

Washington State University
Institutional Animal Care and Use Committee

Guideline #10: Drug and Chemical Administration

Approval Date: 11.8.2019 (Replacing Version 8.29.2019)

A. Purpose

The purpose of this policy is to provide researchers with the daily acceptable volumes of fluids or compounds that may be administered to animals. These guidelines apply to healthy, adult animals. When immature or debilitated animals are used, the veterinary staff must be consulted.

B. Background

The administration of excessive dose volumes may produce pain, excitement, and altered physiological parameters (e.g., serum electrolyte imbalance, increased blood pressure, and increased respiratory rate), and cause abnormal compound absorption.

C. Guideline

Administration of Drugs and Chemicals

A. Route and volume: The following table indicates the common routes and maximum volumes for administration of substances. For most mammalian species these volumes can be safely administered: 5 ml/kg subcutaneously; 0.05 ml/kg intramuscularly; 10 ml/kg intraperitoneally; and 5 ml/kg intravenously as a bolus or 2-4 ml/kg/hr continuous infusion. Substances administered parenterally (by injection) should be:

1. Isotonic (same concentration of solute as blood)
2. Close to physiologic pH (6.8-7.2). If not, administer through a central vessel (jugular vein) or buffer the solution to reach appropriate pH
3. Sterile, endotoxin-free and delivered aseptically. If not a commercially manufactured solution, it should be prepared aseptically and filtered through a

0.2 micron filter. Refer to [IACUC Policy 29](#) for additional requirements when using non-pharmaceutical grade drugs.

4. Appropriate volume as determined by route, species and animal size (see Table 1)
 - i. Excessive volumes by any route can cause pain, necrosis, and changes in absorption as well as leakage from the site of injection
 - ii. Commercially available labeled drugs will list route and volume recommendations
 - iii. Intramuscular injection site volumes must consider the size of the animal and the muscle that is being injected. The table below reflects volumes for adult animals in large muscle bodies such as the triceps, gluteal, quadriceps, dorsal lumbar, semimembranosus, and semitendinosus muscles. Large volume IM injections will need to be injected in multiple sites. A general guideline is no more than 5 mls in one site in sheep, goats, and swine and no more than 10 mls per site for cattle and horses.

Table 1. Drug Administration Routes and Volumes (and maximal dose volumes) ^D

Species	PO* (ml/kg)	IV bolus* (ml/kg)	IV drip* (ml/kg/hr)	IP* (ml/kg)	SC* (ml/kg)	ID* (ml/inj)	IM* (ml/kg/site)	IN* (ml/inj)	Gavage (ml/kg)
Mouse	10	1-5	2-4	1-20	1-40	0.05-0.1	0.05 ^B (0.1) ^D	0.03-0.05	1-20
Rat	10	1-5	2-4	1-10	1-10	0.05-0.1	0.1 ^B (0.2) ^D	0.03-0.05	1-20
Guinea Pig	5	1-5	2-4	1-10	1-5	0.05-0.1	0.05 ^B (0.1) ^D	0.03-0.05	1-20
Hamster	5	1-5	2-4	1-10	1-5	0.05-0.1	0.05 ^B (0.1) ^D	0.03-0.05	1-20
Rabbit	10	1-5	2-4	1-5	1-5	0.05-0.1	0.05-0.1 ^C	0.2-0.5	1-10
Dog	5	1-5	2-4	1	1-5	0.05-0.1	0.05-0.1 ^C	0.2-0.5	1-20
Cat	5-20	1-5	2-4	1-10	1-5	0.05-0.1	0.05-0.1 ^C	0.2-0.5	1-20
Swine	5-20	1-5	2-4	1-10	1-5	0.05-0.1	0.05-0.1 ^C	0.2-0.5	1-20
Sheep/ Ruminant	5-20	1-5	2-4	1-10	1-5	0.05-0.1	0.05-0.1 ^C	0.2-0.5	1-20

^A For non-aqueous injectates, consideration must be given to time of absorption before re-dosing. No more than two intramuscular sites should be used per day. Subcutaneous sites should be limited to two or three sites per day.

^B Values in ml/site for adult animals and large muscle bodies. Adjust for size

^C Values in ml/kg/site

^D Maximum volume in ml/site in adult animal and large muscle bodies. Lower volume for smaller sizes

B. Oral administration

1. **Voluntary consumption:** Substances are typically mixed with the daily diet, flavored water, or other palatable items to encourage consumption. Care should be taken to maintain an appropriate daily caloric intake and to habituate animals to any novel food items before adding drug. Care should be taken to ensure animals consume all agent offered. Food or water containing additives should be clearly labeled and disposed of properly. Please refer to [WSU IACUC Policy #35](#) on food and fluid restriction and diet manipulation.

2. **Gavage:** Oral gavage is a widely used method for safely administering known quantities substances to animals by properly trained (experienced/qualified) personnel. The maximum dosing volume is 1.5 ml for a 30 gram mouse (10 ml/kg), and 16 ml for a 400g rat (10-20 ml/kg). When performed properly, the procedure can be used to administer 50-200 µl into the stomach of mice daily.

If you have any questions about this guideline, need training in one of the above methods, or need the information regarding a species not listed above, please call the Office of the Campus Veterinarian at 509-335-6246 or email at or.ocv.alert@wsu.edu.

D. References

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Abbreviation	Expanded Word
PO	Per os (Oral)
IV	Intravenous
IP	Intraperitoneal
SC/SQ	Subcutaneously
ID	Intradermal
IM	Intramuscular
IN	Intranasal

1. Diehl, K., et al. 2001, A Good Practice Guide to the Administration of Substances and Removal of Blood, Including Routes and Volumes, J Appl Toxicol 21:15-23.
2. Iwarsson K, Lindberg L, Waller T (1994) Common non-surgical techniques and procedures. Chapter 16. Svensen P, Hau J 9eds). Handbook of Laboratory Animal Science. Volume 1. CRC Press, Inc. Boca Raton, FL
3. Guide for the Care and Use of Laboratory Animals 8th edition, 2011 (the Guide) <http://grants.nih.gov/grants/olaw/Guide-for-the-care-and-use-of-laboratory-animals.pdf>

4. Turner, P. et al. 2011, Administration of Substances to Laboratory Animals: Routes of Administration and Factors to Consider, American Association for Laboratory Animal Science, Volume 50, 5:600-613
5. Turner, P. et al. 2011, Administration of Substances to Laboratory Animals: Equipment Considerations, Vehicle Selection and Solute Preparation, American Association for Laboratory Animal Science, Volume 50, 5:614-627