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Intravenous Jugular Catheterization for Rats

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1 Works for me This protocol is published without a DOI.

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ABSTRACT

This protocol outlines the step-by-step setup and procedure of the pre-op, surgery, and post-op for intravenous jugular cathetarization for rats in intravenous self-administration studies (e.g. cocaine, oxycodone).

PROTOCOL CITATION

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intravenous surgery, catheterization, rats

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GUIDELINES

Keep surgery station/field as clean and sterile as possible:

- Wear sterilized gloves when operating on a rat
- Replace pads after operating on 3-4 rats
- Sterilize tools in hot bead sterilizer or keep them soaking in betadine-alcohol solution in between animals

Always make sure the rat is completely anesthetized before beginning the surgery

- Pinch between the toes to check for a response
- Do not begin surgery if you see the rat resisting/pulling back its leg

Monitor the oxygen and fluid level of the anesthesia machine to ensure that isoflurane is being delivered to nose cone during surgery.

Check and recheck the flow of the catheter consistently throughout surgery.

- If the flow is blocked, catheter tubing may be kinked, or be hitting the heart or sides of the blood vessel
- Readjust the catheter tubing (i.e. turn the tubing or pull extra tubing out of the pocket and reinserting it)

MATERIALS

NAME	CATALOG #	VENDOR

NAME	CATALOG #	VENDOR
Isoflurane vaporizer	Mobile Laboratory Animal Anesthe	VetEquip
Isoflurane		
Vetbond		3M corporation

MATERIALS TEXT

Prep/Recovery Station:

- Blue and green pads
- Gloves
- Shaver
- Scale
- Surgery log book and sheets
- 25 gauge needles (blue)
- Saline (Bacteriostatic, 0.9% sodium chloride)
- Cefazolin
- Flunixin
- Hoodsies
- Metal Caps
- Vetbond
- 1mL syringes
- 10 mL syringes
- Water circulating/Heating pad
- Recovery cage
- Sharpies and pens
- Procedure stickers (orange)

Surgery Station:

- Blue or green pad
- Sterile gloves
- Hot bead sterilizer
- Lamp
- Isoflurane
- Anesthesia machine
- Alcohol prep wipes
- Blunt scissors
- Small sharp scissors
- Hemostat clamps
- Tooth/tissue forceps,
- Sharp pointed forceps
- Stainless steel stick
- 2 inch gauze
- Cotton tip applicators
- 18 gauge needles (pink; for saline bottles)
- 20 gauge needles (black; need a lot, one per animal)
- 1 mL syringe
- Flusher
- Saline (Bacteriostatic, 0.9% sodium chloride)
- 10 (round) or 11 (sharp) blade
- Non-dissolvable/black suture thread
- Suture needle
- Catheters
- Canoe (modified 18 gauge needle)
- Alcohol (70% ethanol) and sterile water glass bowls
- 2 4x4" dishes (1 with betadine-alcohol solution and 1 with sterile water)
- Blood collection tubes (if you're doing eye bleeds)
- Microcapillary tubes (if you're doing eye bleeds)

SAFETY WARNINGS

There is potential exposure to isoflurane which may cause dizziness and headaches.

BEFORE STARTING

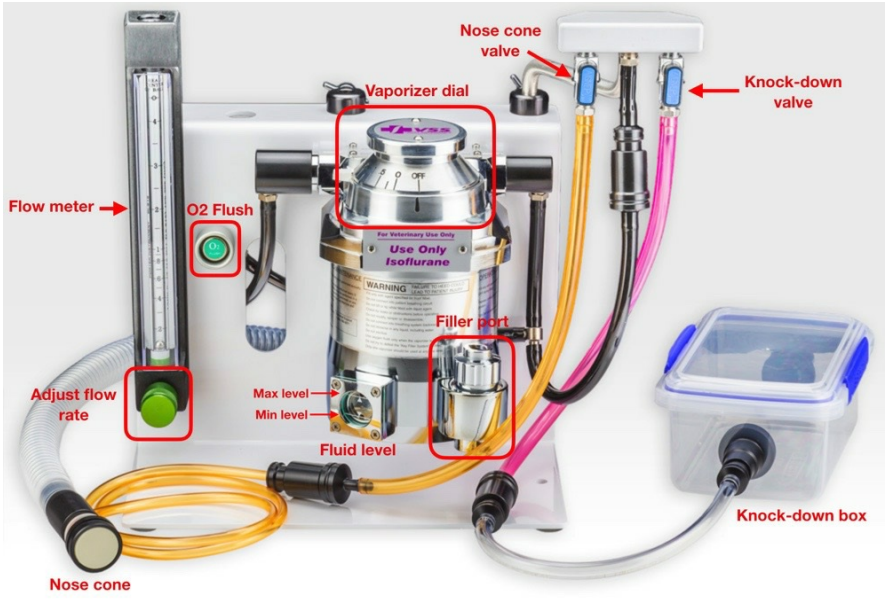
Set up prepping/recovery station:

1. Line the prepping/recovery station with green pads.
2. Set up prepping field with shaver, scale, and surgery log.
3. Set up recovery field with vetbond, cefazolin (160 mg/kg, antibiotic), flunixin (2.5 mg/kg, analgesic), hoodsies, metal caps, 25 gauge needles (blue), 1 ml syringes (1 for cefazolin and 1 for flunixin), 10 ml syringe, and a recovery cage (lined with blue pad) placed on top of a water-circulating heating pad.

- Prepare 160 mg/kg cefazolin: add 6.25 ml saline in 1 vial of cefazolin (each vial contains 1 g cefazolin)
- Prepare 2.5 mg/kg flunixin: add 1.5 ml flunixin to 30 ml bottle of saline (diluted from 50 mg/kg flunixin meglumine)

Set up anesthesia machine:

1. Place the mobile rodent anesthesia machine next to surgery station. Place nose cone on surgery table and secure it with tape.
2. Open oxygen tank with tank wrench. Make sure there is air flowing to the knock-down box by putting the knock-down valve (pink) in the downward position.
3. Adjust oxygen flow rate to 1 LPM.
4. While isoflurane vaporizer is OFF, unscrew the filler port and pour isoflurane into the resevoir until the fluid level is just below the max level.



Anesthesia machine diagram.

Set up surgery station:

1. Line the surgery station with green pads.
2. Set up surgery field with lamp, alcohol prep wipes, surgery tools, canoe (modified 18 gauge needle), gauze, cotton-tipped applicators, 20 gauge needles (black), 18 gauge needles (pink, for saline bottle), 10 ml syringe (filled with saline), flusher (filled with saline), 10 or 11 blade, black suture thread, suture needle, catheters, 1 glass bowl with 70% ethanol, 1 glass bowl with sterile water, 1 dish with betadine-alcohol solution, and 1 dish with sterile water.

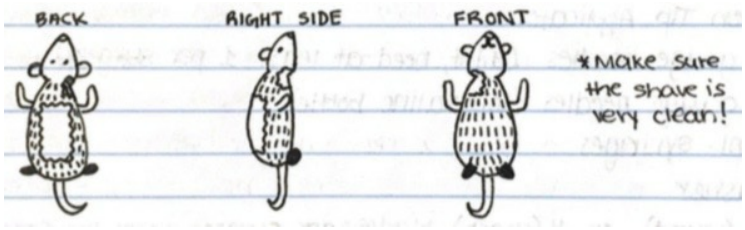
Animal Preparation for Surgery

1 Place rat in the knock-down chamber. Set isoflurane vaporizer dial on 5 to begin anesthetizing rat.

2 Once breathing is constant (about 2 breaths every 3 seconds) and deep, turn off isoflurane and take the animal out for

preparation.

3 Shave the back from above the legs to just below the arms. CAREFULLY shave the neck on the right (unless stated otherwise).



Drawn by SS. Areas to shave for surgery.

4 Scan the rat and check its RFID to ensure it is the correct rat.

5 Weigh the rat and record its weight in surgery log.

6 Place animal back into the knock-down chamber. Turn the isoflurane up to 3 if there is a long wait to be operated. Turn isoflurane to 5 if the surgeon is almost done/ready.

Monitor the rat's breathing when it is under isoflurane. Overexposure can cause death during surgery.

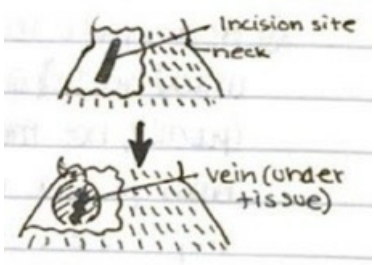
Surgery Procedure

7
1. Take the rat from the induction chamber and place it on the surgery table.
2. Place its nose in the nose cone and put the nose cone valve (orange) in the downward position to deliver isoflurane.

Make sure the rat is completely anesthetized before doing eye bleeds or making an incision.
- Breathing should be deep, slow, and constant
- Can check by pinching between the toes, and making sure the rat doesn't resist

8 Clean the rat's neck with an alcohol prep pad.

9 Make a small incision (about 2 cm) on the neck where you see the vein beating under the skin.



Drawn by SS. Incision site for the neck.

