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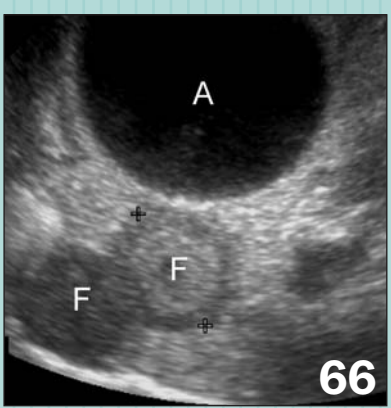

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Application of the Cranial Vena Cava Venipuncture Technique to Small Exotic Mammals

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Vittorio Capello graduated from the University of Milan, Italy, in 1989. He works entirely on medicine and surgery of exotics (particularly dedicated to rabbits, rodents, ferrets and other small mammals), providing professional services for two clinics in Milan. He has lectured, published, and taught courses and practical laboratories on these subjects. He has been a speaker at the European Congress of Veterinary Dentistry, North American Veterinary Conference, British Small Animal Veterinary Conference, as well as ICE since 2003. He is a member of the Advisory Board of Exotic DVM magazine and the author of the Rabbit and Rodent Dentistry Handbook.

Anatomic sites and techniques for venipuncture in small exotic mammals have been extensively described in the literature. Sites include the cephalic, jugular, lateral and medial saphenous, femoral, marginal and central ear, ventral tail and ventral lingual veins, as well as the cranial vena cava. Other sites and techniques of blood collection, such as clipping the nails, collection from the orbital sinus or cardiac puncture, are considered less safe and less humane and are not appropriate in companion exotic mammals.

The amount of blood that can be safely collected from a small mammal is up to 10% of the total blood volume. Total blood volume is estimated to be approximately 6% of the body weight. For example, up to 6 ml of blood can be safely drawn from a 1-kg ferret and up to 0.6 ml from a 100-g hamster. Required volumes depend on the tests desired and capabilities of the reference laboratory or blood analysis equipment. Some instrumentation is capable of producing reliable results on small samples of whole blood, reducing the required volume significantly. In many cases, 1 ml of blood is adequate for a complete blood count and standard biochemistry panel.

Although not widely known and practiced, venipuncture of the cranial vena cava is frequently the best technique for quick and safe collection of adequate-sized blood samples from small exotic mammals. In this article, the anatomy and technique of this procedure will be illustrated in the ferret with comparison to some rodent species.

Anatomy of the Cranial Vena Cava

The cranial vena cava (CVC) is the main vessel located cranial to the heart. In the ferret, it has a diameter of 3-3.5 mm. The CVC originates from the external and internal jugular veins (which are joined by the subclavian vein) and enters the right atrium of the heart (Fig 1).

The external jugular veins (Fig 2) are larger than the internal jugular veins, and jugular venipuncture is usually performed on the external veins. The diameter of the main jugular vein is typically 1.5-2.5 mm, smaller than the CVC, and it decreases in diameter as it courses cranially. The cranial portion of the exterior jugular vein is thin and flat when compared to the cranial portion of the CVC. Sometimes venipuncture is ineffective because the needle penetrates both walls of the vessel. Even if the syringe is pulled back while collection of blood is attempted, it is difficult to maintain the tip of the needle in the lumen of the vein.

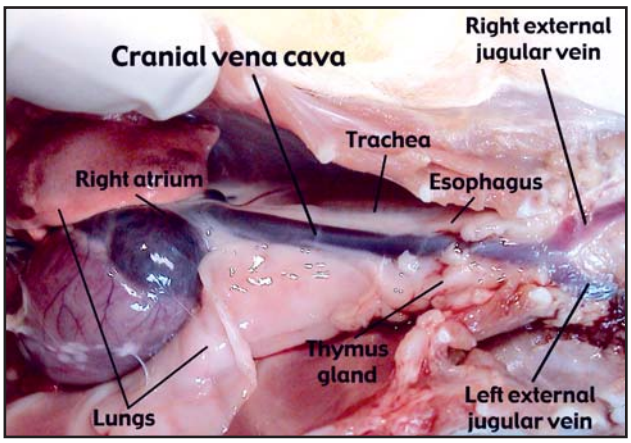

Fig 1. The CVC and its anatomic relationship with the other intrathoracic organs shown in a cadaver specimen, after removal of the sternum. The CVC originates from the confluence of the external jugular veins and enters the right atrium of the heart.

