HEMOSTASIS IN SURGERY
The normal physiological response that prevents significant blood loss following vascular injury is called hemostasis.

Blood vessel injury triggers the following sequence:

- The vessel constricts to reduce blood flow
- Circulating platelets adhere to the vessel wall at the site of trauma
- Platelet activation and aggregation, coupled with an intricate series of enzymatic reactions involving coagulation proteins, produces fibrin to form a stable haemostatic plug

Hemostasis
Why talk of hemostasis in surgery? – for a safe surgery – we have a number of technical choices to achieve hemostasis – we have no guidelines, but only manufacturers’ recommendations – we only have one book on the scope of veterinary surgery.
Techniques for closure of the vessels: *manufacturers recommendations*

* 3 sizes of clips and applicators
* 2 sizes of staples
History of electrosurgery

- 3000 BC: The Egyptians used the heat for the treatment of cancer
- Top 800: Discovery of the properties of electricity (electrocautery - current)
- 1889: Sir Henry Thompson built the first high-frequency generator
- 1890: Proven, the action of the alternating current high-frequency in human tissues
1900: A. Riviere used equipment Arsonval (raises the tension by reducing the current high frequency) to destroy a cancerous lesion of the skin.

1909: Nagelschmidt uses the therapeutic effects of tissue heating and called diathermy.

1910: The electrosurgery is recognized as a surgical instrument to insert surgical armory.

1926: Cushing and Bovie build the first electrosurgical generator with sufficient haemostatic effect and fast cutting for neurosurgery.

1969: Valleylab generator invented the first solid-state controlled manually and laptop with isolated outputs.

History of electrosurgery
Electrosurgery: Application of high frequency electric current directly to cut tissue and coagulate.

High frequency (above 100 kHz) = stimulation are so quick to produce no effect on the neuromuscular system.
“An adequate surgical training is a prerequisite to the adoption of electrosurgery... It little behooves the novice to take up such a powerful weapon, dangerous in the hands of the unskilled.”
A.O.R.N.
(Association of Operating Room Nurses)

The ESU is classified as "...the most dangerous equipment used daily in the operating room..." and "...a major cause of harm to patients than any other equipment..."
With the latest technology in burn within the plate is always caused by a problem of positioning the plate (displacement, poor adhesion, uneven surfaces, scars, swelling, presence of other electrodes electro ...)

The burns are caused by poor patient-plate interface causing an increase in current density ...

Risk of burn
Rules and laws related

- European Directive 93/42/CEE: requirements for the marketing of medical devices in the EU
- D.Lgs. 81/08 (Consolidated Safety): safety workers and users, DPI, risk assessment,…
- Rules CEI (62-5, 62-11, 64-8,…): electrical safety equipment and systems
- Manufacturer’s instructions in the manual and maintenance manual and the training events
Advantages of modern electrosurgery

- Decreased operative time
- Tools easy to use
- Precise and delicate dissection
- Tissue manipulation reduced
- Reduced bleeding
- Less ligatures
- Better visibility of the operative field
- Reduction of pain and post-operative infections
- Increase in outpatient surgery
- Safety during endoscopic surgery
How to manage medical devices

- **Health Department**: Programming, acquisition & monitoring
- **Clinical Engineering**: Purchase, training, maintenance, electrical safety
- **Prevention and Protection Service**: Risk analysis, protectors, accidents
- **Preventive Medicine**: Monitoring workers' health
- **Technical Department**: Safety and electrical system maintenance
How to use the electric scalpel

• Bipolar use:
  - the RF power is delivered between two points, through which the surgeon is able to carry out small clots. No need return plate.

• Monopolar use:
  - how to use electrosurgery through the active electrode and neutral electrode, and these two electrodes has the active electrode is used to cut, coagulate and so on. the patient’s tissue surface due to very low, while the neutral acts only as a return electrode with which it closes the electrical circuit that includes the patient and the electrosurgical
Coagulation

• Bipolar: type of coagulation using bipolar forceps that can deliver the power of radio frequency output impedance on the value of 100 ohms. This value is roughly what has the section of tissue that may normally be between the tips of the pliers.

• Monopolar: particular waveform output that allows the water contained in the cells to evaporate gradually, without the cellular tissue can "burst" (as happens in the cut): Drying (ball electrode in contact with the fabric => dehydration slow heating) Electrocution (electrical discharge on the tissue, without direct contact)
Energy

Due to the pressure, the cell expands

Cell exploded

Coagulation

Cell coagulated

Cut

Dehydration by heating

Intense energy
• How often you need to adjust the power during surgery?
• Who makes settings?
  • Us alone
  • No HTA studies to confirm the reduction of staff costs
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The fusion process: **LigaSure™**

- The fusion of tissue refers to the process where the collagen and elastin combine to form the ligature.
- The end result is the creation of a single layer of tissue area impermeable to fluids.
- It's a system that uses a combination of pressure and Radio Frequency for a true synthesis of the vessels.
The fusion process: **LigaSure™**

Handpiece applies the optimum pressure to vessels / tissues.

The generator measures the strength and chooses the appropriate setting of energy.

The pulses are adapted to the cycle progression of vessel closure, warning that the reaction is complete.
Difference between Bipolar & fusion process

**Bipolar:** The lumen is open and there is a proximal thrombus.

**Fusion:** The artery was fused and obliterated the lumen.
Superior Thyroid Vein with a seal performed by the precise. This slide also shows the birefringence. Magnification of x2

- Sintesis area
- Termical diffusion
- Normal vessel
Harmonic devices

The electricity supplied by the generator is converted into mechanical energy through a system of piezoelectric crystals.

The knife or the tip of the instrument connected to the axial vibration generator with a constant frequency of 55,500 Hz.

The longitudinal extent of the vibration can be varied between 25 and 100 µ in 5 levels, adjusting the generator power.
Harmonic devices

There are 3 possible effects:

- cavitation
- coagulation
- cutting

The balance between cutting and coagulation depends on:

- power
- blade
- tissue tension
- force / pressure
Conclusions

• the wide range of tools leaves some open problems
– we must have all platforms in the operating room?
– platforms in the same hospital should be the same?
– Which training:
• young surgeons
• nurses
• experienced surgeons
– what to teach
Our course: hemostasis in surgery
Here to care
Here for safe surgery