1. **Summary:**

In this presentation we will study the perioperative management protocols of patients who will receive an interventional technique. We will also analyse the location of equipment and personnel in the operating room. We will also talk about basic interventionism material.

Endovascular techniques are procedures encompassed within interventional radiology. They are minimally invasive surgical procedures and widely applied in human and veterinary medicine.

The increase of the demand for these techniques means that more and more literature and studies are available.

2. **Perioperative protocol:**

As far as possible, the patient will be admitted 24 hours before the intervention to perform a pre-anaesthetic evaluation including:

- Complete blood count
- Biochemistry and electrolytes
- Coagulation factors
- Chest x-rays
- Electrocardiogram
- Echocardiography prior to the intervention

Once hospitalized, blood will not be extracted from jugular vein, since it will be the access route for the intervention. Depending on whether the approach is cranial (via jugular) or caudal (via femoral) the opposite peripheral pathways will be used, that is, if we access via jugular, we will apply the intravenous
catheter in the saphenous vein and if we access via femoral, we will apply the intravenous catheter in the cephalic vein.

Fluid therapy will be performed with Ringer-lactate at a maintenance flow rate and dose.

During surgery, the ECG leads will be placed on the pads, furthest away from the work area.

During the post-surgery recovery, monitoring should be performed for 24 hours.

3.- Disposition in the operating room:

The layout of the interventional operating room is very important, since not less than 4-5 people will need to intermingle with large and bulky machines. The ideal staff in the operating room (in our intervention team) is the following:

- 2 interventionist veterinarians
- 1 veterinarian specialized in anaesthesia
- 1 veterinarian specialized in radiology
- 1 nurse specialized in interventionism

As for the non-expendable material in the operating room, it consists of:

- Fluoroscope
- Ultrasound
- Anaesthesia machine
- Contractor injection pump
- Large surgery table for guides and catheters
- Table for material

4.- Equipment and material:

Endovascular techniques share a characteristic with angiography techniques: the need for specific vascular radiology material. Without the proper equipment and learning curve, it is not only impossible, but also dangerous to perform the techniques described above.

Regarding the equipment and material required, the most commonly used are the following:

- **Fluoroscope arc**: it emits radiation continuously, which is captured by an image intensification system and / or acquisition screen. Currently, the radiation they emit is limited and reduced thanks to intensification screens and advanced software systems, which allow a decrease in the radiation exposure rate for the patient and the veterinary staff. The systems used for vascular intervention must always have an image recording system, because without it, the evaluation of mainly selective angiograms would be complicated. In addition, the most advanced equipment allows the contrast subtraction and Road Mapping.

- **Subtraction of contrast**: Through a software system, the fluoroscope "learns" the image it previously shows and "subtracts" it, that is, eliminates it from a second image. It gives a clean and clear image of the blood vessels that can later be used in Road Mapping.
- **Road Mapping:** It allows the overlay on the screen of a previously recorded image. This allows us to be guided and precisely manoeuvre inside the patient's vascular system.

- **Automatic pressure pumps (angiographic):** They are useful in the performance of angiographic studies, mainly when the volume and rate of contrast to be administered is large, for example for a contrast ventriculography in large patients.

- **Contrast media:** The iodine type are the most used ones in angiography and therefore in vascular therapy; they allow the obtaining of a radiopaque image that allows the visualization of vascular structures at inoculation in the system. Although the ideal contrast medium is iohexol (low non-ionic osmolarity), other options exist, and all have their contraindications, so it is important to inform the owner accurately about its use. Problems such as nephropathy associated with contrast medium occur in both human and veterinary medicine.
  - **Sodium amidotrizoate** (Urografin®): It is the one with the highest kidney complications, so its use is limited to 1-2ml / kg patient.
  - **Iopromide** (Ultravis®).
  - **Iohexol** (Omnitrast®) Higher cost, but currently has the least side effects, dosage of 2ml / kg patient.

- **Needles and introducers:** They are used for puncture and vascular access, which can be venous or arterial. The use of introducers for the Seldinger technique is always more appropriate than the use of conventional needles since it allows the exchange of guides, catheters and contrast administration without loss of access and with less trauma in the access area.
  - **Introducers:** Usually have a non-return valve which prevents blood from escaping, but allow the introduction of catheters and guides through it. They also have a lateral access for the injection of contrast material or heparinized serum during the intervention.
  - **Introducer "Peel-away":** It is a type of introducer and is used in pacemaker therapies since they are removed by "peeling" the introducer without removing it completely.