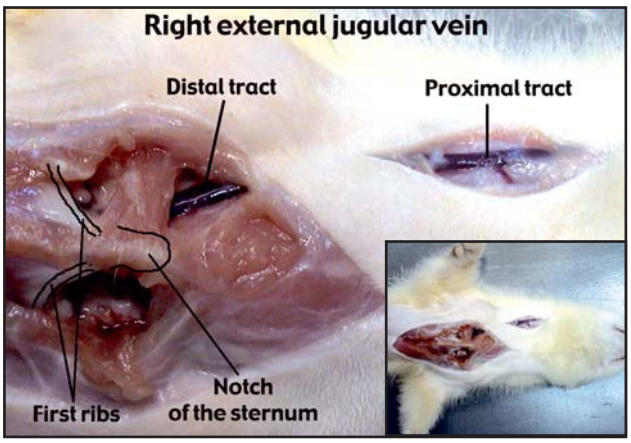

Fig 2. The right external jugular vein of a ferret is shown. The cranial portion is located in the laryngopharyngeal region, and the caudal portion is seen just craniolateral to the notch of the sternum and the first right rib, before it enters the thorax.

Technique of Venipuncture of the Cranial Vena Cava

Venipuncture of the CVC is effective and safe when performed with proper restraint of the patient. With the exception of very quiet or sick individuals, this technique is better performed with the patient under sedation or general anesthesia induced by isoflurane. Manual restraint can be effective in some cases but should be weighed against the potential stress for the patient.

As a general rule, small species, such as sugar gliders and hedgehogs, must be sedated. In most cases, samples can be collected from ferrets with manual restraint only. In the author's experience, Marshall Farms' ferrets are much easier to manually restrain than typically larger European ferrets. If properly held in a quiet environment, rabbits can also be restrained manually for this procedure, although, with the exception very small rabbits, other peripheral veins are easily accessible in this species.

A 25- to 27-gauge needle is selected to prevent disruption of the blood vessel and to minimize risk of hemorrhage. Standard needle lengths allow access to the cranial portion of the CVC, far from other important anatomic structures.

Collection of blood via CVC venipuncture is shown here in two ferrets, using either sedation (Fig 3) or manual restraint (Fig 4).

