

Patient Return Electrode Lesions

Although new technologies and staff education have increased patient safety during electrosurgery, the Clinical Information Hotline still receives several calls each month regarding lesions found at the patient return electrode (PRE) site.

The most common questions are:

- What causes a PRE-site injury?
- Why haven't improved technologies eliminated PRE-site lesions?
- What does a PRE-site "burn" look like?
- How can nursing staff prevent PRE-site lesions?
- What should the OR staff do if a patient sustains a PRE-site injury?

What causes a PRE-site injury?

An electrosurgical unit (ESU) supplies radio frequency (RF) current for the purpose of cutting and coagulating tissue. A high concentration of current is used to therapeutically cut and coagulate the tissue at the surgical site; however, it is not desirable for this same current to cause tissue damage at any other site. In order for the current to transform from a highly concentrated therapeutic current to a benign current, it must be dispersed (go from the point of high concentration to an area of low concentration). The current that is concentrated at the contact point of the ES pencil quickly passes through the patient's muscles and collects at the PRE. If the surface area of the PRE is large enough to keep the current dispersed, then the current will exit the patient without causing tissue damage at the exit PRE-site.

- If a dry or partly dry PRE is not in intimate contact with the skin, it produces instantaneous tissue destruction by pinpoint arcing, much like small lightning bolts.¹
- If high power settings are used for an extended period of time, the surface area of the PRE may be too small to disperse the current safely. Concentration of any current creates heat. Should the heat exceed 45° C (112° F), varying degrees of tissue injury will occur.

Why haven't improved technologies eliminated PRE-site lesions?

- The first patient return electrodes were large metal plates that were placed under patients' buttocks. The weight of the patient maintained plate-to-patient contact. Burns were commonplace; some caused by hot spots due to uneven body contours and some due to poor conduction of bone or adipose tissue.
- Because of continued patient injury, it was recommended to cover the metal plate with a conductive gel to help fill in the plate-to-patient interface and improve the conduction. This measure helped, but patient burns continued.
- By the early 1970's, semi-disposable plates made of cardboard covered with aluminum foil came into use. These also required the use of a gel over the entire surface, but PRE burns still occurred.
- Manufacturers then designed disposable pre-gelled patient return electrodes with adhesive borders that not only maintained complete pad-to-patient contact, but also assisted in current conduction and helped keep the pad-to-patient interface cool.

© Valleylab, 2000



Jan Fickling RN, CNOR
Clinical Product Specialist

Clinical Information Hotline News is a free service provided by VALLEYLAB for the advancement of perioperative safety. To request additional copies, please contact:

CLINICAL INFORMATION HOTLINE

1-800-255-VLAB (8522) X2005

clinical.hotline@valleylab.com

www.valleylab.com



Cherie Ryan Loeffler RN, BSN, CNOR
Clinical Product Specialist

- By the early 1980's, these disposable, gelled adhesive pads became the standard of care. Although the incidence of PRE-site injury decreased, it was not eliminated.

It is important to note that PRE-site burns can and do occur with isolated as well as ground referenced units. If the PRE becomes partially or completely detached from the patient, the pad-to-patient interface may decrease enough to concentrate the current and cause an electrosurgical burn.

Detachment of the return electrode can occur due to:

- Poor application or site preparation; placement over hair or oily skin.
- Movement or repositioning of the patient after pad application.
- Inadequate adhesive, defective materials and dried out gel or adhesive.
- Accidental pulling or tension on the PRE cable.
- Finally, in the early 1980's a contact quality monitoring system was developed to monitor the interface between the patient and the PRE. This system reduces the occurrence of patient burns resulting from partial or complete PRE detachment and is now the standard of care.

The use of contact quality monitoring systems has significantly reduced patient injury due to burns at the PRE-site; however, some hospitals, outpatient facilities, doctor's offices, and clinics continue to use old technology (non-contact quality monitoring systems) and patient injuries continue to occur.

What does a PRE-site "burn" look like?

A burn is an injury resulting from exposure to heat, caustics, electricity, or some radiations. Burns are marked by varying degrees of skin destruction and hyperemia often with the formation of watery blisters, and in severe cases, by charring of the tissues. Burns are classified according to the extent and degree of the injury.²

Concentrated RF current can cause minor to severe tissue damage under the patient return electrode. The severity depends on the duration of exposure and density of the RF current. In almost all instances, PRE-site burns are evident during the procedure or upon removal of the PRE.⁽¹⁾

- A first degree burn is characterized by heat, pain and reddening of the burned surface but not exhibiting blistering or charring of tissues.²
- Second degree burns are marked by pain, blistering, and superficial destruction of dermis with edema and hyperemia of the tissues beneath the burn.²
- A third degree burn is characterized by destruction of the skin through the depth of the dermis and possibly into underlying tissues, loss of fluid, and sometimes shock.²
- Occasionally a lesion will be described as a fourth degree burn when all of the skin elements are destroyed, including hair follicles, fascia tissue, muscles, and deeper tissue.¹

A distinguishing characteristic of a burn caused by electrosurgical current is that some tissue damage will be

apparent at the time of the insult or within one hour.⁽³⁾ If the damage is not apparent within one hour, then the lesion is not a result of an electrosurgical burn. Almost all electrosurgical burns are small, usually of less area than a half-dollar, deep and highly non-uniform of depth. Typically, a cross section of the burn should reveal it to be dish-shaped.⁽¹⁾

One type of lesion will appear as a small to medium size deep burn.

