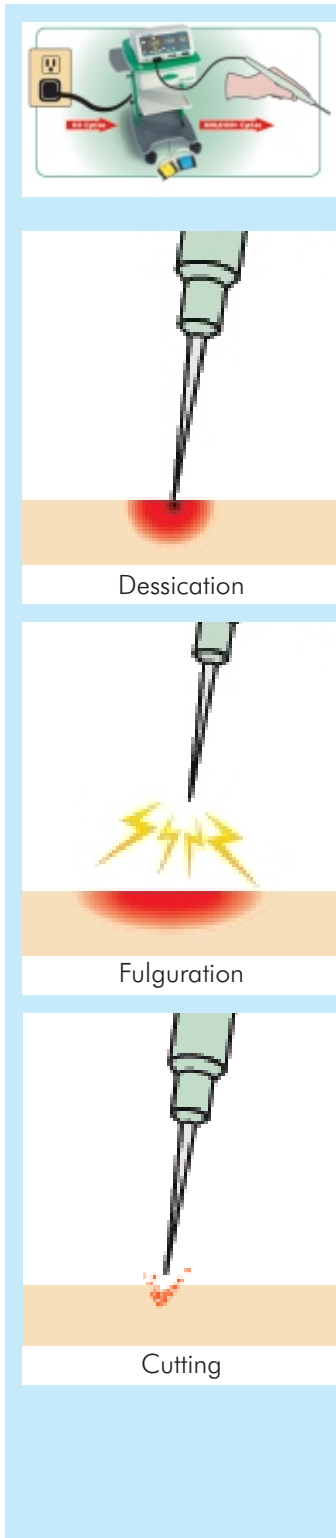


PRINCIPLE OF ELECTROSURGERY



Electrosurgery (Diathermy) is the application of electrical (radio frequency (RF) current to biological tissue. An electro surgical generator supplies the source of electric current which transfers energy to tissue.

The use of electrosurgery (Diathermy) during an operative procedure is almost as common as wearing gloves. There are various energy sources and methods employed with the use of electrosurgery, but (RF) current is typically used by the surgeon to cut or obtain hemostasis.

Principles of Electrosurgery

The standard electric current alternated at a frequency of 60 Hz (cycles per second). This current when transmitted through human body results in excessive neuromuscular stimulation and perhaps electrocution. These effects ceases at a frequency of 100,000 (cycles/second) 100KHz, Electrosurgery (diathermy) can be safely performed at "radio frequency" above 100KHz.

The electric energy when applied to biological tissue causes following responses:

a. Dessication

It is direct energy application that slowly drives water out of the cells

creating a dying out of the cells.

The blood vessels are thrombosed
Dessication can be achieved with either the cutting or the coagulation current by contact of the electro surgical device with the tissue.

b. Fulguration

It is from of coagulation. It is sparking of energy above the tissue to create a surface charring. When the spark reaches the tissue, it has a very high current density. This tissue effect is superficial.

Fulguration requires a high enough voltage to produce sparks with a coagulation effect rather than cutting.

c. Cutting

These waveforms vaporize the cellular explosions which result in a scalpel like dissection. True electro surgical cutting is a non-contact activity in which the electro surgical pencil is a short distance from the tissue.

Mechanism of electrosurgery

The electrosurgery current is produced by generator, which, converts current 60Hz to Radio frequency AC convent of above 200Hz.

When the current is concentrated, heat is produced and amount of

heat produced determines the tissue response. The smaller the application area, the greater the current density at the application site.

Alternating current flows through the patient. Current enters the body at a high density and leaves the body at a low density.

Electrosurgical waveforms

Electrosurgical generators can produce a variety of waveforms and each waveform creates different tissue results.

Cut:

When current waveforms are continuous it is called cutting current. The cutting current will cut the tissue but provides little homeostasis. This waveform produces heat very rapidly.

Coagulation

When current waveforms are pulsed or intermittent they are called coagulation current, which provides coagulation but does not allow for smooth cutting. This interrupted waveforms will produce less heat instead of tissue vaporization, a coagulation.

Blend

The blend current is an intermediate current between the cutting and coagulation currents.

