Subject: Administration of Substances: Maximum Volumes and Other Recommendations

BACKGROUND

This Standard Operating Procedure (SOP) describes best practice standards for administration of substances to laboratory animals. If an investigator wishes to deviate from this SOP, all changes must be outlined and justified in the protocol application (approval of the protocol indicates approval of the deviation from the SOP for that project only).

The administration of substances must be performed in such a manner that the animal’s health is not compromised. Administration of excessive volumes can lead to adverse health outcomes, such as painful injections, ulceration or necrosis of the injection site. If multiple injections are administered, recommend alternating injection sites in order to avoid adverse consequences of multiple injections at the same site.

In addition, the investigator must remain cognizant of hazardous agents being injected into animals. Procedures using safe practices to avoid self-inoculation must be performed. For more information contact the Office of Environmental Health and Safety.

IACUC Procedure

1. Repeated needle use
   i. Best practice: Use a sterile needle only once then discard. Use of the same needle on multiple animals can spread infectious diseases. In addition, dull, dirty, or bent needles can lead to adverse consequences such as injection site abscesses or systemic bacterial infections. Once a needle is inserted into an animal, it can never be re-inserted into the stock container of solution (i.e. vial, tube, bag). If resistance is felt upon inserting into an animal, the needle must be discarded regardless of how many times it was used.
   ii. When rodents need the same volume of the same drug, some investigators will draw up a total amount of drug for several animals into one syringe and use that syringe to inject multiple animals. However, the same needle should not be used. The needle should be replaced between animals. Care must be taken to prevent needle injuries to the technician. If the animals are in the same cage, one needle may be used on multiple animals if it is in the IACUC-approved protocol. This is not encouraged, however, up to 5 uses per needle may be considered approvable with adequate justification. Note that 5 uses does not mean 5 animals—if one animal requires 2 injection attempts, that counts as 2 uses. A needle used for IV or IP administration cannot be used in more than one animal. Needle reuse must not be employed in animals housed in different cages or known to be sick, as well as USDA-covered species.

2. Parenteral injection safety
   a. Definitions:
      i. Single-dose vials (or single-use vials) are intended for use in a single patient for a single case/procedure/injection. Single-dose or single-use vials are labeled as such by the manufacturer and typically lack an antimicrobial preservative.
      ii. Multi-dose vials contain more than one dose of medication. They are labeled as such by the manufacturer and typically contain an antimicrobial preservative to help prevent the growth of bacteria. However, this preservative has no effect on viruses and does not fully protect against contamination when safe injection practices are not followed.
   b. Best practice: Use single-dose vials or bags of fluids only once then discard. Repeated use of these items may result in contamination and infection of recipient animals.
      i. If it is necessary to reuse a single-dose vial or bag of fluids, care must be taken to prevent contamination. Label the vial or bag with the date of first use. Use precautions to prevent contamination. Discard vial/bag after 30 days.
   c. Labeling requirements
All substances that are administered to animals by any route must be in a labeled container. This applies to both primary (e.g. vial, bottle) and secondary (e.g. syringe, fluid bag) containers and must include, at a minimum, the name and concentration of the compound and the expiration date in legible text.

- Compounds drawn into syringes do not need to be labeled if they will be used immediately.
- If alternative methods of labeling are required they must be described in the animal care protocol.

### Table 1. Administration volumes: Best practice per administration (maximum per administration)

<table>
<thead>
<tr>
<th>Species</th>
<th>Oral</th>
<th>S.C.**</th>
<th>I.P.</th>
<th>I.M.***</th>
<th>I.V. bolus</th>
<th>I.V. slow infusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>10 (20)</td>
<td>10 (40)</td>
<td>20 (80)</td>
<td>0.05ml (0.1ml)</td>
<td>5</td>
<td>(25)</td>
</tr>
<tr>
<td>Rat</td>
<td>10 (20)</td>
<td>5 (20)</td>
<td>10 (20)</td>
<td>0.1ml (0.2ml)</td>
<td>5</td>
<td>(20)</td>
</tr>
<tr>
<td>Rabbit</td>
<td>10 (15)</td>
<td>5 (10)</td>
<td>5 (20)</td>
<td>0.25 (0.5)</td>
<td>2 (5)</td>
<td>(10)</td>
</tr>
<tr>
<td>Dog</td>
<td>5 (15)</td>
<td>1 (5)</td>
<td>1 (20)</td>
<td>0.25 (0.5)</td>
<td>2 (5)</td>
<td>(10)</td>
</tr>
<tr>
<td>Minipig</td>
<td>10 (15)</td>
<td>1 (5)</td>
<td>1 (20)</td>
<td>0.25 (0.5)</td>
<td>2 (5)</td>
<td>(10)</td>
</tr>
<tr>
<td>Cat</td>
<td>10 (15)</td>
<td>(100ml)</td>
<td>5 (20)</td>
<td>(0.5ml)</td>
<td>2 (5)</td>
<td>(10)</td>
</tr>
</tbody>
</table>

*Contact veterinarian for other species.
**Subcutaneous sites should be limited to 2 or 3 sites per day. The subcutaneous recommendations do not apply to complete Freund’s adjuvant.
***No more than 2 intramuscular sites should be used per day.

### Table 2. Needle size recommendations (needle sizes decrease in diameter with increasing gauge)

<table>
<thead>
<tr>
<th>Species</th>
<th>Oral**</th>
<th>S.C.</th>
<th>I.P.</th>
<th>I.M.</th>
<th>I.V.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse</td>
<td>21g</td>
<td>26g</td>
<td>26g</td>
<td>26g</td>
<td>26g</td>
</tr>
<tr>
<td>Rat</td>
<td>15-16g</td>
<td>23-25g</td>
<td>22-25g</td>
<td>25-26g</td>
<td>23-25g</td>
</tr>
<tr>
<td>Rabbit</td>
<td>18-22Fr***</td>
<td>21-25g</td>
<td>20-22g</td>
<td>22-25g</td>
<td>21-25g</td>
</tr>
<tr>
<td>Dog</td>
<td>NA</td>
<td>18-22g</td>
<td>NA</td>
<td>20-25g</td>
<td>18-22g</td>
</tr>
<tr>
<td>Minipig</td>
<td>NA</td>
<td>20g</td>
<td>NA</td>
<td>19-22g</td>
<td>20-22g</td>
</tr>
<tr>
<td>Cat</td>
<td>8Fr</td>
<td>20-25g</td>
<td>NA</td>
<td>22-26g</td>
<td>22-23g</td>
</tr>
</tbody>
</table>

* Contact veterinarian for other species.
** External diameter
*** 3.5-5Fr for nasogastric

### REFERENCES

• Waynforth HB & Flecknell PA. Experimental and Surgical Technique in the Rat. Academic Press. 1992
• Suckow MA & Schroeder V. The Laboratory Rabbit. The Laboratory Animal Pocket Reference Series. CRC Press. 2010.

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