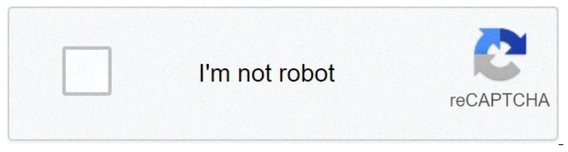

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Surgical diathermy working principle

surgical diathermy The purpose of this guideline is to provide guidance about surgical diathermy. Electrosurgical units (diathermy machines) were first introduced during the early twentieth century to facilitate haemostasis and/or the cutting of tissue during surgical procedures This is achieved by passing normal electrical current via the diathermy machine and converting it into a high frequency alternating current (HFAC). The HFAC produces heat within body tissues to coagulate bleeding vessels and cut through tissue. At this high frequency of over 300,000 Hz, the nervous system and muscles are not affected when the current passes through the body. Due to the high risks of injury to both patients and staff which could lead to permanent disfigurement or death, guidance is required for staff using electrosurgical machines. There are two different types of electrosurgery: monopolar and bipolar. Monopolar electrosurgery is the emitance of the HFAC from the diathermy via an active electrode through the patients body tissues and returned back to the diathermy machine via a return electrode or patient return pad (Rationale 1). Bipolar electrosurgery is the passage of the HFAC from the diathermy machine using only the patient's tissue grasped between a pair of bipolar forceps, to form a complete electrical circuit within the patient. Bipolar diathermy does not require a patient return pad as both active and return electrodes are combined within the forceps . Background Electrosurgery has three effects on body tissue: cut - generation of heat destroys tissue cell coagulation - tissue cells contract to increase normal clotting fulguration - cell walls destroyed through dehydration Each of these processes generates smoke plume which contains: chemical by-products (eg acrylonitrile and hydrogen cyanide) which can be absorbed by the skin and lungs carbonised tissue, blood particles and viral DNA particles infectious viruses and bacteria have also been noted . To reduce associated health hazards, specially designed smoke evacuation systems should be used where available and high-filtration masks donned for all surgical procedures . Prior to use The Electrosurgical Unit (ESU) should only be used by members of the peri-operative team who have been adequately trained and deemed competent. The ESU should be inspected and safety features tested (eg lights, activation of the return electrode sound indicator) before each use . All cables and electrodes must be checked prior to use to ensure insulation is intact . Any problems must be reported to the Biomedical Engineering department immediately and the ESU taken out of use. The volume of the activation sound indicator should be maintained at an audible level (Rationale 2). The ESU should be mounted on a wheeled stand that is tip-resistant and moves easily. The ESU should not be used in the presence of flammable agents eg, alcohol, tincture-based fluids (Rationale 3). The ESU should be operated at the lowest effective power setting to achieve the desired effect for coagulation and cutting (Rationale 4). The ESU cord should be of adequate length and flexibility to reach the appropriate electrical outlet without stress. Any kinks, knots or curls should be removed from the cord before it is plugged into the appropriate electrical outlet. The patient’s skin integrity should be evaluated and documented in the peri-operative care plan before and after ESU use (Rationale 5). The type of return electrode used should also be documented in the care plan. The patient’s jewellery must be removed (Rationale 6). If two ESUs are used simultaneously during an operative procedure they must have the same technology, eg both are grounded or isolated (Rationale 7). General use The ESU should be protected from spills. Fluids should not be placed on top of the ESU (Rationale 8). The return electrode mat should be the appropriate size for the patient’s weight. A paediatric plate should be used for patients under 22kg and an adult plate used for patients over 22kg (Rationale 9). In most circumstances, only active electrodes recommended by the manufacturer should be used. If an adapter is used, it should be one that is approved by the manufacturer and does not compromise the generator's safety features. Before the start of the procedure, the perioperative team must ensure that any part of the patient is not touching any earthed objects such as the trim of the operating table or intravenous (IV) drip stands. Minimal materials between the patient and the return electrode mat must be ensured to prevent any injury to the patient. This includes draw sheets, sliding sheets, blankets, gamgee, nappies and any other clothing. A high level of patient dignity must be upheld at all times. Patient positioning devices should be placed under the return electrode mat where applicable. The return electrode mat should not be folded whist in place during surgery or at the end of the list. Storage of the mat should follow manufacturer's guidelines. If the return electrode mat is faulty or broken, it must not be used. It should be decontaminated and sent