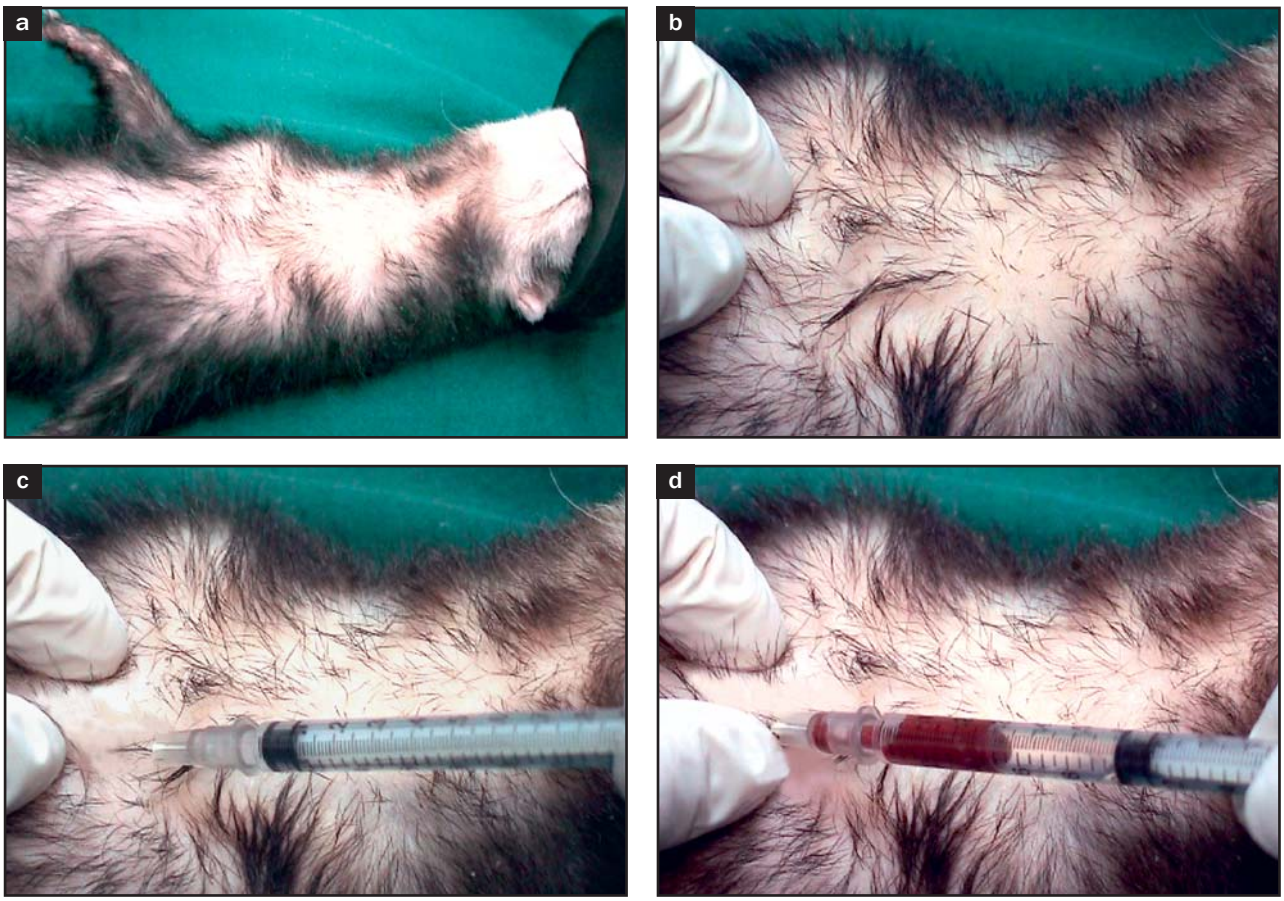

Fig 3. a) Anesthesia is induced with isoflurane (4-5%) and maintained just long enough to complete the procedure. The patient is placed in dorsal recumbency. **b)** The correct needle insertion site is identified as a notch between the manubrium of the sternum and the first rib. The area may be shaved for better visualization although it is not necessary. The site is prepared as for standard venipuncture. **c)** The needle is inserted into the thoracic cavity lateral to the manubrium of the sternum and cranial to the first rib, directed into the center of the notch. The syringe is directed lateromedially with a slight angle (20-30°) toward the sagittal plane. At the same time, it is directed slightly ventrodorsally to allow the needle to meet the CVC, which lies dorsal to the sternebrae. **d)** The ideal position is found by gently advancing and retracting the needle while maintaining negative pressure until a few drops of blood appear in the hub of the needle and blood begins to fill the syringe.

