

NASAL OXYGEN ADMINISTRATION
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A nasal oxygen catheter is a convenient and inexpensive method to supply dogs and cats with oxygen at inspired concentrations ranging from 30 - 60%. Relative contraindications for this procedure include nasal masses, rhinitis, and coagulopathy (especially severe thrombocytopenia or other causes of abnormal primary hemostasis). Use a 5 French catheter for cats, and 8 or 10 French for dogs.

Materials needed:

- 5, 8, or 10 French PVC nasal oxygen catheter or red rubber feeding tube
- Humidifier setup
- Needle holder
- Suture Scissors
- 000 monofilament nylon suture
- 22 gauge needle
- 2 % lidocaine injection, 0.1 - 0.5 ml
- 2% lidocaine lubricant
- 1" *waterproof* white tape
- Material for neck wrap to anchor tubing
- O2 source, flowmeter, humidifier, tubing
- Optional: .5% phenylephrine drops



Procedure:

Tip the animal's head back slightly and infuse 0.1 - 0.5 ml of 2% lidocaine solution to provide topical anesthesia to the nasal mucosa. If the animal has nasal cavity congestion or is at increased risk of hemorrhage, 1-2 drops of phenylephrine (Neo-Synephrine 0.5% solution) may be instilled to reduce excessive nasal cavity swelling and to limit the likelihood of hemorrhage. If phenylephrine is used, wait 2-3 minutes after infusing the lidocaine before administration.



Open the nasal oxygen catheter and place it alongside the patient's head to estimate the length required to reach from the nostril to the vertical ramus of the mandible. This is the external landmark for the nasopharynx/soft palate.



Place a 1" "butterfly" of the waterproof tape (tear it in half so it is ½" wide for cats) around the catheter at the portion that will remain just outside the nostril. This will serve as both depth gauge and an anchor to suture to. Apply the 2% lidocaine lubricant to the catheter, and infuse a small amount into the nostril.



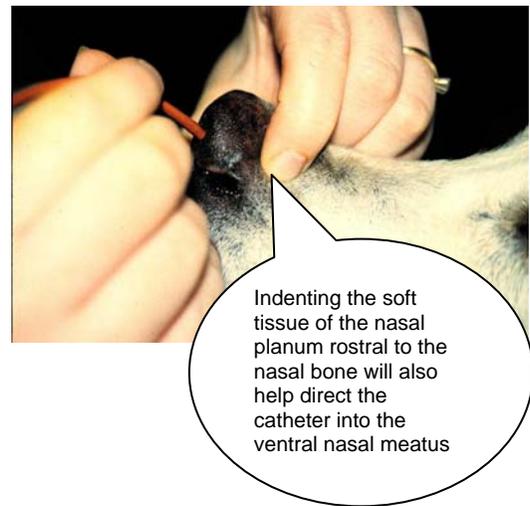
Grasp the catheter 2 cm from the tip and gently advance the catheter tip into the nostril. Cats are easy: most attempts at passing a nasal tube will result in the tube being placed appropriately in the ventral nasal meatus, and the tube usually passes to the nasopharynx without difficulty.

The trick in dogs is to direct the catheter into the ventral nasal meatus, below the middle turbinate. To accomplish this, advance the catheter until the tip passes by the folds at the nasal orifice (generally 0.5 - 1.5 cm into the nostril), then direct the catheter in a markedly ventral and slightly medial orientation. The catheter should point to the first incisor tooth on the ipsilateral side.

Pushing the nose up (to make a pug nose appearance) is often critical to success in dogs.

It helps to elevate the entire nose dorsally at the same time you indent the soft tissue in front of the nasal bone.

Surprisingly, most animals with respiratory distress tolerate this procedure extremely well, as long as you do not restrain them. I'll often perform this by myself, in the animal's cage. The trick is to keep your hands in contact with the animal's muzzle, and "ride" with their movements.