to the biomedical engineering department. The return electrode mat should be placed on the operating table prior to the patient's transfer onto the operating table. As a minimum, one third of the patient's body should be on the mat (Rationale 10). If using a disposable return electrode plate, it should not be placed over: a bony prominence implanted metal prosthesis (Rationale 11) areas distal to a tourniquets (Rationale 12) scar tissue (Rationale 13) hairy surfaces (Rationale 14) pressure points/areas Extreme care must be taken when using flammable liquids, such as Alcoholic Chlorhexidine or Betadine to prep the patient. If these chemicals come in to contact with the disposable pad, major burns can occur to the patient. These areas should be dried thoroughly before using electrosurgery The majority of the return electrode should be positioned as close to the operative site as possible (Rationale 15). The return electrode should be connected to the ESU prior to draping to ensure adequate contact and then the lead disconnected from the ESU temporarily to allow for the draping of the patient and the positioning of the surgeon (Rationale 16). The return electrode and its connection to the ESU should be checked if any tension is applied to the cable if the surgical team repositions the patient. The cable should not be wrapped around metal objects, eg theatre table trims. Incomplete adhesion of a dispersive electrode may be caused by moisture (Rationale 17). Return electrodes plates that have been removed from a patients skin should be discarded and a new plate should be applied straight away (Rationale 18). Return electrodes plates should not be used on children suffering from epidermolysis bullosa. A return electrode mat or bipolar electrosurgery should be used instead (Rationale 19). The power setting should be confirmed verbally between the operator and the user before activation. The power settings are determined in conjunction with the manufacturers written recommendations, patient size and type of procedure (Rationale 20), It is the responsibility of the surgeon to activate the active electrode . Staff should check the entire ESU circuit if the operator requests continual increase in power to identify any incomplete circuitry. If either the monopolar or bipolar equipment falls below the sterile field, it must be disconnected from the ESU and replaced immediately (Rationale 21). If the return electrode plate detaches from the patient, the surgery must cease until a replacement plate has been administered. The active electrode tip should be easy to clean, securely placed & be single use (Rationale 22). When not in use the active electrode should be placed in a clean well-insulated holster. It is the responsibility of the scrub practitioner to ensure that the active electrode is holstered when not in use to prevent burns to the patient and staff (Rationale 23). If patients or staff receive an injury or if there is an equipment failure while an ESU is being used, the ESU, with its active and return electrodes, must be handled in accordance with the recommendations of the MHRA . Device identification, maintenance and service information and adverse event information should be included in the report . Following the final surgical count the single use active electrode tip should be discarded into a sharps bin. This is the responsibility of the scrub practitioner. The return electrode plate should be removed carefully to avoid denuding the surface of the skin. If the condition of the skin is acceptable, verbal confirmation should be given to all members of the operating team. The patient’s skin integrity should be evaluated and documented before and after ESU use. Following removal of the electrode, if the child’s skin appears to be damaged, the following should be carried out: inform the surgeon (Rationale 24) carry out any prescribed treatment (Rationale 24) record in the child’s health care records (Rationale 25) complete an Incident Report Form (Rationale 26) inform staff in Recovery Room (Rationale 27) it is the surgeon's responsibililty to inform the child and family. Laparoscopic electrosurgery Principles of laparoscopic electrosurgery are the same as normal electrosurgery. However, staff must be aware of these principles to avoid any problems . Insulated laparoscopic equipment must be used for all laparoscopic procedures. The insulated laparoscopic equipment must be checked to ensure it is intact (Rationale 28 and 29). Ensure that non-insulated metal objects are kept at a distance from an activated active electrode to avoid creating an alternative pathway. Laparoscopic active electrodes which are damaged should not be used. Single use laparoscopic active electrodes should not be re-used. Capacitive coupling occurs when alternating current is transferred from an insulated instrument to an uninsulated instrument through a capacitor. To avoid the phenomena of capacitive coupling: use a non-conducting trocar use a low setting if using a metal trocar (in the absence of a non-conducting trocar) ensure there is good contact with the abdominal wall . If insulation should fail, the current could pass directly to other metallic objects in the surgical area or inadvertently burn