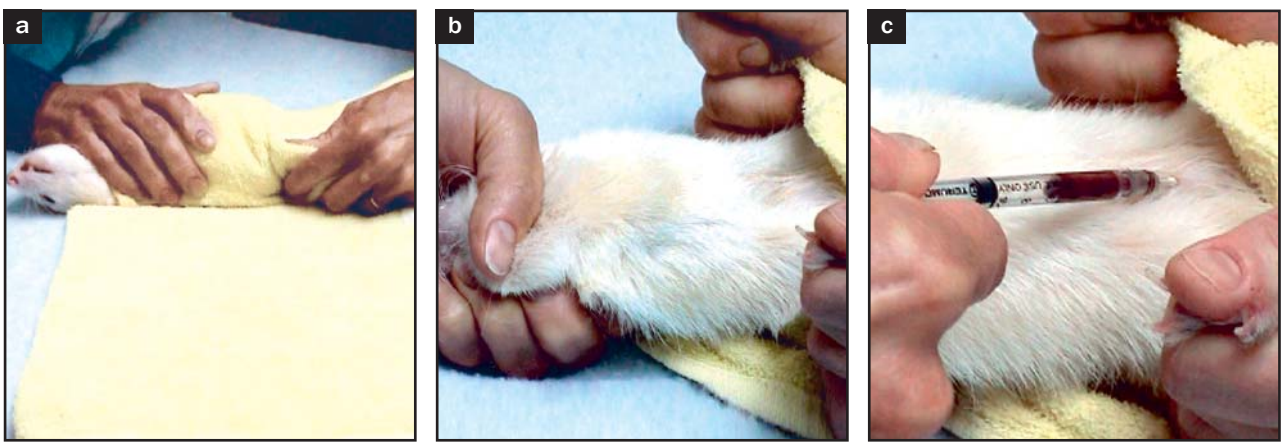

Fig 4. a) When CVC venipuncture is to be performed on a conscious ferret, the animal is restrained by wrapping it in a towel. **b)** The head is held by the operator while an assistant restrains the forearms and body of the ferret. **c)** Venipuncture is performed as described in Fig 3.

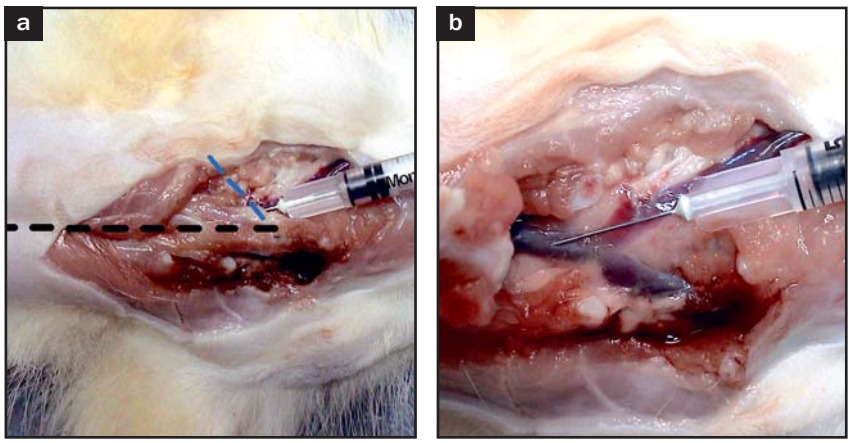

Fig 5. a) Correct positioning of the needle and syringe, shown in a ferret cadaver. The needle is inserted into the thoracic cavity lateral to the notch of the sternum and cranial to the first rib (blue dotted line). The syringe is directed lateromedially with a slight angle (20-30°) toward the sagittal plane (black dotted line). **b)** The point where the needle is inserted into the CVC is shown. The first two pairs of ribs have been dissected, and the cranial part of the sternum is reflected caudally in order to visualize the CVC.

