UNIVERSITÉ LAVAL

Direction des services vétérinaires — Standard Operating Procedure

Re: General procedure for blood collection	Number: P-16
Scope: A directive from the Direction des services vétérinaires to users and staff of Université Laval animal facilities (campus and affiliated research centres).	
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Purpose: Describe the maximum blood volumes, recovery periods to observe, and clinical signs to check when collecting blood.	Version 3

General considerations

- The maximum volume of blood that can be collected from an animal varies according to species, breed or line, weight, age, and health status (see Table 1 and Table 2).
- Observe the animal's overall condition before collecting blood and note any anomalies. If the animal presents clinical signs, consult a veterinarian before proceeding.
- Always collect the minimum blood volume needed for the analyses that will follow. Be sure to select a collection site commensurate with the required sample size.
- It is preferable to use the largest gauge needle allowed to facilitate collection and ensure the blood vessel does not collapse.
- Regarding punctures, if you fail after three attempts, seek help from someone with experience so that the number of punctures the animal is subjected to is kept to a minimum.
- When multiple punctures are scheduled over a short period, a temporary intravenous catheter is recommended (see *PNF AD-3 Pose de cathéter intraveineux périphérique temporaire* (Placement of a temporary peripheral catheter)).
- The time allocated for an animal's recovery between blood collections is determined by the volume of blood taken (see Table 3 and Table 4).

Definitions

- Puncture: the act of inserting a needle or making a narrow opening in a tissue
- Collection: the taking of a biological sample of an organ, tissue, or fluid

Blood volume

- For equivalent body weights, the total blood volume of obese or geriatric animals is less than that of healthy animals. When calculating the total blood volume of a geriatric or obese animal (see *PNF O-3 Pesée des animaux* (Animal weighing)), reduce the volumes indicated in Table 1 by 15%.

Table 1: Mean blood volumes of laboratory animals

Species	Mean blood volume (ml/kg) [1, 2]
Mouse	72
Rat	64
Hamster	74
Guinea pig	80
Ferret	75
Rabbit	57
Dog (beagle)	85
Cat	57
Cynomolgus monkey	65
Rhesus monkey	56
Pig	65

[1] Reduce the amounts by 15% for obese or geriatric animals.
[2] Data for a healthy adult animal with an adequate nutritional plan.

- If samples are collected daily, you may collect up to 1% of the blood volume (Table 2).
- A maximum volume equivalent to **15%** of the total blood volume may be taken in a single collection (Table 2).
- A maximum volume equivalent to **20%** of the total blood volume may be taken over 24 hours using **multiple** collections (Table 2).

- After collecting less than 10% of the total blood volume, subcutaneous administration of lactated Ringer's solution equivalent to 3 times the collected blood volume is strongly recommended.
- After collecting 10% or more of the total blood volume, or in the event of multiple collections, lactated Ringer's solution equivalent to 3 times the collected blood volume **must be administered**.

Table 2: Blood volumes that can be collected for a given weight and percentage

Species (weight)	Total blood volume (ml) [1]	1% (ml)	7.5% (ml)	10% (ml)	15% (ml)	20% (ml) [2]
Mouse (25 g)	1.8	0.02	0.14	0.18	0.27	0.36
Rat (250 g)	16	0.16	1.2	1.6	2.4	3.2
Hamster (100 g)	7.4	0.07	0.56	0.74	1.11	1.48
Guinea pig (800 g)	64	0.64	4.8	6.4	9.6	12.8
Ferret (800 g)	60	0.6	4.5	6	9	12
Rabbit (4 kg)	228	2.2	17	23	34	46
Dog (10 kg)	850	8,5	64	85	127	170
Cat (4 kg)	228	2.2	17	23	34	46
Cynomolgus monkey (5 kg)	325	3,3	24	32	49	65
Rhesus monkey (5 kg)	280	2.8	21	28	42	56
Pig (30 kg)	1950	19.5	146	196	292	390

[1] Reduce the amounts by 15% for obese or geriatric animals.

[2] It is possible to collect 20% of an animal's total blood volume in a 24-hour period **only** when **multiple collections** are done.

Table 3: Recovery period following a single collection

Percentage of volume collected	Recovery period
1%	1 day
7.5%	1 week
10 %	2 weeks
15%	4 weeks

Table 4: Recovery period following multiple collections

Percentage of volume collected	Recovery period
7.5%	1 week
10–15 %	2 weeks
20 %	3 weeks

Possible complications after blood collection

Hematoma

- A hematoma (pooling of blood outside of a blood vessel, generally subcutaneous, accompanied by bruising and pain) can form at the puncture site for several reasons:
  - poor puncture technique (e.g., laceration of a vessel)
  - insufficient compression following a puncture
  - diminished coagulation capacity in the animal
- The condition usually resolves itself. In the event of a problem, contact a DSV veterinarian.
- Puncturing a hematoma is prohibited.

Hypovolemic shock

- Some animals may go into hypovolemic shock after blood collection. It is essential to check the animal's condition during and after collection and be able to recognize the clinical signs related to hypovolemic shock:
  - weak pulse
  - pale mucous membranes
  - slow capillary refill time
  - diminished mental state
  - cold extremities

- decreased body temperature

- In the event of hypovolemic shock in rodents, euthanize the animal. For large animals, immediately discuss the appropriate treatment with a DSV veterinarian.

Anemia

- Some animals may suffer from anemia following blood collection. It is important to check an animal's condition after collection and know how to recognize the clinical signs related to anemia:
  - increased heart rate
  - pale conjunctiva and oral mucosa
  - paleness of the tongue, mucous membranes, ears, legs (rodents)
  - exercise intolerance
  - weakness and possible anorexia
  - low hematocrit
- When you observe signs of anemia in an animal, stop collecting blood immediately. Allow the animal to recover before blood collection is resumed.
- Discuss the appropriate treatment and the recommended recovery time with a DSV veterinarian

References

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SOP Revision History		
Version 2	January 16, 2018	Clarification of general considerations. Added recovery period for a 1% collection in Table 3.
Version 3	April 1, 2020	Added requirement to use lactated Ringer's solution as a replacement fluid. Clarified total blood volumes of geriatric and obese animals.