersive electrode.[1,2]

The bipolar modality has a two-tip electrode that transfers the energy to the patient. The **current pathway** for this device goes from the generator through the cord to one tip of the forceps, through the tissue between the tips to the other tip, and then back to the generator. The current flows only through the tissue that is between the forceps tips. The only accessory required is the active electrode and the associated cord. **Bipolar electrosurgery** can be used as an alternative to **monopolar electrosurgery** when devices or implants would be in the current pathway between the monopolar active and dispersive electrodes.[1,2]

The advanced bipolar modality uses bipolar electrosurgery with a computer-controlled tissue feedback response system to sense tissue impedance. This allows for the continuous adjustment of the voltage and current generated by the unit. Continuous adjustment permits use of the lowest possible power setting that will achieve the desired tissue effect. The advanced bipolar modality does not require a dispersive electrode and requires less voltage. The energy flows only through the tissue that is between the forceps tips.[1,2] Some of the devices also have a cutting mechanism, allowing for cutting and coagulating of tissue between the forceps tips.[3]

The **tripolar device** has a tripolar tip consisting of a central pole and an outer pole on either side. The current flows from the center pole to the outer poles, creating a corona of energy that makes a blade-like incision. The primary current alternates with a second current that passes from one of the outer poles to the other, resulting in simultaneous cutting and coagulation.[1,3]

Argon-enhanced coagulation, also known as argon beam coagulation, is radio-frequency coagulation from an electrosurgical generator that delivers monopolar current through a flow of ionized argon gas. The risks related to this modality are similar to those for monopolar electrosurgery with the addition of the risk for gas emboli.[4]

The electrical current used by the ESU consistently flows on a pathway from the wall, through the device, to the accessories, through tissue, through the accessories, back to the device, and to the wall. Most adverse events associated with **electrosurgery** are related to the current trying to flow back to ground.[1,3] The majority of adverse events that result from the use of electrosurgery or electrocautery are burns. Burns may be caused by **direct application** that results in **thermal spread** beyond the intended target tissue, **insulation failure**, **antenna coupling**, **direct coupling**, **capacitive coupling**, **residual heat**, or **inadvertent activation** and may be described as **alternate site injuries.**[1,5-12] Adverse events have been reported to occur during various procedures and

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