

### Electrosurgery Safety Update: Patient Return Electrode Warming

Patient return electrode (PRE) warming is not a new topic for the Clinical Information HOTLINE. It was first addressed in the HOTLINE newsletter, "Pad Warming... Patient Comfort or Patient Risk?" in January of 1998. Although five years have passed, the questions concerning pad warming continue:

***Can the PRE be placed in a warmer?***

***Can the PRE be wrapped in a towel with a warm bag of IV fluid?***

***Can the PRE be warmed by any method?***

Questions such as these persist because perioperative nurses are concerned with the well being of their patients. Providing for the patient's comfort is one of the many aspects to consider. This is especially true during surgical procedures when the patient is awake and aware of external stimuli.

It is estimated that 85% of all surgical procedures performed employ the use of electrosurgery. The PRE is an integral part of the monopolar electrosurgical circuit because it removes electrical current from the patient by completing the patient/generator circuit. Improper application or poor conductivity of a return electrode can result in a pad site burn. "Historically, patient return electrode burns have accounted for 70% of the injuries reported during the use of electrosurgery."<sup>1</sup> Consequently, a key objective in return electrode design is to develop a pad that minimizes the heat produced in and under the

return electrode. Less heat produced under the return electrode indicates better thermal distribution, resulting in a safer outcome for the patient.

Since the inception of electrosurgery in 1926, the patient return electrode has taken many forms. Presently there are several types of conductive return electrodes available such as dry conductive adhesives, water-based gels and a patented PolyHesive™ hydrogel. Any of these conductive materials can feel cold, wet, and unpleasant to the awake patient. Warming the return electrode seems to be the logical answer. But is this in the patient's best interest?

Thermal distribution is affected by a pad's ability to uniformly disperse current. When electrical current encounters areas with high resistance (fatty tissue, scar tissue, or bony area) or becomes concentrated in a small area, it produces more heat. When current travels through areas with lower impedance or disperses over a wider area, less heat is produced. "The Association for the Advancement of Medical Instrumentation (AAMI) establishes and maintains the industry standards regulating the safe use of electrosurgery, including patient return electrodes. In 1993, AAMI adopted HF-18, 5.2.3.1 the 'Maximum Safe Temperature Rise Protocol' to establish the safe skin temperature ranges for preventing pad site burns."<sup>2</sup> The temperature of normal resting skin is approximately 33° C and "the AAMI protocol has established a maximum safe temperature rise of 6° C in



Jan Fickling RN, CNOR  
Clinical Product Specialist



Inga Lisa Johnson RN, BSN  
Clinical Product Specialist



Cherie Ryan Loeffler RN, BSN, CNOR  
Clinical Product Specialist

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skin temperature. If there is a temperature rise of 12° C, burns begin to occur.”<sup>3</sup>

Some pads, because of their composition, size, and shape will have different heat distribution.

#### **Dry adhesives:**

Dry adhesive pads are thin and pliable but do not evenly fill contours on the skin; this can potentially concentrate current in areas where the contact is more secure. These pads use acrylic-based adhesives made from pure polymers that actually stick to skin.

#### **Water-based gels:**

Water-based gel pads may have an improved pad-to-patient interface compared to dry adhesives, but caution must be used when storing. These pads should be stored flat to prevent gel migration, which could cause uneven skin contact and heat distribution.

#### **PolyHesive™ hydrogel:**

The PolyHesive™ hydrogel is a substance comprised primarily of deionized water, polyvinylpyrrolidone (PVP) and other proprietary compounds. These components together “enhance conductivity, lower skin resistance, and decrease thermal concentration to minimize the risk of a pad site burn.”<sup>4</sup>

In view of the fact that PolyHesive™ hydrogel contains at least 50% water, **warming the return electrode in any way prior to application is contraindicated.** Warming a hydrogel return electrode could alter the conductive adhesive properties by drying out the pad. Pad dehydration can increase impedance, compromising the safety and effectiveness of heat dispersion at the return electrode. The same may be true for water-based gel pads. Warming may also affect the tackiness of dry adhesive pads to either stick more aggressively or not stick as effectively. If these return electrodes are also split pads, drying can further complicate the operation of a contact quality monitoring\* system by triggering alarms and interrupting power due to detection of high impedance. Before the surgical procedure can continue, the PRE will have to be replaced, adding to patient cost and increased surgical time. “The added measure of safety provided by a contact quality monitoring system is not available with a standard return electrode and therefore dry spots could go undetected, possibly compromising patient safety.”<sup>5</sup>

With the use of any patient return electrode, it is imperative to read the return electrode packaging and instructions for use (IFU) provided with the product. Most PRE package expiration dates are related to “shelf life” not sterility. The

product carton will also indicate how the product should be stored, for example, at room temperature, not in a warm environment. Manufacturers provide these instructions to warrant their product and ensure optimal performance. Unless instructions indicate otherwise, warming return electrodes is not in compliance with product labeling.

Although patient comfort should be considered in contributing to a positive patient outcome, safety is the most important factor in patient care. The following recommendations should be considered:

- Contact the manufacturer if the IFU, pad packaging, or product carton are vague regarding pad warming, shelf life, and storage
- Apply the PRE after induction if the patient is receiving general anesthesia
- Explain to patients remaining awake that the PRE may feel cold, wet, or sticky and why. An informed and prepared patient is less likely to over-respond to unexpected stimuli.

An educated perioperative nurse is the patient’s best advocate.

**\*Contact Quality Monitoring** is a system that actively monitors tissue impedance (resistance) at the interface between the patient’s body and the patient return electrode and interrupts the power if the contact quality and/or quantity is compromised.

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1) Valleylab, (2001) Principles of Electrosurgery

2) Valleylab, (2000), The Science of PolyHesive™ Patient Return Electrodes

3) Ibid

4) Ibid

5) HOTLINE Newsletter, “ Pad Warming...Patient Comfort or Patient RISK?” 3(1): January 1998.



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