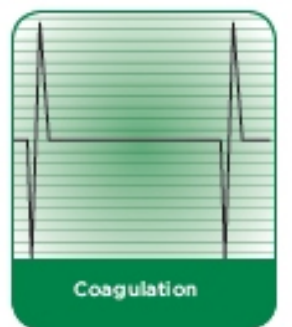
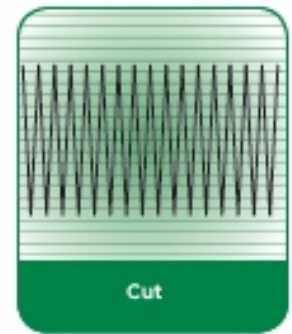
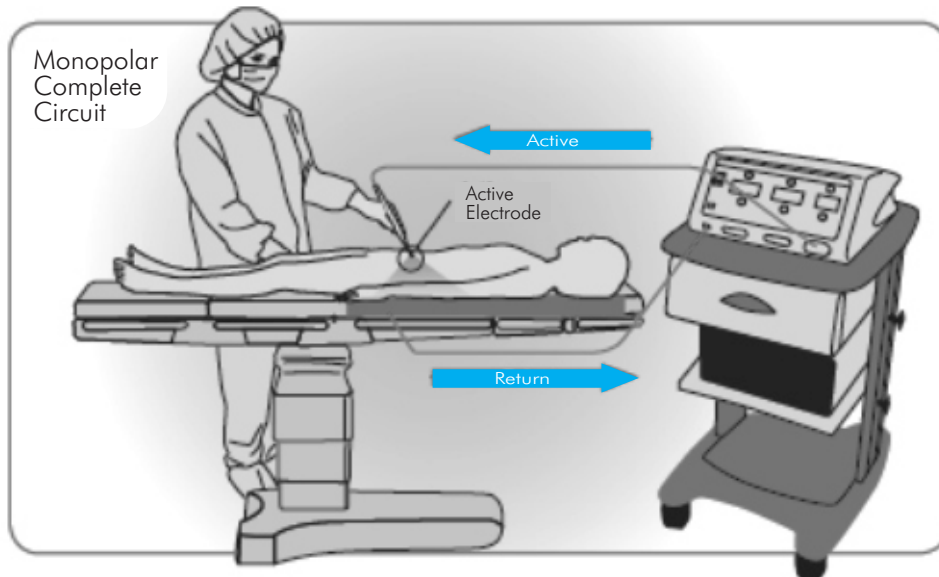
Types of electrosurgery

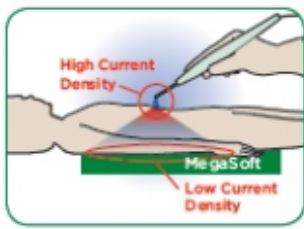
There are two basic types of electrical circuits:

Monopolar Bipolar

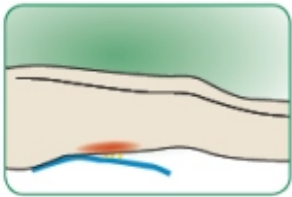
Monopolar:

It is an electrosurgical technique in which the tissue effect takes place at





Proper Application of Pad



Improper Application of Pad

a single active electrode anti dispersed by a patient return electrode.

Bipolar

It is an electrosurgical technique in which the electrosurgical effect takes place between paired electrodes, across the tissue to be treated. No patient return electrode is needed. Typically bipolar forceps are utilized for this technique.

Hazards of Electrosurgery

1. Pad site burns

If the surface contact between the patient and the return electrode is reduced or if the impedance of that contact is increased a dangerous condition can develop.

In case of reduced contact area, the current flow isn't concentrated in a

smaller area. As the current concentration increases the temperature at the return electrode increases. If the temperature at the return electrode site increases enough, a patient burn may result.

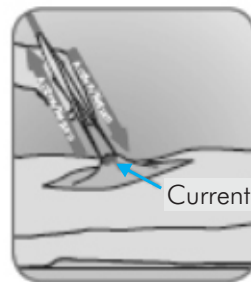
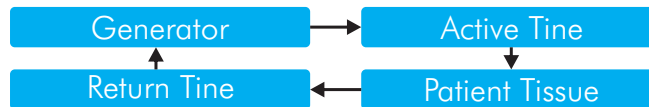
Surface impedance can be compromised by excessive hair, adipose tissue, bony prominences, fluid invasion, adhesive failure, scar tissue and other variables.