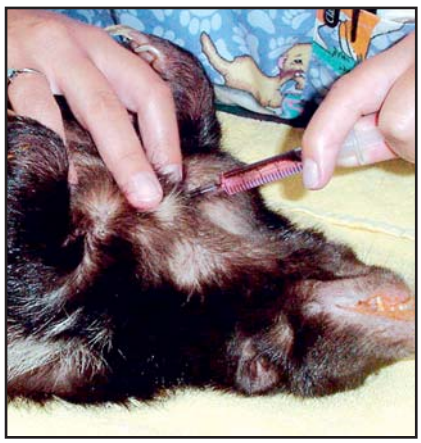

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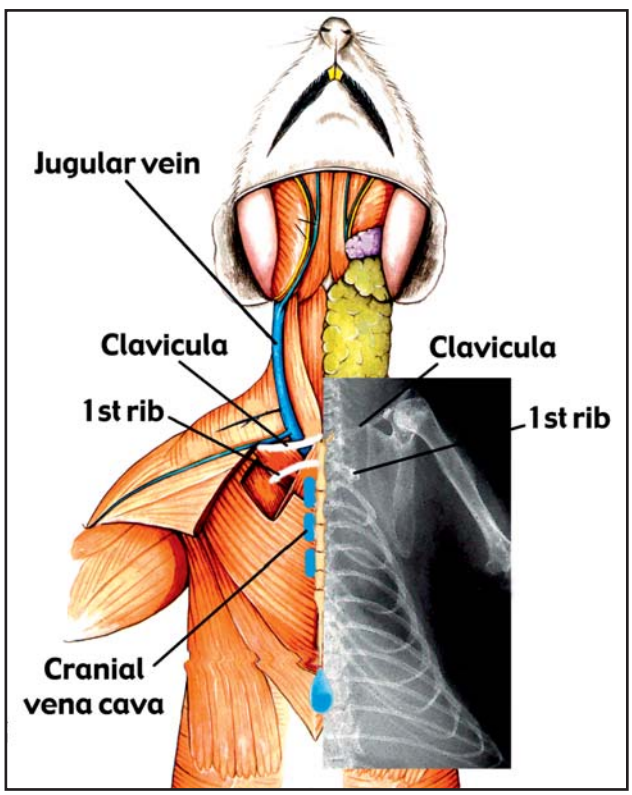
Fig 6. Venipuncture of the cranial vena cava is also very useful in larger patients, such as the skunk, where thick skin and excessive subcutaneous fat make access of other sites more difficult.

CVC Approach in Rodents

Rodent species possess a small clavicular bone that articulates between the notch of the sternum and the scapula/humeral junction (Fig 7). Upon palpation, it resembles the first rib. The clavicle must be considered when performing CVC venipuncture; while the technique is the same as that described for ferrets, the needle is actually inserted cranial to the cranial margin of the clavicle (not cranial to the first rib) (Fig 8).



Modified from Popesko, Rajtová and Horak, 1992

Fig 7. Anatomic relationship between the clavicle, the first rib and the sternum in the golden hamster.

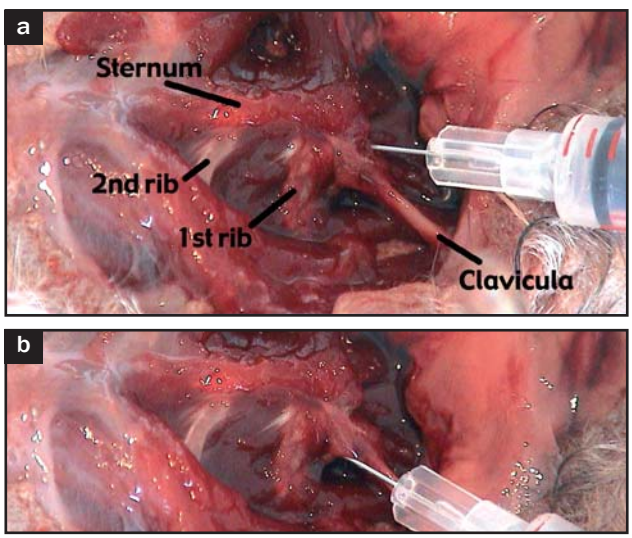


Fig 8. Correct positioning of the needle for insertion into the CVC, shown in a golden hamster cadaver. The needle is inserted cranial to the clavicle **(a)**. The insertion cranial to the first rib (and caudal to the clavicle) changes the proper angulation and forces the needle more laterally, making the venipuncture more difficult **(b)**.