- **Catheters:** Hollow and thin tubes of great length, used for the introduction of contrast material or embolization. There are various types, with various shapes and sizes. All have a hydrophilic coating that prevents friction with the glass.
  - The main catheters used are the following:
    - **Angiographic diagnosis:**
      - Selective
      - Non-selective
    - **Guided:** Large diameter catheters that can be penetrated by angioplasty balloons and other instruments. They serve to channel guides and catheters. The tip includes various morphologies straight, curved, Hockey-stick with and without holes, multipurpose, cross over and with angle of 45º.
    - **Measuring catheters:** Used to measure the vessels from the inside, for example for taking of measurements prior to placement of a stent system in the caudal vena cava.
    - **Infusion catheters:** Allows the infusion of liquids and substances.

The diameter of the catheters is measured on the French (or Charrière) scale and is called "French", which determines the scale of the external diameter using an equation. The equation is the following: Diameter = Fr / 3 (or Fr = Diameter x 3). This scale is universally used in medical instruments of catheter or tubular type.
- **Guides:** hydrological wires used to “guide” a catheter, balloon, or other type of device to a specific site. The most used in veterinary medicine are those of 0.035 “and 0.025”, and it is always advisable to use a guide as large as possible according to the patient and the catheters size, since the larger diameter of the guides, the greater subsequent support of catheters, such as angioplasty or valvuloplasty catheters.

- **Balls:** special type of catheter, which may have a light through which guide can be passed or contrast studies performed, and another light through which the balloon that is placed at the end of it is inflated. These balloons are made of material with a high rupture index and little elasticity, which allows its dilation to block blood flow or perform angioplasty (remodelling) of the blood vessel, cavity or valve.

- **Handles:** catheter-type systems with a metal handle inside that allows trapping a structure inside the vessel to achieve its displacement or extraction. The system consists of a catheter through which the loop attached to a cable is passed; when it slides inside the catheter it opens at its end and when it retracts, it closes. Currently, they are used for the treatment of adult filaria extraction.

- **Stents:** Tubular structures made of different materials that are placed directly or by means of balloon-like devices in the inner lumen of a blood vessel, keeping it open. Currently, stents with internal valve systems that improve the outcome in patients undergoing valvuloplasties exist, including the use of stent with autologous tissue valves that decrease the ability of rejection and re-stenosis of the device.

- **Mechanical embolisers:** Multiple types of devices exist, but the most commonly used are coils and amplatzer type devices.

- **Occlusive devices** (Amplatzer): It is currently the most used system in human and veterinary medicine. It has a double umbrella structure similar to the original Rashkind and Cuaso. This structure consists of a network of nitinol fibers and fibers with thrombogenic capacity. A specifically veterinary medicine device is available (Amplatz Canine Ductal Ocluder®).

- **Vascular Occlusion Devices Plug:** Similar to amplatzer devices, have different morphologies and are usually used for the occlusion of peripheral vascular systems such as portosystemic shunts and other aberrant vessels. They do not have fibers of thrombogenic substances inside, and this is why the embolization is more progressive.

- **Coils:** the oldest devices used in endovascular therapy, consisting of a spring-shaped platinum wire or surgical steel wound, between which fibers with thrombogenic properties are placed; although their release system has been modified, it is still a device with high migration capacity. Currently in combination with a Cava Stent, its main application is intrahepatic shunt occlusion, using a technique that combines both devices.

5.- **Endovascular techniques and procedures:**

Minimally invasive surgical techniques are gaining ground to conventional surgical techniques in veterinary medicine. A faster patient recovery rate, lower risks of infection and bleeding, as well as the possibility of tackling pathologies that until now were difficult to solve by conventional surgery, confer a prosperous future in veterinary medicine.
The so-called minimally invasive techniques include the so-called endovascular techniques. These procedures address the surgical techniques that can be performed from inside the blood vessels.

More and more pathologies can be solved by this type of techniques, which are usually are grouped into three major groups:

- Obstructions or narrowing of the vascular lumen or cavities.
- Abnormal communications or shunt between two vascular regions (cardiac cavities or blood vessels).
- Studies and/or treatment of arrhythmias (arrhythmology).

6.- References: