Electrosurgical Units - Safety

Health Care Technology Unit
ORBIS DC-10 Flying Eye Hospital
Medical diathermy

Electrodes of equal size give equal heating effects

Electrosurgery

Collecting electrode (patient plate electrode)

Heating or burning electrode

Electrodes of unequal size – more intense heating effect at small electrode
Figure: Relative current densities at contact with patient.
High current density at irregularity of electrode.
Figure: Correct flow of high-frequency current from electrosurgery through tissue to dispersive electrode and patient cord back to generator.
Figure  Alternate return paths to ground when normal return path through patient cord is broken.
Figure 1: Stray current flow from an RF isolated electro-surgical unit.
Electrosurgical unit with a DC isolated patient
Safety guidelines

• Electrosurgery uses high levels of continuous or pulsed radio frequency power. It presents some unique hazards.
• It generates sparks with the attendant ignition hazard.
• It generates radio frequency interference that could obstruct monitoring.
• It can cause burns at inadvertent ground return paths if its return circuit is inadequate. Demodulation products could contain components that cause fibrillation or stimulation.
• DC monitoring currents can cause chemical burns.
• Capacitive or inductive coupling may occur.
Safety guidelines

• Active electrodes or other applicators of electrosurgical devices shall be properly secured, as recommended by the manufacturer of the device, when not in active use.

• If cautery, electrosurgery, or electrical equipment employing an open spark is to be used during an operation, flammable anesthetics shall not be used.

• Flammable germicides or flammable fat solvents shall not be applied for the preoperative preparation of the field.
Safety guidelines

• Liquid germicides used in anesthetizing locations, whenever the use of cautery or electrosurgery is contemplated, shall be nonflammable.
  – A particular hazard is created if cautery or high-frequency electrosurgical equipment is employed following use of a flammable medicament for preparation of the skin, since the liquid remaining on the skin or vapors pocketed within the surgical drapes can be ignited.
  – Fire from Flammable Germicides and Defatting Agents. The vapors from flammable solutions of disinfecting agents, or fat solvents left on the skin or saturating the drapes, can persist for long periods and be ignited by the arc that occurs when a high-frequency electrode contacts tissue. Non-flammable germicides or detergents should be used when the use of electrosurgery is contemplated.

• Proximity of high-frequency leads to other wires, causing capacitive or inductive coupling, with resultant current in electrodes attached to the patient.
Setting Up the Electrosurgical Unit

- Verify with anesthesia personnel the type of anesthetic to be used.
- Prior to sterilization, inspect patient leads and fulgurating and coagulating tips for integrity and cleanliness and bits of tissue or carbon that would interfere with proper function.
- Test them for electrical continuity. Similarly, check when these leads and tips are removed from the sterile package by the instrument nurse.
Setting Up the Electrosurgical Unit

• Make certain that the electrosurgical unit, together with its dispersive electrode and cable, foot switch and cable, and line cord, is free of dust and “operating room clean.”

• **Locate the electrosurgical unit on the operator’s side of the table as far as possible from the anesthesia machine and monitoring equipment.**

• Locate where the power cables, and the active electrode and dispersive electrode leads hang naturally and are not stretched across traffic lanes.

• **Position the leads and electrodes for physiological monitoring equipment as far as possible from the active cable and active electrode when it is in use.**
Setting Up the Electrosurgical Unit

- Utilize as large a dispersive electrode as practical, commensurate with the site of the operation and position and size of the patient.
- Locate electrode as close as possible to the operative site.
- If a plate is used, exercise care so that the patient’s skin is not traumatized or folded.
- Provide contact with as great an area of skin as is possible.

NOTE: If contact jelly is used on the dispersive electrode, use the correct type and spread uniformly over the electrode.
Setting Up the Electrosurgical Unit

- Place the dispersive electrode against as large an area of soft tissue of the patient as practical.
- Avoid direct contact with bony prominences such as those of the scapula, sacrum, ilium, or patella.
- Check for continued contact during a long procedure, or when changes in patient’s position are necessary.
- Attach the dispersive electrode securely to its cable, and check its mechanical and electrical integrity prior to preparing the operative site and draping the patient.
Setting Up the Electrosurgical Unit

• Do not employ electrosurgery without use of the dispersive electrode, unless the operator specifically orders monoterminal or bipolar techniques and directs the omission of the dispersive electrode.

• NOTE 1: On an electrosurgical unit with a dispersive cable continuity alarm and automatic cutoff switch, follow the manufacturer’s directions for preoperative testing.

• NOTE 2: On electrosurgical units without a continuity alarm, the hospital should provide an external means for periodically testing the integrity of the dispersive cable.
Operation of the Electrosurgical Unit

• Personnel adjusting the electrosurgical unit during the operative procedure must be aware that if the surgeon needs currents in excess of those usually required for a comparable procedure, a fault might have developed in the active electrode or dispersive electrode cables.

• If a flammable anesthetic agent has been employed for induction of inhalation anesthesia, even if followed by a nonflammable agent for maintenance, the electrosurgical unit should not be used on the neck, nasopharynx, and adjacent areas.
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• If a flammable anesthetic agent has been employed for induction of inhalation anesthesia, even if followed by a nonflammable agent for maintenance, the electrosurgical unit should not be used on the neck, nasopharynx, and adjacent areas.
Operator Burns

• To minimize burns to the operator:
  – Check to see that the control dials are set at the operator’s minimum preferred settings.
  – Avoid the use of eyeglasses with metal frames.
Patient Burns

• To minimize burns to the patient:
  – Make sure the conductive surface of the dispersive electrode is in good contact with the skin.
  – Do not make a large increase in power setting for an unexpected weak surgical effect.
Patient Burns

Picture above shows an example of a Patient Plate burn
Patient Burns

Photo courtesy of Alexandre Henrique Hermini, CE, DSc – Campinas-SP-Brazil
Patient Burns

Photo courtesy of Alexandre Henrique Hermini, CE, DSc – Campinas-SP-Brazil
Patient Burns

Photo courtesy of Alexandre Henrique Hermini, CE, DSc – Campinas-SP-Brazil
Putaway and Storage

• After using an electrosurgical unit:
  – Clean cutting and fulgurating tips of all blood, debris, carbon, and tissue prior to storage.
  – Clean all electrical contacts.
  – Coil lead cables neatly and store in appropriate locations.
  – If the electrosurgical unit is stored other than in an operating room, select a dust-free location within the operating suite.
Repair of the Electrosurgical Unit

• The electrosurgical apparatus contains complex circuits that can develop malfunction after a period of operation.

• Prominently tag any item of electrosurgical equipment that is known or suspected to be defective and do not use again until it has been inspected and repaired by competent personnel.
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