- The injury may be relatively small, a dime to half-dollar in size.
- It will present at the time of PRE removal as a 2nd or 3rd degree burn.
- The shape of the lesion may appear as an identical image to a section of the PRE's perimeter.⁴
- There may be a charred section of tissue near the edge of the PRE's conductive adhesive surface indicating arcing between the patient's skin and the PRE.⁵

Another type of lesion is an electro-thermal injury due to high intensity, less concentrated continuous RF current over a long duration of time.

- Injury may appear as a large pink to red 1st to 2nd degree injury.
- Lesion will probably mirror the size and shape of the PRE.
- Blisters and tissue sloughing may not be immediately evident, but may occur days to weeks post injury.

Heating a gelled PRE may increase the incidence of electrical-thermal burns. This injury may be associated with the inappropriate use of conductive solutions used for distention/irrigation procedures such as transurethral resections or hysteroscopic ablations. (Refer to **ECRI Health Devices**, June 1998 Vol. 27, No. 6, *Skin Burns Resulting from the Use of Electrolytic Distention/Irrigation Media during Electrosurgery with a Rollerablation Electrode*, p 233-235)

Allergic reaction at PRE site

Some patients are sensitive or allergic to adhesives or gel materials used to manufacture patient return electrodes. These patients may suffer minor to severe reactions under the PRE-site. Unfortunately, the combination of heat from the RF current and hypersensitivity to the adhesive or gel may exacerbate a skin reaction. The additional heat from a warming blanket or other warming device may also increase the chance and degree of an allergic injury.

- Lesion usually mirrors the gel, the adhesive or both.
- Skin will be very pink or red.

Lesions that are noted hours to days post procedure are usually due to pressure necrosis, shearing forces, or chemical and allergic reaction.

How can nursing staff prevent pad site lesions?

- Use full surface adhesive patient return electrodes and contact quality monitoring systems.
- Inspect the return electrode package when opening. Do not use PRE if package is damaged or outdated.
- Inspect pad and cable for defects. Check for adequate hydration of adhesive and gel.
- Do not warm the gelled patient return electrode.
- Choose the appropriate sized PRE for each patient and follow manufacturer's recommendation regarding power restrictions on smaller PREs.
- Choose a muscular site close to the surgical site for pad application. (Refer to **Hotline News**, Vol. 2, Issue 3 "*Does Placement of the Patient Return Electrode Make a Difference?*")
- Avoid degreasers, prepping agents, and pooling of fluids.
- Clean and/or shave as recommended by PRE manufacturer instructions for use.
- Avoid close contact with warming blanket.
- Use firm application technique. Check entire PRE and edges for full contact with patient.
- Do not place safety straps over PRE. Avoid other pressures including patient or staff person's body weight.
- Check PRE whenever patient is re-positioned or if there is any tension on the cable.
- Do not re-apply a patient return electrode that has become detached.
- Always use the lowest power settings that provide the desired surgical effect.
- Check PRE prior to increasing normal power settings.
- Remove PRE slowly, supporting patient's skin during removal.
- Refer to the PRE and ESU manufacturer for complete instructions for use, cautions and warnings.

What should the OR staff do if the patient sustains a pad site injury?

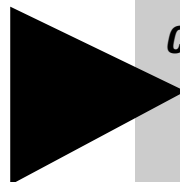
- Accurate documentation is of vital importance, especially if a patient injury is suspected. Remember that the injury may not be an electrosurgical "burn", so refer to the injury as a lesion.
- Document serial number of generator.
- Document product and lot numbers of patient return electrode.
- Document patient's skin condition before, during, and after the procedure.
- Document the condition of the PRE prior to and after use.
- Document the secure application and any intervention if PRE becomes partially or fully detached.

- Document both repositioning of patient and re-checking of the PRE.
- Document power ranges and mode settings.
- Document secure PRE interface prior to any power setting increase.

Report any suspected patient injury and follow your facility's established policy and procedure. Save all equipment, devices, and packaging that have been used or have come in contact with the patient. Report serial numbers and lot numbers to manufacturers of ESU and PRE.

Careful nursing practice combined with improved technical advances will help reduce and possibly eliminate injury at the pad site.

-
- 1 Gendron, Francis, G., (1988), *Unexpected Patient Burns: Investigating Iatrogenic Injuries*, 1st Edition, Quest Publishing Co., Brea, CA p. 86-87
 - 2 Webster's Medical Desk Dictionary, (1986), Merriam-Webster Inc., Springfield, MA
 - 3 Pearce, J.A., et al. (1983), Skin burns from electrosurgical current, *Med Instrum*, 17 (3):225-231
 - 4 ECRI Health Devices, (July, 1993), Investigation Device-related "Burns", Vol. 22, No. 7 p. 339
 - 5 ECRI Health Devices, (Jan. 1987), ESU Burns from Poor Return Electrode Site Preparation, Vol. 16, No. 1 p.35



Clinical Information Hotline News

is also available for viewing
and printing from our website:

www.valleylab.com