tissues directly. Insulation can fail due to repeated uses, manhandling or using high voltages . Cardiac patients Staff should take special precautions when using the ESU with patients with pacemakers and automatic defibrillators as the use of the ESU may interfere with the pacemaker's circuitry (Rationale 30). Patients with pacemakers should have continual ECG monitoring during ESU use. The following additional precautions should be observed for children with pacemakers: Ensure the distance between the active electrode and the dispersive electrode is as short as possible (Rationale 31). Keep all ESU cables away from the pacemaker and its leads. Have a defibrillator immediately available for emergencies during surgery. Use bipolar where possible. Have a magnet or control unit available. Patients with automatic implantable cardioverter/defibrillator (ACID) should have: The ACID device deactivated before the ESU is activated (Rationale 32). A defibrillator immediately available for use. Patients with cochlear implants The following precautions should be observed for patients with cochlear implants: Use bipolar where possible. If monopolar diathermy is deemed necessary by the surgeon ensure the distance between the active electrode and the return electrode is as short as possible by using an return electrode mat (Rationale 33). Maintenance All Electrosurgical Units should be checked annually by the Biomedical Engineering department. If reusable patient return electrodes become damaged, immediate withdrawal should be actioned and returned to the company . Rationale Rationale 1: To complete the circuit and return the high frequency alternating current to the ESU. Rationale 2: To immediately alert staff when the ESU is activated inadvertently. Rationale 3: Ignition of flammable agents by the active electrodes has resulted in injuries to patients and staff. Rationale 4: To reduce the amount of electrical current passing through the patient. Rationale 5: To enable the evaluation of the patients skin condition for possible injuries. Rationale 6: Metal is a conductor of electricity and may cause burns from directed current. Rationale 7: There may be an opportunity for the electricity to take alternative pathways increasing the potential for burns. Rationale 8: To prevent fluids entering the generator causing malfunction. Rationale 9: A reduced surface area, increases the impedance of the electrical current, increasing the risk of burns. Rationale 10: Muscle is a good conductor of electrical current. Rationale 11: To reduce the risk of superheating above the site of an implanted metal prosthesis. Rationale 12: Adequate tissue perfusion is not assured if the dispersive electrode is placed distal to tourniquets. Rationale 13: Adequate tissue perfusion is not assured if the dispersive electrode is placed over scar tissue. Rationale 14: Hair at the contact site prevents complete contact with the patient’s skin, which may provide opportunity for arcing of electricity between the skin and the dispersive electrode. Rationale 15: To prevent contamination of the sterile field. Rationale 16: The electrode cable wrapped around metal objects could induce a current and cause an electrical shock to staff. Rationale 17: The skin must be dry; moisture is a conductor of electricity. Rationale 18: To ensure that the dispersive electrode connection remains intact. Rationale 19: To avoid any skin trauma upon removal. Rationale 20: To reduce the potential for injury and operate the ESU at the lowest possible setting. Rationale 21: To prevent contamination of the surgical site. Rationale 22: Carbon build-up on the active electrode tip inhibits the ESU from working safely and properly. Rationale 23: To minimise the risk of accidental activation and injuries. Rationale 24: To facilitate treatment. Rationale 25: To maintain an accurate record. Rationale 26: To meet Hospital Policy. Rationale 27: To maintain observation of the injury. Rationale 28: To prevent insulation failure. Rationale 29: Cracks or breaks in the insulation can result in the current escaping at the point of the defect & burning un-targeted tissue. Rationale 30: To ensure that there is no interference to the pacemaker device. Rationale 31: The patient’s pacemaker may interpret electrocautery as cardiac activity and inhibit the pacemaker from initiating a heartbeat. Rationale 32: Using electrosurgery on a patient with an activated ACID may trigger an electrical shock to the patient. Rationale 33: To ensure that the current path between the surgical site and dispersive electrode does not pass through the vicinity of the stimulator or leads. References Reference 1: Rothrock JC, McEwan DR (2011) Alexander's care of the patient in surgery (14th Edition) St Louis, Elsevier Mosby pp. 241-244 Reference 2: Spruce L, Braswell ML (2012) Implementing AORN recommended practices for electrosurgery. Association of Registered Nurses (AORN) Journal, 95(3) pp.373-390 Reference 3: Association for Perioperative Practice (AfPP) Standards and recommendations for safe perioperative practice. Harrogate, AfPP Reference 4: O'Riley M (2010) Electrosurgery in perioperative practice. AfPP Journal, 20(9), pp.329-333. 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