



INDIANA UNIVERSITY

Office of Research Compliance (ORC)

Institutional Animal Care and Use Committee (IACUC)

Guidelines for Blood Collection

This guidance applies to all Indiana University faculty, staff, and students in the use of animals in biomedical research involving blood collection. The IUSM IACUC is obligated to provide guidance that notify and train personnel concerning the appropriate techniques, equipment, and agents for performing appropriate procedures to ensure humane care and use of laboratory animals.

Background

These guidelines are intended to provide general guidance for those planning experimental procedures on animals that include the withdrawal of blood. Exceptions to these guidelines may be approved by the IACUC based on written scientific justification provided by the investigator. For species or guidelines not listed, LARC veterinarians can assist with the selection of appropriate procedures.

Blood loss can produce subtle to profound physiologic and clinical effects in the animal, including but not limited to, hypovolemic shock, anemia, and death. Various recommendations regarding the volume of blood that can be safely collected from different species have been published. These guidelines are based on current literature (references below).

Statement

Restraint

All animals will need to be restrained to prevent movement that could result in the laceration and injury of the animals during blood collection. Personnel can physically restrain the animal by hand or a restraint device. Specific devices or handling techniques vary depending on the species, temperament of the animal, and skill of the person drawing blood. Chemical sedation or anesthesia can be used in any animal.

Circulating blood volume by species

All survival blood collections are limited by calculated blood volume and frequency of blood collection. The maximum blood collection volumes are based on values from mature, healthy animals. The estimated blood volume in adult animals is 55 to 70 ml/kg body weight.

Single Sampling

For any single survival blood draw, volume removed should be limited to 10% of blood volume. A maximum limit of 15% of the blood volume can be taken at a single time and should be accompanied by fluid replacement with IP or SC injection of sterile Lactated Ringer's Solution. Single blood draws up to 10% of the blood volume should be followed by a two week recovery period.

Multiple Sampling

Many protocols require serial blood collection over the life of the animal. Of the circulating blood volume, approximately 10 can be removed every three to four weeks, 7.5% every 7 days, and 1% every 24 hours.

	Circulating blood volume (ml/kg)	Example Body Weight (kg)	Blood Volume (ml)	10% Blood Volume (ml)	15% Blood Volume (ml)	Expected Exsanguination Volume (ml)
Mouse	72	0.025	1.8	0.2	0.3	0.5
Rat	64	0.250	16	1.6	2.4	4.8
Dog	85	10	850	85	128	255
Swine	65	100	6500	650	975	1950
Rabbit	56	4	224	22	34	67

Determining maximum safe blood sample volumes in small rodents based on body weight		
Body Weight (g)	Circulating Blood Volume (mL)	Draw No More than 7.5%–10% of Circulating Blood Volume (mL)
20	1.10–1.40	0.082–0.14
25	1.37–1.75	0.10–0.18
30	1.65–2.10	0.12–0.21
35	1.93–2.45	0.14–0.25
40	2.20–2.80	0.16–0.28
125	6.88–8.75	0.52–0.88
150	8.25–10.50	0.62–1.0
200	11.00–14.00	0.82–1.4
250	13.75–17.50	1.0–1.8
300	16.50–21.00	1.2–2.1
350	19.25–24.50	1.4–2.5

Sites for blood collection by species

MOUSE

Saphenous vein

- This is a preferred site for blood collection
- Obtainable volumes: small to medium
- Can be performed on awake animals
- Can be used for multiple blood draws

Facial vein

- This is a preferred site for blood collection
- Obtainable volumes: medium to large

- Can be performed on awake animals
- Can be used for multiple blood draws

Ventral tail artery

- This is a preferred site for blood collection
- Obtainable volumes: small to medium
- Can be performed on awake animals with minimal restraint
- Can be used for multiple blood draws

Distal tail transection (tail clip)

- Other methods are preferable
- Analgesics and/or anesthetics should be used at the time of tail clip
- Obtainable volumes: small
- The quality of the sample is variable, as it may be contaminated with mixed tissue fluids
- This collection method can only be used a limited number of times. A maximum total of 5mm of tissue from the tip of the tail can be removed from any one animal over the lifespan of the animal.