Assess Pad site location

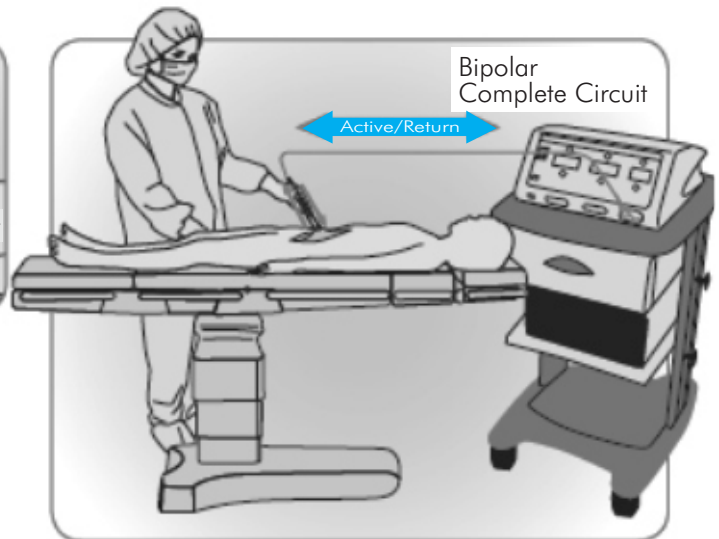
Choose: Well vascular Red muscle mass
 Avoid: Vascular insufficiency irregular body contours and Bony prominences.

2. Direct coupling

Direct coupling occurs when the user accidentally activates the



Close up of bipolar grasp of tissue



generator while the active electrode is near another metal instrument. The secondary instrument will become energized. This energy will seek a pathway to complete the circuit to the patient return electrode. There is potential for significant patient injury. Do not activate the generator while the active electrode is touching or in close proximity to another metal object.

3. Insulation failure

Many surgeons routinely use the coagulation waveform. This waveform is comparatively high in voltage. This voltage or “push” can spark through compromised insulation. Also high voltage can blow holes in weak insulation. Breaks in insulation can create an alternate route for the current to flow. If this current is concentrated it can cause significant injury.

4. Capacitative coupling:

A capacitor occurs whenever a nonconductor separates two conductors. A capacitor creates an electrostatic field between two conductors and as a result a current in a conductor can, through the electrostatic field, induce a current in the second conductor.

During laproscopic surgery, an inadvertent capacitor may be created by the surgical instruments. The conductive active electrode is surrounded by non conductive metal cannula.

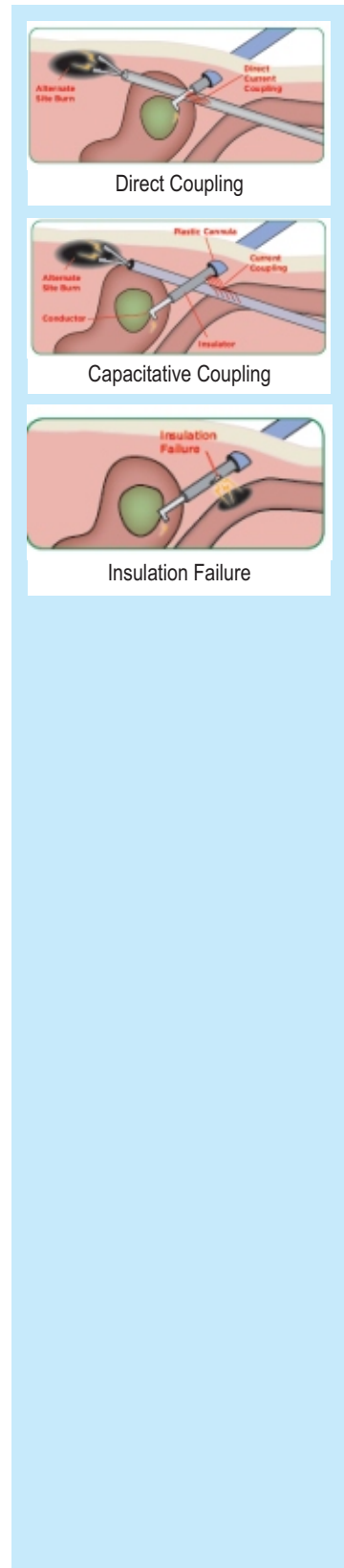
Recommendation to avoid complications

- Inspect insulation carefully.
- Work of lowest possible power setting.
- Use brief intermittent activation.
- Do not activate in open circuit.
- Do not activate in close proximity or direct contact with other instrument.
- Use bipolar electro-surgery when appropriate.

Surgical Smoke

Surgical smoke is created when tissue is heated and cellular fluid is vaporized by thermal action of an energy source.

Viral DNA, bacteria, carcinogens and irritants are known to be present in electro-surgical smoke. Universal precautions indicate a smoke evacuation system should be used.



References

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2. Sheilds CA, schechter Da tetzloff P, Method for creating ideal tissue fusion in soft tissue structures using radio-frequency (rf) energy. *Surg Technol Int* 2004; 13:49-55.
3. Gallagber K, Dhinsa B, Miles J. Electrosurgery. *Surgery* 2010. 29:2;70-73.