

Advanced vessel-sealing devices

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Advanced laparoscopic procedures have driven a parallel explosion in novel technologies that facilitate the performance of such procedures. This is particularly the case for vessel-sealing devices. Monopolar diathermy still plays a vital and effective role in laparoscopic surgery, but has limitations in terms of sealing larger blood vessels and is accompanied by the risks outlined above. Therefore surgeons have increasingly used advanced energy devices to facilitate dissection and to seal and divide blood vessels up to 7 mm in diameter. Furthermore, it is suggested that the use of advanced vessel-sealing devices reduces operative time and thus recovery is enhanced. There are three main types of advanced energy devices: bipolar electro-surgery, ultrasonic electro-surgery and combination devices. In all cases, the surgeon needs to be aware of the characteristics of these devices and their capacity to cause thermal injury in order to use them safely.

Bipolar electro-surgery devices Advanced bipolar tissue fusion technology is a vessel-sealing system that is used in both open and laparoscopic surgery by fusing the vessel walls to create a permanent seal. It uses a combination of pressure and energy to create vessel fusion that can withstand up to three times the normal systolic pressure. New technology such as the LigaSure™ system (Medtronic) involves advanced bipolar technology that uses the body's collagen and elastin to both seal and divide, allowing surgeons to reduce instrument handling when dissecting, ligating and grasping – a valuable asset particularly during laparoscopic surgery. The feedback-sensing technology incorporated in the instrument is designed to manage the energy delivery in a precise manner and results in automatic discontinuation of energy once the seal is complete, thus removing any concern that the surgeon has to use guesswork as to when the seal is complete. The newer instruments actively monitor tissue impedance and provide a real-time adjustment of the energy being delivered. Using this technology, LigaSure can seal vessels of up to 7 mm diameter, with an average seal time of 2–4 seconds, as well as pedicles, tissue bundles and lymphatics with a consistent controlled and predictable effect on tissue, including less desiccation.

Robert Lawson Tait, 1845–1899, surgeon, Birmingham, UK. The harmonic scalpel is an instrument that uses ultrasound technology to cut tissues while simultaneously sealing them. It utilises a hand-held ultrasound transducer and scalpel that is controlled by a hand switch or foot pedal. During use, the scalpel vibrates in the 20 000–50 000-Hz range and cuts through tissues, effecting haemostasis by sealing vessels and tissues by means of protein denaturation caused by vibration rather than heat (in a similar manner to whisking an egg white). It provides cutting precision, even through thickened scar tissue, and visibility is enhanced because less smoke is created by this system during use compared with routine electro-surgery. Currently, the harmonic scalpel is in common use during laparoscopic procedures, as well as open surgery, such as thyroidectomy, and several plastic surgery operations, e.g. cosmetic breast surgery. There are several such devices on the market, which vary in form and function.

- Combination

energy devices In the last 5 years, technology has evolved concerning both harmonic and bipolar advanced energy devices. One product, the Thunderbeat STM (Olympus), has combined both modalities in a single device. By simultaneously using ultrasonic vibration and bipolar diathermy, this device can seal and divide arteries and veins up to 7 mm in diameter in a shorter amount of time with no smoke or mist. Advanced vessel-sealing devices

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