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Electrosurgery

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Table 1.

Electrosurgical Modalities

Type	Use	Indication	Definition
Monopolar	Monopolar modes	Cutting, coagulation, desiccation, fulguration	There is 1 active electrode on the end of the surgical instrument
Bipolar	Bipolar modes	Coagulation of a discrete area	There are 2 active electrodes on the end of the surgical instrument (bipolar forceps)
Monoterminal	Monopolar modes	Cutting, coagulation, desiccation, fulguration	Return electrode is not directly connected to the patient's body and the earth acts as an indirect return electrode
Biterminal	Monopolar or bipolar modes	Cutting, coagulation, desiccation, fulguration	Both the active electrode and the return electrode (grounding plate) are in contact with the patient's body

Table 2.

Electrosurgical Techniques

Method	Electrical Current	Amperage	Voltage	Indications	Definition
Electrocautery (heat)	Direct or alternating	N/A	N/A	Superficial destruction, coagulation	An electrical current heats a metallic probe, which is then applied to tissue
Electrocoagulation (contact coagulation)	Continuous (cutting mode) or interrupted (coagulation mode)	High	Low	Deepest destruction	Direct contact of the active electrode; the tissue is heated below the boiling point and undergoes thermal denaturation
Electrodesiccation	Continuous (cutting mode) or interrupted (coagulation mode)	Low	High	Superficial to deep destruction	Vaporization (desiccation) of the water content and drying occurs in the superficial tissue layers at the end of coagulation
Electrofulguration (noncontact coagulation)	Interrupted current (fulguration or coagulation mode)	Low	High	Superficial destruction	The active electrode is held a few millimeters above the tissue; the electric current bridges the air gap by creating a spark
Electrosection					
Pure cutting	Continuous (cutting mode)	High	Low	Cutting with minimal lateral heat damage	Little coagulation on the incision walls and little hemostasis
Blend cutting	Interrupted (blend or coagulation modes)	High	Low	Cutting with good hemostasis	More coagulation on the incision walls and more hemostasis than pure cutting

Abbreviation: N/A, not applicable.

Table 3.

Electrosurgery Facts

- Electrosurgery involves many techniques that use high-frequency electrical currents to achieve a specific surgical (thermal) effect on tissue, such as cutting or coagulation.
- The flow of electricity is called a current, which is measured in amperes (amps). The voltage is the pressure that forces the current to flow through the circuit and is measured in volts.
- Heat is created by tissue resistance to the current and results in carbonization and smoke; the flow of an electrical current within the body is relatively poor.
- Electrocautery is safe in patients with pacemakers, defibrillators, and implanted stimulators, as there is no electromagnetic field generated; bipolar electrocoagulation may be another alternative in this patient population.
- The waveform of a current does not have a predictable effect on tissue. The depth and the rate at which heat is produced are directly related to the tissue effect (ie, desiccation vs coagulation vs section) and are affected by the voltage, waveform, power, and size of electrode tip.
- Cutting mode employs a continuous current with the highest maximum output power and lowest peak voltage compared to other modes. It results in minimal lateral heat spread and tissue damage.
- A small-tip electrode is appropriate for superficial electrocoagulation and a large-tip electrode can be used for deep coagulation.
- A thin, needle-shaped electrode is used for pure cutting. The cutting of the tissue should be brisk with the lowest possible power setting.
- Monoterminal electrosurgery has a lower maximum output power and is associated with a higher risk for skin burning than biterminal electrosurgery. This method is mainly used for low-power procedures conducted on conscious patients who can sense possible skin burns and are placed on insulated tables.

Practice Questions

1. **A 71-year-old woman with a pacemaker/defibrillator is undergoing Mohs micrographic surgery. Which method is the safest for hemostasis during surgery?**
   a. biterminal electrocoagulation
   b. electrocautery
   c. electrodesiccation
   d. monopolar electrocoagulation
   e. monoterminal electrocoagulation

2. **Which method usually causes the deepest level of tissue damage during hemostasis?**
   a. electrocautery
   b. electrocoagulation
   c. electrodesiccation
   d. electrofulguration
   e. electrosection

3. **Which electrosurgical mode has the highest maximum output power?**
   a. bipolar mode
   b. coagulation mode
   c. cutting mode
   d. fulguration mode
   e. monoterminal mode

4. **A 59-year-old woman is scheduled for curettage and electrodesiccation of a superficial basal cell carcinoma on the upper back. Which method is preferred for deep electrodesiccation?**
   a. large-tip electrode and coagulation current
   b. large-tip electrode in fulguration mode
   c. small-tip electrode and coagulation current
   d. small-tip electrode and cutting current
   e. small-tip electrode in fulguration mode

5. **A 32-year-old Asian woman is scheduled for superficial electrosurgical destruction of a small flat seborrheic keratosis on the face. Which treatment method is preferred?**
   a. large-tip electrode and coagulation current
   b. large-tip electrode and cutting current
   c. large-tip electrode and fulguration current in noncontact mode at the maximum power
   d. small-tip electrode and cutting current
   e. small-tip electrode and fulguration current at the maximum power

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