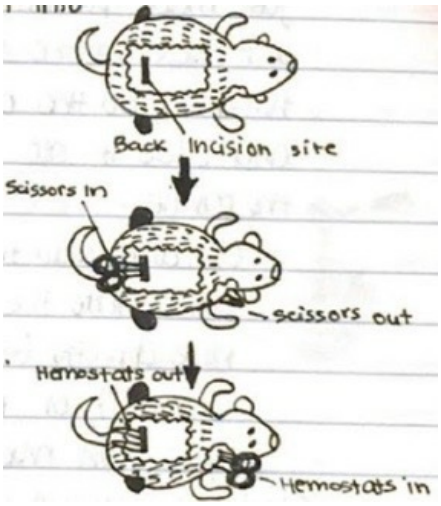
10 Use sharp forceps to carefully dig through the muscle/tissue until you locate the jugular vein. The vein will look purple.

11
1. Strip/clean the jugular vein of all attached tissue. Want it to be clean so you can penetrate it easily.
2. When you're done, flush the vein with saline to keep it moist and cover the incision site with gauze.

12
1. Flip the animal over so that the back is facing you.
2. Clean the back with an alcohol prep pad, and try to clean any loose hairs off.
3. Make an incision large enough for the catheter to fit into (about 3-4 cm) on the lower back near above the legs.

13
1. Using blunt scissors, start blunt dissecting at the back incision and move towards the neck incision.
2. Poke a hole through the neck incision with the scissors, creating a passageway from the back to the neck.

14 Place the hemostat clamps through the neck incision with the ends sticking out of the back incision, and remove the blunt scissors. Gently rest the hemostats off the rat.



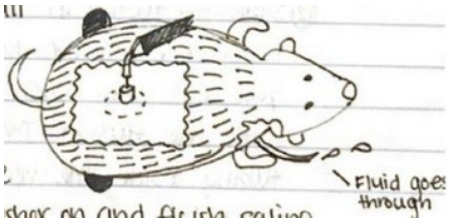
Drawn by SS. Placement of the blunt scissors and hemostats in the rat's back.

15 Test the catheter to make sure there are no leaks.

16 Grab the end of the catheter tubing with the hemostats, and pull the tubing through the pocket until it comes out of the

neck.

17 1. Push the catheter into the body (can use hemostats to help).
2. Align the catheter in the center of the rat (not too high on the shoulders and not to low on the back).
3. Using a blade, poke a hole large enough for the catheter threading to go through.
4. Clean the catheter port, attach the flusher, and make sure the catheter can be flushed.



Drawn by SS. Flush catheter in the rat.

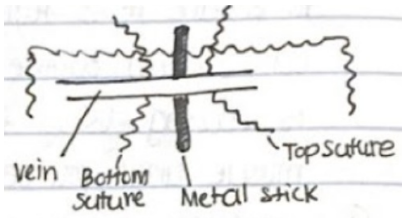
When pushing the catheter through the skin, make sure you place fingers under the catheter.

18 1. Flip the rat back so the neck is facing you.
2. Flush the open skin with saline.

19 Find the jugular vein again, and then isolate it by placing the metal stick underneath it.

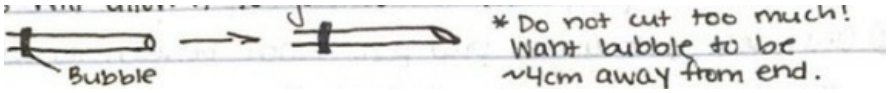
Drawn by SS. Metal stick placed underneath jugular vein.

20 1. Cut a piece of black suture thread, fold it in half, and put it under the vein.
2. Cut the thread at the folded part so that it becomes 2 pieces.
3. Place one piece of the thread above the vein, the other piece below the vein.



Drawn by SS. Placement of suture threads above and below the metal stick under the jugular vein.

21 Bevel the catheter tubing so that it has a sharp edge. The sharp edge will allow the tubing to enter the vein more easily.



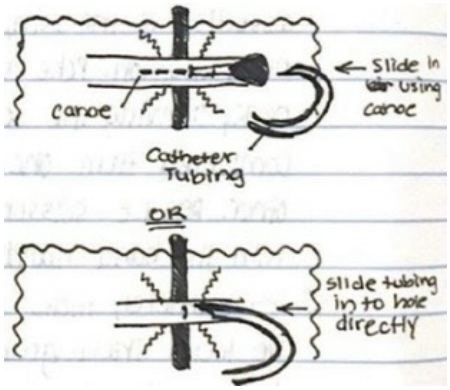
Drawn by SS. Bevel the catheter tubing.