Cardiac puncture

- Terminal blood collection only
- Obtainable volume: large
- Animals must be anesthetized

Retro-orbital sinus

- Other methods are preferable
- Animals must be anesthetized
- Obtainable volume: large

RAT

Saphenous vein

- This is a preferred site for blood collection
- Obtainable volumes: small to medium
- Can be performed on awake animals
- Can be used for multiple blood draws

Jugular vein

- Obtainable volumes: medium to large
- Animals are usually sedated
- Excellent technical and handling skills are needed.

Tarsal and Metatarsal Vein

- Obtainable volumes: small
- Can be performed on awake animals

Lateral Tail Vein

- Obtainable volumes: medium to large
- Lateral tail vein can be pierced with either a lancet or needle or incised with a small scalpel blade
- Can be performed on awake animals
- Can be used for multiple blood draws
- Warming the tail with warm water or a warm compress will increase obtainable blood volume

Cardiac

- Terminal blood collection only
- Obtainable volume: large
- Animals must be anesthetized

DOG

Jugular vein

- Obtainable volume: large

Cephalic vein

- Obtainable volumes: medium to large

Lateral saphenous vein

- Obtainable volumes: medium to large

PIG

Auricular vein

- This is a preferred site for blood collection.
- Obtainable volumes: medium to large

Cephalic vein

- Obtainable volumes: medium to large

External jugular vein

- Obtainable volumes: large

Anterior vena cava

- Obtainable volumes: large
- This method can be used in piglets <14 weeks of age
- Chemical sedation is necessary for this method

Femoral artery or vein

- Obtainable volumes: medium to large

Lateral plantar metatarsal vein

- Obtainable volumes: medium to large

RABBIT

Central ear artery or marginal ear vein

- This is a preferred site for blood collection
- Obtainable volumes: medium to large
- Damage to the central ear artery may inhibit vascular access to the pinna and lead to sloughing of the skin

Cephalic vein

- Obtainable volumes: medium to large

Jugular vein

- Obtainable volumes: large

Cardiac puncture

- Terminal blood collection only
- Obtainable volumes: large
- Animals must be anesthetized for this method of blood collection

References

1. J Fox, L Anderson, G Otto, K Pritchett-Corning, M Whary. 2015. Laboratory Animal Medicine, 3rd edition. Elsevier.
2. NM Lindstrom, DM Moore, K Zimmerman, SA Smith. Hematologic Assessment in Pet Rats, Mice, Hamsters, and Gerbils: Blood Sample Collection and Blood Cell Identification. Clin Lab Med. 2015 Sep;35(3):629-40.
3. JJ Bogdanske, S Stelle, MR Riley, BM Schiffman. 2011. Laboratory Rat, Procedural Techniques. CRC Press.
4. JJ Bogdanske, S Stelle, MR Riley, BM Schiffman. 2011. Laboratory Mouse, Procedural Techniques. CRC Press.
5. KH Diehl, R Hull, D Morton, R Pfister, Y Rabemampianina, D Smith, JM Vidal, C Vorstenbosch. 2001. A Good Practice Guide to the Administration of Substances and Removal of Blood, Including Routes and Volumes. J. Appl. Toxicol 21, 15-23.
6. N Duffee, A Vaughn. 2014. Laboratory Animal Data, Quick Reference Guide. 2nd edition. American Association for Laboratory Animal Science.
7. M Varga. 2014. Textbook of Rabbit Medicine. 2nd edition. Butterworth Heinemann.
8. S Parasuraman, R Raveendran, R Kesavan. Blood sample collection in small laboratory animals. J Pharmacol Pharmacother. 2010 Jul;1(2):87-93.

Contact

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