

FLUID AND DRUG ADMINISTRATION

When drugs, injectable anesthetics or other agents are to be administered, one or more of several different routes may be selected. The route is governed by the nature of the agent being administered, the animal, the purpose of the administration and other factors.

The more common routes of administration used for laboratory animals are classed as follows:

Gastro-Intestinal Tract

Oral or per os-- through the mouth

Gavage-- into the stomach via a tube

Rectal or per rectum-- into the rectum via the anus

Parenteral

Intravenous (IV) -- directly into the vascular system through a vein (See blood collection section)

Intraperitoneal (IP) -- into the abdominal cavity

Subcutaneous (SC)-- under the skin

Intramuscular (IM)--into a muscle

Intradermal (ID)-- between layers of the skin

A. Gastro-Intestinal Tract

Substances may be administered orally by addition to the food or the drinking water, by use of a capsule or pill or by instillation into the mouth using a mechanical device, such as a syringe or a "gun." Capsules or coated pills are rarely used in rabbits or rodents. When used, capsules or pills are placed in the mouth near the back of the tongue, and the animal is induced to swallow by stroking the throat.

Substances administered in the food or water may present a problem with

quantification of amount actually consumed, or reduced intake of food or water if they can taste it. Diets can be customized by commercial vendors to incorporate or eliminate substances and provide a uniform, palatable diet (see Veterinary Resources).

Stomach tubes or gastric feeding needles are inserted through the mouth into the stomach or lower esophagus (Fig. 7). Care must be taken that the tube does not enter the trachea or the needle puncture the esophagus. In most cases, introduction of the tube toward the rear of the mouth will induce swallowing, and the tube readily enters the esophagus. A violent reaction (coughing, gasping) usually follows accidental introduction of the tube into the larynx or trachea. Flexible or plastic tubes may be bitten or chewed, and some care must be taken to prevent this.

With rabbits, a dowel of wood or plastic with a hole in the center is inserted behind the incisors, and the mouth held shut by an assistant. This prevents chewing and permits easy entrance of the stomach tube. Rabbits should be placed in a restraining device before attempting this procedure to avoid unnecessary struggling and injury. A small curved metal tube usually with a ball on the end (feeding needle) is often used with small rodents. Entrance may normally be obtained without anesthesia using ordinary hand restraint, and the ball prevents trauma to the esophagus and oral cavity. With the stomach tube fitted to a syringe or aspirator, materials may be administered or withdrawn as required.

B. Parenteral

Parenteral routes of administration involve injections into the various compartments of the body. Sites used for collection of blood from veins may also be used for intravenous administration, and procedures are similar. Intraperitoneal administration is one of the most frequently used parenteral routes, but other commonly used locations are the musculature and subcutis. Materials given intramuscularly must be in small amounts. Regardless of the route to be used, it is essential that the subject be securely restrained to avoid injury to personnel caused by dislodged needles and to animals because of struggling.

The investigator should know the physiological properties of the substance that is to be injected. Considerable tissue damage and discomfort can be caused by irritating vehicles or drugs. The use of the footpads as an injection site for antigens with or without adjuvant is not acceptable because it is a needless and painful procedure. A more suitable site for antigen injections is subcutaneously over the dorsum using small volumes at multiple sites.

The following outline provides basic information on equipment and techniques for parenteral injections in rodents and rabbits. Demonstration/instruction sessions can be arranged with Veterinary Resources.

a. MOUSE

- i. Intravenous Equipment: 27-30 g needle, 1 ml TB syringe, mouse holder, warming lamp.

The lateral veins of the tail are the most frequently used veins. Best results are obtained if the tail is immersed in water or the mouse warmed in the cage with a warming lamp. The veins can be seen when the tip of the tail is lifted and rotated slightly in either direction. The tip of the needle can be followed visually as it penetrates the vein. Trial injection soon discloses whether or not needle is in the vein. Practice and training are essential.

- ii. Intraperitoneal Equipment: Syringe and 23 to 27 g, ½ to 1-inch needle, preferably with a short bevel.

The mouse is grasped as described in Appendix 7-4 (Fig. 1) and held in dorsal recumbency in a head-down position.

The injection is made in the lateral aspect of the lower left quadrant. The use of a short bevel needle and its insertion through the skin and musculature followed by immediately lifting the needle against the abdominal wall aids in avoiding puncture of the gut lumen. Rapid injection, especially with a large syringe, may cause bruising of tissue and hemorrhage from the pressure of the spray, hence it should be avoided. Unless the left leg is immobilized, there is considerable risk of the mouse's movement causing puncture of the viscera. The maximum volume injected IP into a 20 gm mouse should not exceed 2 ml.

- iii. Intramuscular Equipment: 26 to 30 g, ½ inch needle with a TB syringe.

