

## Normal Clinical Parameters for MWDs

**Table 1. Normal Vital Signs at Rest.**

NORMAL VITALS AT REST	
Temperature (rectal)	101° to 103° F
Heart/Pulse rate	60 - 80 bpm
Respiratory rate	16 - 30 bpm (note that controlled panting is common in MWDs)
Blood pressure	Systolic 120 mmHg, Diastolic 80mmHg, Mean 90-100 mmHg

**Table 2. Complete Blood Cell Count Parameters.**

BLOOD CELL COUNT PARAMETERS	
WBC	6 - 17 X 10 <sup>3</sup> /μL
RBC	5.5 - 8.5 X 10 <sup>6</sup> /μL
Hgb	12 - 18 g/dL
Hct	35 - 45%
MCV	60 - 77 fl
MCH	19.5 - 24.5 pg
MCHC	32 - 36 g/dL
Platelet count	200 - 900 X 10 <sup>3</sup> /μL

**Table 3. Blood Chemistry Parameters.**

**NOTE:** Results from serum chemistry analyzers calibrated for human serum may be unreliable or misleading based on methodology for **albumin** and **total calcium** concentrations.

BLOOD CHEMISTRY PARAMETERS				
Albumin	2.5 - 4.4 g/dL		GGT	0 - 7 U/L
ALP	20 - 150 U/L		Glucose	60 - 110 mg/dL
ALT	10 - 118 U/L		HCO <sub>3</sub>	17 - 25 mmol/L
Amylase	200 - 1200 U/L		Lactate	1.5 - 2.0 mmol/L
AST	14 - 45 U/L		pCO <sub>2</sub>	24 - 38 mmHg
Bicarbonate	12 - 27 mmol/L		pH	7.35 - 7.45
BUN/SUN	7 - 25 mg/dL		pO <sub>2</sub>	85 - 100 mmHg
Calcium (total)	8.6 - 11.8 mg/dL		Potassium	3.7 - 5.8 mmol/L
Chloride	105 - 111 mmol/L		Sodium	138 - 160 mmol/L
Creatine kinase	20 - 200 U/L		Total bilirubin	0.1 - 0.6 mg/dL
Creatinine	0.3 - 1.5 mg/dL		Total protein	5.4 - 8.2 g/dL

# Unique Clinical Anatomy and Venous Access

Dogs differ anatomically and physiologically in several key areas in comparison to people. Knowledge of these differences will assist HCPs when managing MWDs.

Most MWDs are German shepherd dogs, Belgian Malinois, and Labrador retrievers, with an weight of 50-80# (23-36 kg). Dose drugs based on actual body weight whenever possible.

Canine blood can be tested using analyzers designed for people, with generally reliable results. Interpretation of results may be unreliable or misleading for albumin and total calcium, however, due to species-specific methodology differences. For all other parameters, if the results appear reasonable, trust them for decision-making.

## **Venous blood sampling and IV catheterization sites:**

Use the cephalic or lateral saphenous veins for routine blood sampling, drug administration, and routine intravenous fluid therapy. Use the external jugular vein for long-term fluid therapy, large volume fluid delivery, and repeated blood sampling.

- Cephalic vein on the cranial (superior) aspect of the forearm (See Figures 1, 2, and 3).
- Lateral saphenous vein on the lateral aspect of the hind limb at the distal tibial area (See Figure 4).
- External jugular vein in the jugular furrow of the neck (See Figures 5-16). Standard human central venous catheter kits can be used; the Seldinger technique is most reliable.

**Figure 1. Cephalic Vein Location on Superior Aspect of Forearm.**



Figure 1 shows cephalic vein location on the cranial (superior) aspect of the forearm.

The vein is best punctured toward the elbow, as the accessory cephalic vein and cephalic vein join in a Y-shaped configuration more distally (toward the carpus).

**Figure 2. Occluding the Vein.**

Figure 2 shows proper technique for an assistant to occlude the vein, while extending the elbow joint. The assistant's thumb occludes the vein while rolling the vein outward at the elbow.



**Figure 3. IV Catheter in Cephalic Vein of Forelimb.**

Figure 3 shows properly placed and secured IV catheter in the cephalic vein of the forelimb of a MWD.



