

Basics of Bipolar Electrosurgery

Bipolar electrosurgery has become more popular in recent years partly due to an increase in laparoscopic procedures. But bipolar is not just for minimally invasive procedures. New generation bipolar generators, modes and instruments can be a safe and effective alternative to higher voltage monopolar electrosurgery. The basic purpose of both monopolar and bipolar electrosurgery is to produce heat to achieve the desired tissue/clinical effect.

A continuous (sinusoidal) low voltage waveform is the most effective for desiccation. **Desiccation** is the process of drying tissue. Because the small amount of tissue held within the grasp of the bipolar instrument is the only part of the patient's body that is part of the electrical circuit, less power is required and the current is concentrated at the tissue within the grasp of the tines. Properly applied, bipolar desiccation minimizes damage to tissue; however, bipolar energy can still cause thermal spread to adjacent tissue if the instrument is activated for a prolonged period of time or if excessive power is used.

Bipolar instruments are comprised of two electrodes (two poles) with equal power density. Bipolar electrosurgical current travels from one electrode, through the grasped tissue to the other electrode to complete the circuit. A patient return electrode (PRE) is not required for bipolar only procedures. Nurses and surgeons have asked if it is dangerous to place a patient return electrode on a patient when both monopolar and bipolar electrosurgery are used during the same procedure. Theoretically, current from a bipolar instrument could be drawn (attracted) toward a PRE; however, the bipolar instrument and the return electrode would have to be in very close approximation before the current would be attracted to the PRE. Since the return electrode is usually placed far enough away

from the surgical site to stay clean and dry, there is minimal risk. The chance of bipolar current being attracted to a monopolar return electrode is extremely remote. Should there be a question or concern, the PRE can be plugged into the ESU when monopolar is required and unplugged when bipolar is used.

Two other important differences from monopolar electrosurgery are bipolar's use of a low voltage waveform and the decreased risk associated with capacitive coupling. Capacitive coupling occurs when electrical current is transferred from a conductor (electrode) through intact insulation and into adjacent conductive materials such as other instruments, cannulas or patient tissue. This is of primary concern during endoscopic monopolar procedures.

Bipolar electrosurgery is often performed in confined surgical sites and under magnification such as laparoscopy, neuro/spinal or eye procedures. Bipolar low voltage continuous current provides effective desiccation without sparking. Tissue will dry out (desiccate) better at lower (slower) power settings. Higher bipolar settings may cause the outer tissue to dry and the inner tissue to remain viable, resulting in re-bleeding.

Some newer generation bipolar instruments have incorporated a manual cutter into the forceps jaws. The forceps holds the tissue, while the bipolar current coagulates and then a guillotine blade manually cuts the tissue. In contrast to the mechanical cutting instruments, other new bipolar instruments have become available that use the bipolar current to cut tissue. Cutting with bipolar is best accomplished with the new **macrobipolar** mode, which provides a higher voltage current specifically designed for bipolar cutting. Bipolar cutting instruments

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are intended to reduce the need for the surgeon to change from a coagulating instrument to a cutting instrument especially during endoscopic procedures, reducing procedure time and improving efficiency.

A brand new bipolar technology has recently been introduced in the form of a revolutionary hemostasis product. This product works by fusing the collagen in vessel walls to create a permanent seal on vessels as large as 7mm. The product can seal tissue bundles without the need to dissect or isolate the vessels. The system uses state-of-the-art biomedical engineering in bipolar energy. A new bipolar vessel sealing generator delivers energy to the vessel via a vessel sealing instrument. The combination of pressure delivered by the instrument and energy delivered from the generator create the seal. The seal mechanism uses the body's collagen to actually change the nature of the vessel walls and obliterate the lumen. The collagen and elastin within the tissue melt and reform to create a permanent seal zone.

Developments in bipolar ESU's and instruments have created a greater variety of surgical applications while maintaining patient safety:

- There is no need for a PRE when using bipolar electro-surgery since the electrical current does not need to travel through the body to complete the circuit.

- A PRE is not required when only bipolar electro-surgery is used, but a PRE may be placed on the patient when both monopolar and bipolar modes are to be used.
- New bipolar systems, with a higher voltage macrobipolar mode, enable the bipolar waveform to "cut" and can be used in a greater variety of procedures.
- Bipolar cutting instruments incorporate either a manual cutter or have the capability of using macrobipolar (higher voltage) energy to cut and dissect tissue.
- Recent bipolar technology provides a unique bipolar energy output that fuses vessel walls for permanent vessel sealing.
- *Bipolar electro-surgery is recommended whenever possible due to reduced risk of patient injury.*

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