Mouse Jugular Vein Catheterization

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The viewer is strongly encouraged to watch the sister presentation on Rodent Surgery Set-up before viewing this presentation.
A general mouse surgery pack generally includes atraumatic (toothed forceps), small scissors, a few sharp pointed forceps, needle holder, fine scissors, and staple or wound clip applicator.

For jugular vein catheterization a few additional custom made instruments are helpful.
To begin surgery induce anesthesia using 3% Isoflurane with a 1 LPM flowrate

The animal is transferred to a face mask and anesthesia adjusted to 2-2 ½ % Isoflurane at 0.5 LPM flowrate
After eye ointment and preemptive analgesic have been given the surgical area is clipped and a mild depilatory (e.g., Nare for lip and face) applied.

The depilatory is applied in a thin layer over the surgical site for 1 minute (or less).
Clean cotton tipped applicators rinsed in water are used to completely remove the depilatory.

Once the depilatory has been removed the area is prepped with 2 alternating scrubs with 70% isopropyl alcohol and betadine.
The mouse is placed on the surgery table, restrained, the third betadine and alcohol scrub preformed and the surgery drape applied.

Animal has been prepped for surgery and draped.
An opening has been cut in the drape to expose the incision site.

The skin is “tented” with atraumatic toothed forceps and a skin incision made with scissors on a line between the point of the shoulder and the ramus of the mandible.
The incision is enlarged using blunt dissection.

The incision is deepened with blunt dissection using sharp tipped forceps (Dumont # 4 or 5), i.e. the forceps' tips are lightly pressed against the fascia close together, and then...
The tips are allowed to open, stretching and separating the tissues along facia planes.

The external jugular vein runs below the outer edge of the mandibular salivary glands.
The jugular vein becomes visible as the tissue is separated.

Retractors can be helpful in keeping the vein exposed as it is separated from the adjacent tissues.
A few drops of 1% lidocaine dripped on the vein will help keep the vein dilated and make catheter placement easier.

Blunt dissection is used to “strip” the vein of the adjacent tissue all the way around the vein.
Once the vein has been freed from adjacent tissue all the way around, a small retractor is placed under the vein.
The retractor is pushed under the vein and brought back up on top of the skin stretching the vein slightly.

Significant variation can exist in the branching of the jugular vein. Failure to clearly visualize the vein can lead to the catheter missing the vein lumen and traveling along the vein sheath instead.
The very sharp tips on most Dumont forceps can easily tear veins. Using very fine sand paper (2000 grit) to blunt the tips slightly can make them safer to use.

The skin retractors are removed and a doubled over 5 cm long piece of 5-0 silk ligature is passed under the vein.
The ligature is pulled under the vein approximately 1/3 of its length and cut at the apex providing 2 ligatures about 2.5 cm long.

A square knot is used to form the cranial ligature ahead of the retractor and the ligature ends left long. The first throw of a square knot is tied in the posterior ligature on the caudal side of the vein retractor.
Very fine scissors or a 23 gauge needle is used to create an opening in the vein. The tension the retractors place on the vein helps prevent hemorrhage from the vein.

If using a needle to open the vein it should be clearly visible in the vein.
The needle is removed and replaced with a catheter.

If the vein is difficult to catheterize, it can be dilated using a tapered steel pin with a diameter slightly larger than the catheter.
Once in the vein, the catheter should be gently pushed in past the rear ligature.

Once the catheter is properly positioned, the first throw of the ligature is tighten and a second throw used to complete a square knot.
Care must be taken not to allow the catheter to slip out of vein or out from under the ligature as it is tied.

Once the square knot has been completed one end of the ligature is passed around the vein and a second square knot tied. Proper placement is confirmed by drawing a small amount of blood into the catheter and then clearing the catheter.
The ends of the rear ligature are cut short and the long end of the anterior ligature is circled around the catheter.

The long end of the ligature is circled around the catheter three times.
Once the long end has been wrapped around the catheter three times it is used to tie a square knot and thus anchor the catheter much more securely.

Once the knot has been tied the ends of the ligature are trimmed.
Once the final knot has been tied, the proper placement of the catheter is once again verified by drawing a SMALL amount of blood into the catheter and returning it to the mouse.

The total volume of heparinized saline infused during the catheter placement checks should not exceed 0.1 ml or fluid overload and/or systemic heparinization may occur.
Once the catheter has been secured and checked the vein retractor can be removed and the catheter used in acute experiments or channeled subcutaneously to a port or opening on the back for chronic experiments.

If the catheter is to be exteriorized for later use, a small incision is made in the skin between the shoulder blades.
A subcutaneous tunnel is made from the back incision to the catheter using blunt dissection or a “tunneling tube”
If using a tunneling tube the catheter is pushed through the tube until it exits the back.

The tube is then removed leaving only the catheter.
The catheter is then anchored to subcutaneous tissue near the jugular vein to prevent excess tension on the vein.

The neck incision is then closed with a simple continuous suture pattern to close the subcutaneous tissue.
A simple interrupted suture pattern is used to close the skin.

An anchor suture for the catheter is then placed in the exit skin incision.
The suture is then wrapped around the catheter several times and secured using a square knot and the skin closed using a two layer closure of the subcutaneous tissue and the skin.