**Figure 4. Lateral Saphenous Vein Location.**

Figure 4 shows location of the lateral saphenous vein on the hind limb of a MWD, located on the lateral aspect of the distal tibial area, coursing caudodorsally from the hock (ankle) and over the gastrocnemius tendon.



**Figures 5 – 16: External Jugular Vein Location and Central Venous Catheterization.**

Figure 5 shows the right external jugular vein (dotted lines) located in the right jugular furrow. The vein is best punctured distal to the junction of the more-proximal tributaries (the optimal insertion site is noted by the red oval). Hair should be clipped and a sterile preparation should be performed.



Figure 6 shows a small skin nick (noted in the red oval) created over the intended catheter insertion site to facilitate penetration of the thick skin of the dog. This nick can be made with the tip of a #11 scalpel blade or the bevel of an 18-gauge needle.



Figure 7 shows insertion of a large bore catheter-over-needle through the skin nick, penetrating the skin and entering the external jugular vein. Note the use of the thumb of the opposite hand to occlude the vein. ***In this figure, and in Figures 8-12, sterile draping is removed to provide better visualization; perform catheterization using sterile technique.***





# Jugular Vein Location & Central Venous Catheterization

Figure 8 shows full insertion of the over-the-needle catheter into the external jugular vein, after removal of the needle.



Figure 9 shows insertion of a Seldinger guide wire adapter into the hub of the catheter that has been placed into the external jugular vein.



Figure 10 shows advancement of the Seldinger guide wire through the catheter and into the external jugular vein. Once the guidewire is advanced about two-thirds of its length into the vein, remove the catheter, leaving only the guidewire in place.



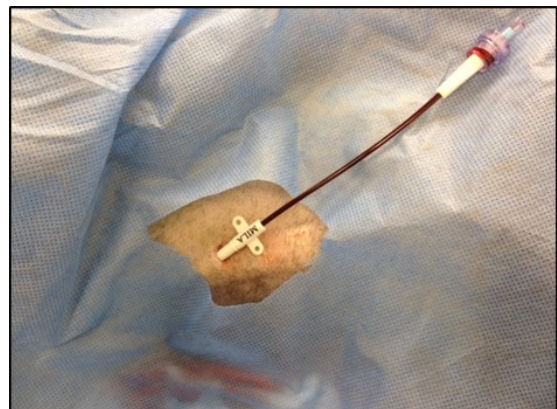
Figure 11 shows initial advancement of the multi-lumen central venous catheter over the guidewire. Use of a dilator (not shown) is often necessary before this step to enlarge the puncture site in the skin.



Figure 12 shows advancement of the catheter into the external jugular vein. Note extension of the guidewire from the proximal end of the catheter (red oval).



Figure 13 shows full insertion of the catheter into the external jugular vein, complete removal of the guidewire, and attachment of an injection port on the catheter hub.



# Jugular Vein Location & Central Venous Catheterization

Figure 14 shows the optimal method to secure central venous catheters to the dog's skin using separate sutures at the wings of the catheter hub and circumferentially around the catheter base.



Figure 15 shows the optimal method to initially secure the central venous catheter using roll gauze or cast padding. Note that the catheter tubing (dotted line) is gently curved caudally and secured between snug layers of gauze/padding.



Figure 16 shows the optimal method to completely secure the central venous catheter using non-adherent bandage material placed over the underlying roll gauze/padding. Note: At least 2 fingers can be inserted beneath the bandage, ensuring the bandaging is not too tight.