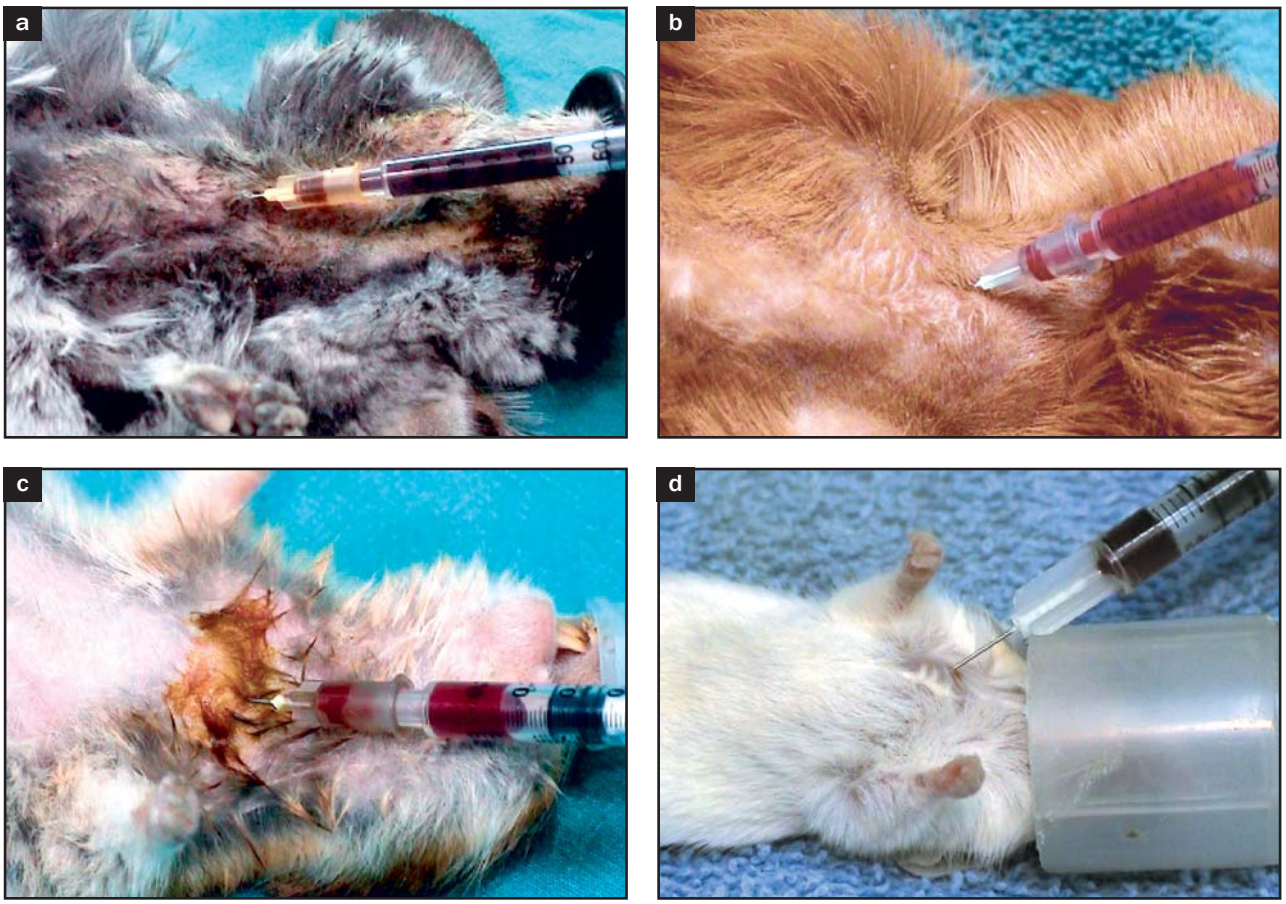


Fig 9. Venipuncture of the CVC is also feasible, effective and safe in species smaller than ferrets. The technique is similar and is shown here in four rodent species: **a)** chinchilla **b)** guinea pig **c)** golden hamster **d)** mouse (BW 25 g). In this case a tuberculin syringe with a 30-gauge needle is used.

Complications and Considerations

Potential complications are similar to those for any standard venipuncture, such as excessive bleeding, sepsis, hemothorax and damage to other intrathoracic structures. The author has not encountered complications using this technique, and anecdotal reports are few. Appropriate needle size and safe, adequate restraint help minimize complications. Venipuncture of the CVC should be considered an effective and safe technique for blood sampling in exotic mammals, particularly in small patients.

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