



Cornell University Institutional Animal Care and Use Committee

ACUP 403.01 Recommended Blood Collection Volume and Frequency

The intent of this Animal Care and Use Procedure (ACUP) is to describe the recommended blood collection volume and frequency from commonly used laboratory animal species. This ACUP is intended for anyone collecting blood samples. This ACUP is approved by the Cornell Institutional Animal Care and Use Committee (IACUC). Any deviation must be approved by the IACUC prior to its implementation.

TABLE OF CONTENTS

1. Introduction
2. Materials
3. Procedures
4. Personnel Safety
5. Animal Related Contingencies
6. References
7. Appendix

1. Introduction

This document provides information about the volume and frequency of blood collection in various species. The maximum limits are set up to maintain animal welfare and prevent potential complications such as hypovolemic shock and death.

2. Materials N/A

3. Procedures

- Do not collect blood from a site presenting inflammation or a hematoma.
- Limit the number of venipunctures to four punctures per day with no more than two punctures per site.
- The table in the appendix shows the maximum volume of blood which can be collected at once or over a 24-hour period, and the corresponding recovery time during which the animal should not be subjected to blood collection again (based on the percentage of total blood volume collected). Example: for a mouse, the sum of blood volumes collected over 24 hours cannot exceed 0.4 mL and the animal cannot be collected again before 4 weeks.
- If >10% blood volume is required, replace collected blood volume by 3–4 times the volume of blood collected with isotonic fluids (i.e., fluids with same tonicity as blood, such as 0.9% saline, 5% dextrose or Lactate Ringer solution).
- Reduce volume collected if the animal is weak, ill, geriatric, over weight or anemic. Hemoglobin concentration (Hb) should be over 9.0 g/dL.

4. Personnel Safety

- Medical emergencies: call 911
- When working with animals wear appropriate PPE, observe proper hygiene, and be aware of allergy, zoonosis, and injury risks. Refer to the CARE Occupational Health and Safety webpage for more information.

5. Animal Related Contingencies

- Post contact information for emergency assistance in a conspicuous location within the animal facility.
- Emergency veterinary care is available at all times including after working hours and on weekends and holidays through CARE (pager1-800-349-2456).
- Non-emergency veterinary questions & requests for care, call or email CARE veterinary staff at 607-253-4378 or care@cornell.edu, respectively.

6. References

- CARE Occupational Health and Safety webpage. <http://www.research.cornell.edu/care/OHS.html>
- Diehl, K.-H. et al., "A Good Practice Guide to the Administration of Substances and Removal of Blood, Including Routes and Volumes", *J. Appl. Toxicol.*, 21, 15–23 (2001)
<http://www.fcv.unl.edu.ar/bioterio/guias/diehl2001.pdf>
- Wolfensohn, S., Lloyd, M. 2nd Edition, Blackwell Science Ltd. 1998.
- Guidelines for survival bleeding of mice and rats;
NIH: http://oacu.od.nih.gov/ARAC/documents/Rodent_Bleeding.pdf

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7. Appendix

| Body weight (g) | *CBV(ml) | 1% CBV (ml) every 24 hrs† | 7.5% CBV (ml) every 7 days† | 10% CBV (ml) every 2 - 4 wks† |
|---------------------------|---------------|--|--------------------------------|----------------------------------|
| 20 | 1.10 - 1.40 | .011 - .014 | .082 - .105 | .11 - .14 |
| 25 | 1.37 - 1.75 | .014 - .018 | .10 - .13 | .14 - .18 |
| 30 | 1.65 - 2.10 | .017 - .021 | .12 - .16 | .17 - .21 |
| 35 | 1.93 - 2.45 | .019 - .025 | .14 - .18 | .19 - .25 |
| 40 | 2.20 - 2.80 | .022 - .028 | .16 - .21 | .22 - .28 |
| 125 | 6.88 - 8.75 | .069 - .088 | .52 - .66 | .69 - .88 |
| 150 | 8.25 - 10.50 | .082 - .105 | .62 - .79 | .82 - 1.0 |
| 200 | 11.00 - 14.00 | .11 - .14 | .82 - 1.05 | 1.1 - 1.4 |
| 250 | 13.75 - 17.50 | .14 - .18 | 1.0 - 1.3 | 1.4 - 1.8 |
| 300 | 16.50 - 21.00 | .17 - .21 | 1.2 - 1.6 | 1.7 - 2.1 |
| 350 | 19.25 - 24.50 | .19 - .25 | 1.4 - 1.8 | 1.9 - 2.5 |
| *Circulating blood volume | | †Maximum sample volume for that sampling frequency | | |

Table 1. Guidelines for survival bleeding of mice and rats;
NIH: http://oacu.od.nih.gov/ARAC/documents/Rodent_Bleeding.pdf

Table 2. Total blood volumes and recommended maximum blood sample volumes for species of given body weights

| Species (weight) | Blood Volume (ml) | 7.5% (ml) | 10% (ml) | 15% (ml) | 20% (ml) |
|------------------|-------------------|-----------|----------|----------|----------|
| Mouse (25 g) | 1.8 | 0.1 | 0.2 | 0.3 | 0.4 |
| Rat (250 g) | 16 | 1.2 | 1.6 | 2.4 | 3.2 |
| Rabbit (4 kg) | 224 | 17 | 22 | 34 | 45 |
| Dog (10 kg) | 850 | 64 | 85 | 127 | 170 |
| Cat (4 kg) | 160 | 12 | 16 | 24 | 32 |
| Minipig (15 kg) | 975 | 73 | 98 | 146 | 195 |
| Goat (30 kg) | 2,400 | 180 | 240 | 360 | 480 |
| Horse (500kg) | 35,000 | 2,600 | 3,500 | 5,250 | 7,000 |

*(cat blood volume 4% body weight)

Table 2 Adapted from Diehl, K.-H. et al., "A Good Practice Guide to the Administration of Substances and Removal of Blood, Including Routes and Volumes", *J. Appl. Toxicol.*, **21**, 15-23

(2001): <http://www.fcv.unl.edu.ar/bioterio/guias/diehl2001.pdf>

Table 2 Adapted from National Centre for the Replacement, Refinement and Reduction of Animals in Research
<http://www.nc3rs.org.uk/bloodsamplingmicrosite/page.asp?id=426>