If the catheter is correctly placed in the ventral meatus, it will pass with slight resistance and a "grating" feel as it passes between the turbinates. If the catheter is in the dorsal meatus, it will pass with little or no resistance until it reaches the level of the medial canthus of the eye, where it will run into the ethmoid turbinate. IF THE CATHETER MEETS WITH FIRM RESISTANCE, YOU HAVE UNDOUBTEDLY PLACED IT IN THE DORSAL MEATUS. REMOVE IT AND TRY AGAIN. FORCING IT IN ANY MORE WILL PRODUCE SIGNIFICANT HEMORRHAGE FROM THE ETHMOID TURBINATE. Once in a while you will not be able to enter the ventral meatus even after 2 excellent attempts. In that case, anesthetize the opposite nostril and try that side. There is enough asymmetry between sides that you'll usually get it into the other side on your first attempt.

Correct position in ventral nasal meatus. The catheter tip sits in the relatively large space over the soft palate.



Incorrect position in the dorsal nasal meatus. The catheter will advance to the ethmoid turbinate (roughly at the level of the medial canthus of the eye) and stop when it hits the ethmoid turbinate.



Once properly placed, fold the exterior portion of the catheter nearest the tape tightly under the wing of the nasal ala, and place the 22 ga needle through the leading edge of one of the tape 'wings'. If the tape is sutured too far caudally, the tube is more likely to 'loop' and work its way out of the nose.

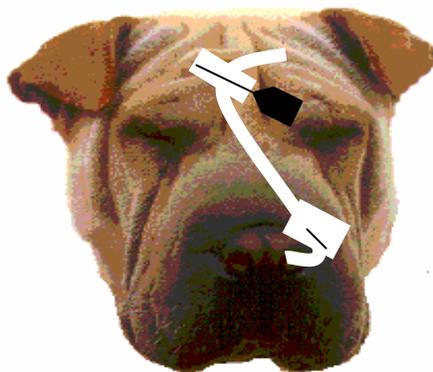
The needled then should pierce the skin under the catheter just caudal to the nasal planum (keep it as close as possible to the nasal planum [hairless skin] as possible), then the other wing of tape in one motion. Slide the free end of the suture through the needle (entering the needle bevel and exiting the needle hub), then remove the needle and tie the suture snug but NOT TIGHT.



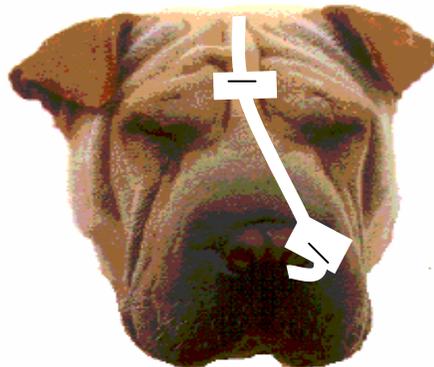
To limit the ability of the dog to 'paw' the catheter out, it should be directed up the midline of the animal's face. In this case, another 'butterfly' of waterproof white tape is wrapped onto the catheter at the level of the frontal sinus. The same suturing technique is used – remember to make the loop snug but not tight.



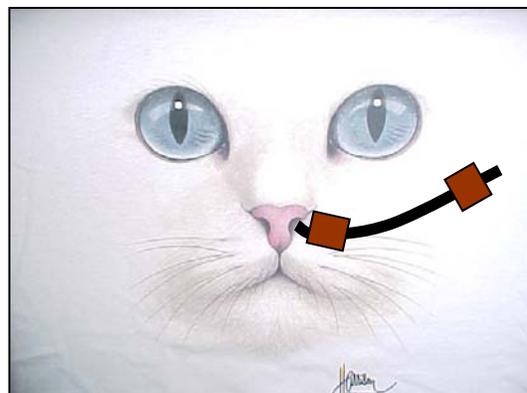
When placing this second suture, it is a good idea to 'overcorrect' the angle of the tape – that is, make an exaggerated 'S' shape of the tube, and place the suture at an angle to the eyes as shown here:



After you release the skin and tube from your grasp, the tension on the tube and skin will pull it straight. The goal is to have it rest as close to the midline as possible when finished, so it is not near the eyes:



In cats and brachycephalic dogs, the maxilla is too short, and the catheter will invariably run right across an eye. In these patients it should instead be routed along the cheek, and the 'butterfly' of tape should be sutured to the skin over the masseter muscle:



The oxygen hose (or the catheter itself if it is long enough) must be anchored to a neck bandage with 1" white tape, to provide a secure anchor for the hose and prevent it from pulling on the sutures. The humidifier is connected, and oxygen administered at the rate of 40 - 50 ml/kg/min to a maximum of 4-5 liters/min.



