A guide to patient return electrode injuries

How to identify electrosurgical burns and help prevent them in the future

A skin injury during surgery can be a serious event that can be avoided. These may often be misdiagnosed as electrosurgical burns. This document may assist in determining the root cause of the injury, so that measures can be taken to prevent future injuries.

In this guide, we'll cover identifying and preventing:

- Pad-site (return electrode) burns
- Chemical burns
- Alternate-site burns
- Pressure-related injuries

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Pad-site (return electrode) burns

This is a burn that occurs at the adhesive patient return electrode pad. The electrical current passes through the electrosurgical instrument (e.g., surgical pencil), through the patient, then returns to the generator through the return electrode.

Because the electrosurgical instrument has a small surface area, it has a more focused concentration, so the current density is greater at the instrument when compared to the return electrode, which has a much greater surface area. Therefore, the heat is much less at the return electrode.

There are a number of reasons for pad-site burns. Long duty cycles and high generator power settings may contribute to pad-site burns. Placement of adhesive return electrodes over bony prominences, scar tissue, metal prostheses, hair, tattoo, potential pressure points or fluid may lead to pad-site injury.

Additionally, if the return electrode is applied incorrectly or becomes partially dislodged during the procedure, there will be a smaller surface area in contact with the patient, increasing the temperature and potentially resulting in injury (Note: MEGADYNE™ MEGA SOFT™ Reusable Patient Return Electrodes are fundamentally different in operation and this type of burn is not possible when using them).

Identifying a pad-site burn

Electrosurgical pad-site burns appear immediately. The burn will be underneath the adhesive return electrode and will be smaller in size when compared to the return electrode. If the burn is approximately the same size or larger than the return electrode, then it is unlikely to be a pad-site burn.

A burn on a patient at the pad site.

Bae, H.-S., et al. (2018). "Intraoperative burn from a grounding pad of electrosurgical device during breast surgery: A CARE-compliant case report." Medicine 97(1).

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Preventing a pad-site burn

The best way to reduce the risk of an adhesive patient return electrode pad-site burn is to follow the instructions for use, and either use a generator that has active monitoring or utilize capacitive coupling patient return electrodes, such as MEGADYNE™ MEGA SOFT™ Reusable Patient Return Electrodes. Active monitoring in the generator constantly assesses the quality of the adhered electrode and reduces the likelihood of a pad-site burn. The MEGADYNE™ MEGA SOFT™ Patient Return Electrode does not allow high concentration of current at the capacitive pad site. Without concentrated electrical current, pad-site burns cannot happen. With MEGADYNE™ MEGA SOFT™ Reusable Patient Return Electrodes, as the surface area of patient contact decreases, the temperature does not increase. Instead, the amount of energy at the surgical instrument will decrease with high impedance per square centimeter.

Chemical burns

The energy from the electrosurgical instrument may move through conductive fluids like alcohol, causing increased heat and potential burn at the site of the fluid.

Identifying a chemical burn

Chemical burns occur hours to days after the procedure. The burn will occur where the patient comes in contact with the caustic agent. Other injuries caused by chemicals, such as urine on the OR table, are more difficult to identify. These may be irregular in shape and examining any residual chemicals on or near the patient may help to identify the cause.

Formic acid burn. Close-up of burns on the leg of a 42-old male patient, caused by spilling formic acid (methanoic acid).

C025/9620 Formic acid burn
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Preventing a chemical burn

The best way to reduce the risk of a chemical burn is to monitor the patient for accidental exposures (e.g., urine or cleaning agents) and thoroughly read and understand all chemicals used in the OR field.

References

AORN Recommended Practices Committee. (2012). Recommended Practices for Electrosurgery. 2012 Perioperative Standards and Recommended Practices, 99-118.
AST Education and Professional Standards Committee. (2012). AST Standards of Practice for Use of Electrosurgery. AST Standards of Practice, 1-25.
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Alternate-site burns

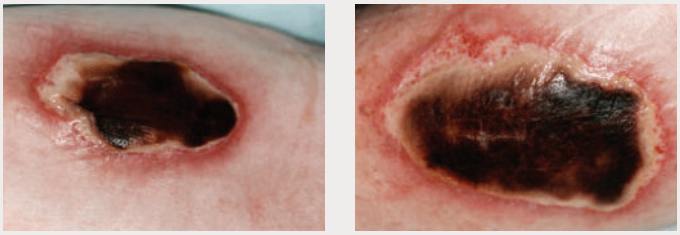
Modern electrosurgical generators are designed as isolated systems. Isolated systems require nearly all of the current flowing from the generator to be returned back to the generator to complete the circuit. Isolated circuits reduce the potential for current to flow to unintended areas.

However, there is always a risk that this circuit may not remain completely closed, and energy may leave the electrical pathway by means of an alternate path. This may happen when something conductive touches the patient and provides a pathway to somewhere other than returning to the generator. The electrical current may take this alternate pathway, which can result in an alternate-site burn. This can occur with both adhesive and capacitive patient return electrode technologies.

Identifying an alternate-site burn	The alternate-site burn can appear anywhere on the patient. For example, a patient in contact with metal on a bed in two places may experience burns. The current could go from one contact point to the other, causing two injuries. If the burn is not at the site of the return electrode or conductive items are near the burn (e.g., IV pole, metal fasteners, pooled fluids), it is unlikely that it is a pad-site burn. If there are tattoos, implants, piercings or jewelry at the site of the burn, it is likely that it was an alternate-site burn.
Preventing an alternate-site burn	Whether using adhesive patient return electrodes or MEGADYNE™ MEGA SOFT™ Patient Return Electrodes, **the risk of alternate-site burns can be reduced by ensuring the area is clear of metal contacts and positioning items such as the IV pole away from the patient.** While MEGADYNE™ MEGA SOFT™ Patient Return Electrodes can be used with tattoos, piercings, implants or jewelry in the electrosurgical circuit, an adhesive patient return electrode cannot. In either case, alternate-site injury may occur if the patient is in contact with an external conductive surface. Additionally, higher power settings on the generator may increase the risk of an alternate-site burn. Adhering to the generator's instructions for use and ensuring the patient is clear of conductive contacts reduces the likelihood of an alternate-site burn.

Pressure-related injuries

Pressure-related injuries can sometimes be confused with a surgical burn, as the injury can potentially be quite severe, resulting in necrotic injuries in extreme cases.

Identifying a pressure-related injury	Unlike pad-site burns, which occur immediately, pressure injuries occur hours or days after the procedure. Pressure injuries occur as a result of soft tissue on a firm or hard surface for prolonged periods.	 **Necrotic injuries on the left and right arms from blood pressure cuffs after several days of readings.** Devbhandari, M. et al. (2006). "Skin Necrosis in a Critically Ill Patient Due to a Blood Pressure Cuff." J Postgrad Med, 52 (2), 136-138. https://www.ncbi.nlm.nih.gov/pubmed/16679680
Preventing a pressure-related injury	Minimizing pressure points by utilizing pressure-reduction pads and avoiding leaving the patient stationary for long periods of time can all contribute to reducing pressure-related injuries.	

For additional information or customer support, please contact us: 1-877-ETHICON or customersupport@eesus.jnj.com

References

AORN Recommended Practices Committee. (2012). Recommended Practices for Electrosurgery. 2012 Perioperative Standards and Recommended Practices, 99-118.
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