IFPN Guideline
for
Electrosurgery Safety

Purpose

Electrosurgical equipment includes a range of different devices which have the capacity to cut and coagulate patient tissue. They are comprised of equipment which give monopolar and bipolar electrical impulses, used during surgery in different situations. This equipment requires that users have appropriate knowledge and skill to ensure patient and personnel safety. If used inappropriately, the electrosurgical unit (ESU) has the potential to cause injury to the patient in the form of electro-thermal burns; perioperative staff as shocks or burns, damage to other equipment, such as implantable devices, explosions and fire. Electrosurgical units have been the cause of numerous fire and patient safety incidents and fires and should be used with knowledge and skill and caution.

Policies and procedures should be in place for the safe management of electrosurgical units.

Recommendations

General recommendations

The Electrosurgical Unit also known as diathermy unit, the active electrode, and patient return electrode should be used in accordance with the manufacturers' recommendations.

A manual of operating instructions (users manual) should be obtained from the manufacturer and be readily available in the practice setting. A brief set of operating instructions should be attached to the ESU.

Equipment should not be used in a manner that is not in accordance with the manufacturers' written instructions.

Personnel should demonstrate competence in the use of the equipment. Personnel should be instructed in the proper operation, care, and handling of the ESU, which may prevent future safety incidents. The best people to deliver this education are representatives from the manufacturer.

Electrosurgical equipment should be inspected before use. Equipment that is damaged or not working properly should be removed from service and inspected by biomedical/equipment

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specialist personnel. The ESU should always be used safely and in a manner that reduces any potential for injury.

The ESU cord should be long enough to reach the wall outlet without stress on the cord or use of an extension cord. The cord should lie flat and be free of kinks or knots. Frayed or damaged cords or plugs should not be used.

ESU safety features, such as lights, and activation sound indicators, should be tested before each use, and be operational during surgical procedures. The level that the alarm sound should be audible. The ESU will sound an alarm if the patient return plate is not firmly connected to it, indicating a weak circuit and potential malfunction.

The ESU should not be used in the presence of flammable agents (e.g. alcohol, ether-based solutions, oxygen) as it may be the source of a fire spark or explosion. Power settings should be confirmed between the surgeon and operating room personnel. They setting should be determined by the size of the patient, type of active electrode, proximity of the patient return electrode to the operative site, and recommendations made by the manufacturer. The power setting should always be set at the lowest level to achieve the desired tissue effect.

The ESU foot pedal should also be enclosed in a plastic bag to prevent fluid invasion and contamination with blood from the floor.

Monopolar Electrosurgery

Active electrode When the active electrode is not in use while on the sterile field, it must be placed in a safety holster which is clean and dry and insulated to reduce the opportunity for inadvertent activation and potential burns.

After use, the ESU should be turned off and cleaned according to the manufacturer's recommendations. The unit should not be saturated or have fluids poured over it.

Patient return electrode

The patient return electrode should be used in a manner that promotes patient safety and reduces any potential for patient injury.

The patient's skin integrity should be assessed and documented prior to placement of the patient return electrode and when the patient return electrode is removed.

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The patient return electrode should be placed as close to the operative site as possible on a large muscle mass. It should not be placed over scar tissue, hairy areas, near metal implants, bony prominences, in areas of vascular insufficiency or where it may be invaded by fluid. A patient return electrode should be selected that is the correct size for each patient (ex. Neonate, paediatric, adult). Once it is placed, the patient return electrode should never be repositioned.

All jewellery should be removed from the patient or rings on their fingers covered with tape, to reduce the chance that their hand may be in contact with other metals providing a path to earth for the electric current. Body piercings should also be removed although the evidence of burns is sketchy and is disputed in the literature.

Excessive hair should be removed before applying the patient return electrode to ensure there is adequate contact with the patient's skin. Clipping is preferable to shaving if possible.

The patient return electrode should uniformly contact the patient's body. The patient return electrode should not gap or tent. Uniform contact between the return electrode and the patient's skin will help to maintain low current density at the pad site and help reduce the likelihood that a pad site injury could occur.

The patient return electrode should never be cut or altered. Single use patient return electrodes should be stored according to the manufacturer's recommendations. Single use patient return electrodes should be discarded after one use. Reusable patient return electrodes should be cleaned after each use and inspected before each use to ensure that no damage has occurred.

The patient return electrode should be removed carefully while supporting the patient's tissue. The return electrode site should be inspected to assure that no injury has occurred and the outcome documented.

Bipolar electrosurgery

Bipolar electrosurgery functions differently than monopolar electrosurgery. It should be used in accordance with the manufacturer's written instructions.

When bipolar ESU is used, a patient return electrode is not needed. Care should be taken to use bipolar active electrodes as they are intended to be used.

The bipolar forceps contains both an active pole and a return pole within the handset. The electrical current does not flow through the patient's body. Therefore, a patient return electrode is not needed.

Bipolar electrosurgery is frequently used when

- Coagulation only is required
- Pin-point or micro-coagulation is required
- The patient has a pacemaker in situ
- Using a laparoscopic approach

Surgical Smoke Plume

Smoke from electrosurgery/diathermy and lasers has been shown to contain low concentrations of toxic gases and vapours such as benzene, hydrogen cyanide, formaldehyde, bioaerosols, dead and live cellular material (including blood fragments and viruses); these produce an unquantified infection risk. The smoke causes ocular and upper respiratory tract irritation, is highly obnoxious, and creates visual problems for the surgeon. There is evidence of mutagenic potential. Currently there is no evidence of human carcinogenicity, but there are persistent concerns.

Local exhaust ventilation (LEV) is recommended where smoke plume is emitted into the OR. These come in the form of purpose designed portable smoke evacuators and room suction systems. Smoke evacuator systems can be add-on units or supplied as part of the diathermy or laser equipment package. For fine work and where space is limited, extraction systems designed as part of the device are usually less cumbersome. None are without some impediment to the ease of use by the surgeon. The irritancy of surgical smoke may affect some staff (especially asthmatics) adversely despite effective LEV. Anyone reporting respiratory symptoms should be referred to the occupational health service.

Minimal Access surgery hazards

Minimally invasive surgery has specific potential for electrosurgical risks harming the patient. The hazards are primarily related to the high number of specialised instruments which are in the small space where surgery is taking place, and the likelihood of electrical interference between the different instruments. The hazards are known as direct coupling and capacitive coupling.

Direct coupling.

Where an active electrode inadvertently touches another instrument during surgery inside the patient, and that instrument is in contact with tissue, a burn may ensue. Any internal burn can be a serious injury and not necessarily detected during surgery. It is helpful for the surgeon to ensure that the uninsulated tip of the electrode is in view at all times so that touching of other instruments is a rare occurrence.

It is essential that electrodes which have a layer of insulation to minimise the risks of direct coupling, are regularly checked in sterile services between uses.

Capacitive coupling

A capacitor is created wherever a non-conductor separates two conductors, and where one conductor creates a current in another, via an electrostatic field. This may transfer the electrical current from the active electrode through intact insulation to adjacent conductive items (e.g. tissue, trocars), which may burn other local tissues causing necrosis. Capacitive coupling can be reduced by using bipolar electrosurgery during minimally invasive surgery.

References

AfPP 2016 **Standards and Recommendations for Safe Perioperative Practice.** Association for Perioperative Practice: Harrogate UK

AORN 2019 **Perioperative Standards and Recommended Practices**. Association of PeriOperative Registered Nurses. Denver USA

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