This route is usually not used because of the small muscle mass available and the danger of damaging vital structures. However, when it is used, the back and hind leg muscles are the usual sites selected.

- iv. Subcutaneous Equipment: 25 to 27 g, ½ inch to ¾ inch needle and TB syringe.

This route is frequently used as an immunization site and the site usually chosen is the area between the shoulder blades. Alternatively, the ventral abdomen is commonly used employing

restraint demonstrated in Fig. 1, Appendix 7-4.

b. RAT

- i. Intravenous Equipment: Depending upon the size of the rat, needles as large as 20 g may be used. One-half to one inch length is usually used.

A rat holder and warming lamp are also important. The techniques described for the mouse apply here also. In addition, the saphenous vein on the lateral aspect of the hind leg may be used. Restraint must be adequate for the safety of both the investigator and the animal. Confinement within a cylindrical holder is the usual method for restraint. Light anesthesia with Ketamine-Xylazine is helpful for restraint. Prolonged IV administration/sampling can be accomplished by jugular vein catheterization. This requires a surgical approach with anesthesia.

- ii. Intraperitoneal Equipment: 23 to 25 g, 5/8 to 1 inch-needles are recommended.

The location is the same as described for the mouse. Restraint is the best with a second person holding the rat in a head-down stretched out position.

- iii. Intramuscular Equipment: 25 to 26 g, 1/2 to 5/8 inch needle and TB syringe.

The back and hind leg muscles are used. As with the mouse, precautions to avoid damage to vital structures must be taken.

- iv. Subcutaneous Equipment: A 23 g, 1 inch needle is recommended.

This route is frequently used instead of the IM route to administer drugs. The usual site is between the shoulder blades, if done frequently, rotate sites. Again, be sure and use adequate restraint. **CAUTION:** rat skin is thick and difficult to penetrate.

Care should be taken to avoid accidental human injections.

c. RABBIT

- i. Intravenous Equipment: 20 to 25 g needle of suitable length with syringe. A short bevel needle not more than 1 inch long and a

syringe of 5 ml capacity or less is recommended.

Use a rabbit holder of metal, plastic, or wood construction or cat restraint bag. Do not attempt this procedure using manual restraint.

The marginal ear veins are used almost exclusively. Do not attempt to inject materials into the central artery of the ear as this may result in necrosis of the ear. Place the rabbit in a holder or cat bag. The hair over the vein is clipped or shaven, and the skin cleansed with alcohol or alcohol-iodine before making the injection.

Cleansing the skin reduces the possibility of injecting dander or hair as well as reducing the bacterial count. The vein can be distended by flicking the margin with the finger a few times. Holding off the vein near the base of the ear will also help to distend the vein. Useful vasodilating agents are described under Blood Collection.

- ii. Intraperitoneal Equipment: 19 or 20 g, 1 or 1.5 inch needle with suitable syringe.

Smaller needles may be used for small volumes of low viscosity substances. Light anesthesia is recommended with Ketamine. Proceed as with rodents.

- iii. Intramuscular Equipment: 22 to 23 g, 1 inch needles. The most frequently used sites are the back muscles lateral to the vertebrae and caudal to the ribs, or the lateral thigh muscles (more desirable). If repeated injections are to be made, rotate sites. The hair should be clipped and the skin disinfected.

Adequate restraint is important. Rabbits are most comfortable in a close fitting cardboard box and may be injected while in the box.

- iv. Subcutaneous Equipment: 20 to 23 g, 1 inch needles.

The area most frequently used is between the scapulae. Clean the skin with alcohol, clip or part the hair, and fold the skin over the needle rather than thrust the needle into the skin.

d. GUINEA PIG

- i. Intravenous

Several veins are used, but there is considerable variation from

individual to individual in their size and usefulness. These include the lateral metatarsal, cephalic, and saphenous veins (27 g) and the marginal ear vein may be used if a very small (30 g) needle is used and the ear is not pigmented. Permanent catheters may be placed in the jugular vein.

- ii. Intraperitoneal Equipment: 19 to 22 g needles with appropriate size syringe.

Light anesthesia may be used if working alone.

- iii. Intramuscular Equipment: 20 to 22 g, 1 inch needles with a 1 to 5 ml syringe.

Not frequently used; however, if care is taken not to injure adjacent structures, injections can be made into the lower back muscles and lateral muscles of the thigh (preferred). An assistant is usually needed.

- iv. Subcutaneous Equipment: 20 to 22 g, 3/4 inch - 1 inch needles with the appropriate size syringe.

The skin of the guinea pig is thick and tough, especially over the shoulders. When making injections in this area, the use of short, heavy gauge needles are recommended, e.g., 20 g, 1 inch. Be certain to use restraint adequate to avoid injury.