In the NCSU-VTH, we use medical-grade oxygen tubing, with adapters to connect it to the nasal tube that fits directly onto the oxygen humidifier (these products may be purchased from veterinary distributors or may be found with an Internet search engine with the key words "oxygen humidifier"). The humidifier in turn screws onto the outlet of the flowmeter.

In a pinch, dry oxygen gas may be obtained off the flow meter from many gas anesthetic machines. If you do not have access to medical grade oxygen tubing, you can substitute with an IV fluid administration set + extension sets. Disconnect the hose from the anesthetic vaporizer, and spike the IV set directly into it. Make sure the connection is tight – if not, you may need to wrap a bit of waterproof white tape around the spike to increase its diameter.



If you use IV administration set tubing, make sure it is clearly identified to prevent accidental (and lethal) IV administration of oxygen gas. If a 5 French nasal tube is used, the male Luer end of the administration set will fit snugly directly into the catheter as shown here. If a larger catheter is used, you will need to cut off the wider portion of



the flared end to facilitate a tight fit.

If you use medical grade oxygen tubing with a size 8 French or larger catheter, a standard oxygen tubing adapter is used to connect the catheter to the tube. Do not use a “Christmas tree” style adapter as shown at the right below, as most of the gas flow will leak out of the connection between this adapter and the oxygen supply hose:



The standard oxygen adapter will not fit into a 5 French catheter. In that case, remove the plunger from a 1-ml TB syringe, and use a bandage scissors to cut off the handle end. The barrel of this syringe will fit snugly into the oxygen supply hose, and the male Luer end fits tightly into the flared end of the catheter:



Regardless how the connections are made, the final step in setup is to insure that all connections are tight. In-line humidifiers have a ‘pop-off’ valve that releases oxygen gas from the canister if the line pressure is too high. When that happens it creates an audible whistle or chirp. You can use this feature to check the system by pinching the nasal catheter off. If the system is tight, the pop-off should sound off within a couple of seconds. You should do this “system check” frequently, and anytime the patient shows increased respiratory effort, as these connections are sometimes fragile. The most common ‘trouble spot’ is a loose water canister at the humidifier unit – screw it on tight!



Maintenance:

Check the following at hourly intervals:

1. Oxygen flow rate
2. Catheter position
3. Patency of the system
4. Remove the catheter and place a new one in the opposite nostril every 48-72 hours to prevent rhinitis. The physical damage from the tube, in combination with chemical irritation from leaching of plasticizers will damage the nasal mucosa. If left in place too long, bacterial overgrowth and mucosal erosion set the stage for bacteremia.

Here are the two most common mistakes made when suturing in a nasal catheter:

- 1) **Suturing the tape nearest the nostril too far back.** The dog in this picture has an inch or so of catheter between the leading edge of the tape and the nostril, allowing normal movements and breathing to force the catheter to back out of the nostril. On top of that, the suture is placed in the middle of the tape, placing this anchor even further back.
 - a. Correction: position the tape as close to the nostril as possible, fold the catheter under the wing of the nostril (the alae), and place the suture at or near the leading (rostral-most) edge of tape, in the most rostral portion of skin that has any hair on it. Don't pass a suture through a hairless area – that part is very sensitive!
- 2) **The second tape is sutured too far back.** This needs to be sutured to the skin over the frontal sinus, which is between this dog's eyes. Suturing too far back allows the catheter to come across an eye (especially in dogs with a 'dished' face anatomy) and as the second picture shows (arrow), leaves a space between the catheter and the bridge of the nose that can sometimes be 2-3" deep. This puts the catheter in the dog's field of vision – imagine spending 48 hours in a hospital with a sutured tube in front of your eye!
 - a. Correction: place this tape closer to the nose, sufficiently far down the 'slope' of the bridge of the nose that the bit of catheter between here and the tape up front is close to the skin.