22 1. Take a 20 gauge (black) needle and carefully make a hole in the vein, being sure to not go through the vein.
2. Once you are in the vein, gently move the needle very slightly in and out and/or twist it, then pull the needle out.

Drawn by SS. Puncture the vein with a 20 gauge needle.

23 1. Place canoe tip into the hole that you just made in the vein.
2. Use sharp forceps to grab the end of the catheter tubing.
3. Using the canoe for guidance, slowly slide the tubing into the vein with the tip of the bevel facing down.

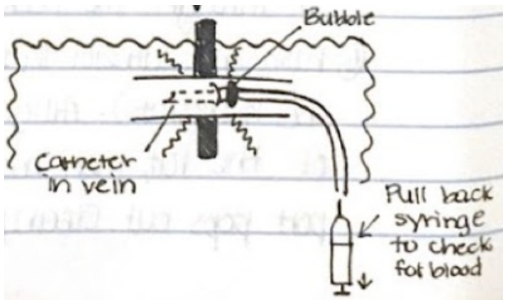
The canoe is optional. Use whatever method is helpful for you to get the tubing in the vein.



Drawn by SS. The top image shows the canoe method. The bottom image shows a direct method of getting the tubing into the jugular vein without the canoe.

24 1. Slide the catheter tubing in until you reach the bubble.
2. Pull back blood with the flusher to ensure that the tubing is in the vein. If you do not see blood or if you feel resistance when you try to pull back blood with the flusher, then the tubing is not in the vein.

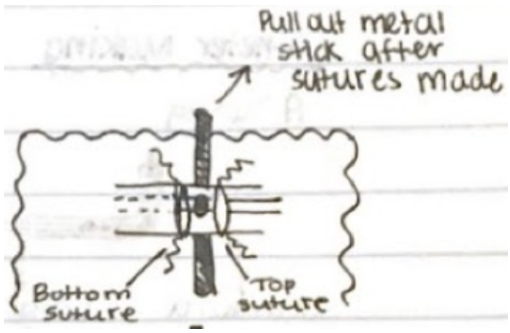
Twist the tubing inside the vein carefully to help with the flow.



Drawn by SS. Catheter in the vein.

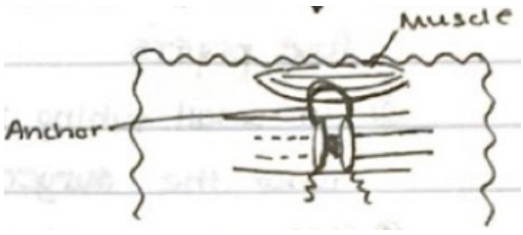
25 Once the tubing is in the vein (up to the bubble) and blood flow is good, tie the top suture above the bubble and the bottom suture below the bubble.

- Make sure the knots are not too tight (will cut off flow of the catheter) or too loose (can release the catheter from the vein)
- Make sure to tie at least 3 knots for each suture



Drawn by SS. Tying the top and bottom sutures.

26
1. Anchor the sutures onto the surrounding muscle using the suture needle.
2. Test the flow of the catheter with flusher again to make sure it is still good.
3. Cut the excess string.



Drawn by SS. Anchoring the suture thread.

27
1. Tuck in any extra catheter tubing into the neck pocket.
2. Check the flow of the catheter again and make sure the tubing did not get kinked.

28 1. If flow is good, pass the rat off to the prep team for post-op, and note how to operation went in the surgery log.
2. Sterilize tools before operating on the next rat.

Post-operation

29 Close catheter port with a hoodsie and metal cap.

When placing hoodsie on, do not press down on the back.

30 1. Slide your fingers down the rat's back to the incision site to bring any pockets of air out from under the skin.
2. Vetbond the incision site to close it, then gently tug the skin apart to make sure it is completely closed and there is no blood coming out.

31 Flip the rat over and close the neck incision with vetbond. Gently tug the skin apart to make sure it is completely closed and there is no blood coming out.

32 With a 25 gauge needle (blue), give the rat point-bodyweight intramuscular injection of Cefazolin to the right leg.

33 With a 25 gauge needle (blue), give the rat point-bodyweight subcutaneous injection of Flunixin between the shoulders.

34 Place the rat in the recovery box. Write down how the animal is recovering in the surgery log.

No more than 2 rats should be in the recovery box at the same time.

35 When the rat wakes up and appears to be active (walking, climbing, exploring, etc.), place the animal back in its home cage and put a POST-OP sticker on the cage card with date of surgery and type of procedure (i.e. IV catheter).