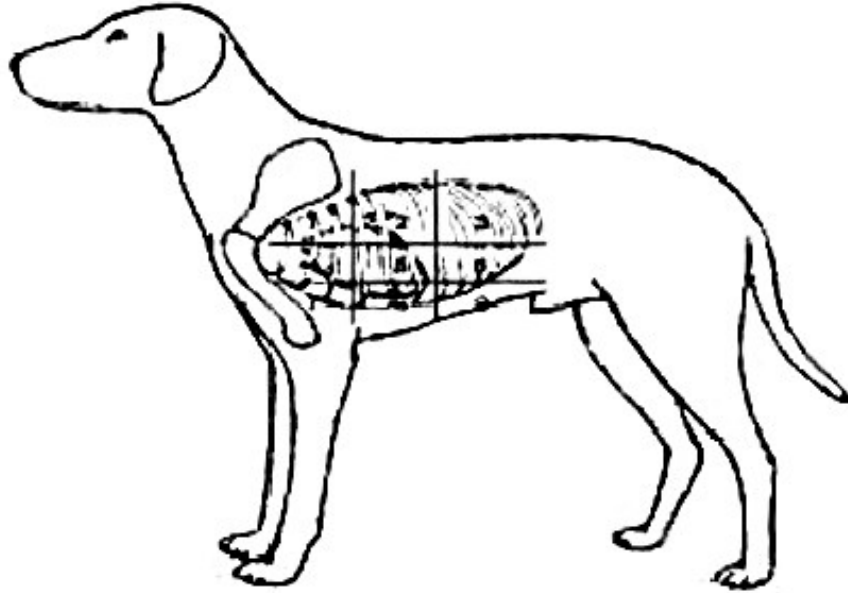


# Routine Cardiovascular Monitoring

- Heart sounds are best auscultated over the lower lateral thoracic wall between the 4th-5th intercostal spaces, typically where the elbow crosses the chest wall when the forelimb is pulled caudally (See Figure 17).

**Figure 17. Heart Sounds Location.**

Figure 17 shows optimal location for auscultation of the heart sounds and palpation of the heartbeat, in the 4th-6th intercostal space just above the sternum and just caudal to the elbow.



- The arterial pulse is best palpated at the femoral artery on the medial aspect of the proximal thigh in the inguinal area, or at the dorsal metatarsal artery on the dorsal aspect of the proximal hind paw. (Figure 18)
- Arterial blood pressure measurement is best measured non-invasively using the dorsal metatarsal artery, located on the dorsal aspect of the hind paw. Alternative sites are the lower forearm and tail base. Neonatal (size 4 or 5) or pediatric (size 6-8) human cuffs and an oscillometric technique work well. Use pediatric settings on the monitor.

**Figure 18. Pulse location.**

Figure 18 shows location for palpation of the femoral arterial pulse, in the inguinal region on the medial aspect of the proximal thigh.



# Routine Cardiovascular Monitoring

- ECG adhesive electrodes should be taped to the pads of the paws of the left forelimb (black lead), right forelimb (white lead), and left hind limb (red lead), as shown in Figure 19. 3-lead electrocardiograms are the norm and are sufficient. Canine ECG complexes resemble human complexes, with minor variations in key electrocardiographic intervals.

**Figure 19. Placement of ECG Electrode Pads.**

Figure 19 shows a technique for placement of adhesive ECG electrodes.



- Pulse oximetry probes used for people (typically finger probes) are best placed on the tongue for optimal reliability (See Figure 20) in unconscious, sedated or anesthetized dogs. In conscious dogs, use the ear pinna, lip fold, or flank skin fold; while not optimal for oximetry, these alternate sites generally yield reliable results in most instances.

**Figure 20. Placement of Human Pulse Oximeter Finger Probe on Tongue.**

Figure 20 shows a technique for placement of standard human pulse oximeter finger probe on the tongue of an anesthetized dog.



# Prevention of Self-trauma & Removal of Devices

Military working dogs will chew at catheters, bandages, and monitoring devices, and will excessively lick and chew at wounds to the point of causing foreign body ingestion and self-trauma. Use muzzles in the immediate period of initial monitoring and care to prevent this.

Tape catheters around the entire circumference of the limb, including the hub and catheter adapter port to adequately secure the catheter. The tape should be snug, but caution used to prevent excessive tightness that will result in distal edema.

For long-term management, a simple option is to fashion a preventive device. The bottom of a standard bucket is removed, 4-5 holes are drilled in the base of the bucket, and cable ties are used through these holes to secure the bucket to the dog's leather collar. The bucket-collar combination is then applied.

(See Figures 21 and 22). Supporting veterinary personnel or MWD handlers should provide these.

***Figure 21 shows the technique to make a bucket to prevent self-trauma by MWDs.***

The bottom of a standard plastic bucket is removed, 4-5 holes are drilled near the base, and cable ties are used to secure the bucket to the dog's leather collar.



***Figure 22 shows the bucket-collar device applied to a Military Working Dog.***

