Guidelines for Survival Rodent Surgery

These guidelines apply to all surgical procedures performed on rodents in which the animals are expected to recover from anesthesia. Prior to performing any surgery techniques on living rodents, the procedure must be approved by the IACUC.

A. Personal Protective Equipment:
1. Clean lab coat, mask, hair cover
2. Gloves: there are two possibilities:
a) Sterile surgical gloves. Using sterile surgical gloves allows you to touch all areas of the sterile surgical field and surgical instruments with your gloved hand.
b) Clean exam gloves using a "tips-only" technique. This technique restricts you to using only the sterile working ends of the surgical instruments to manipulate the surgical field. The hand must never touch the working end of the instruments, the suture, suture needle, or any part of the surgical field.

B. Pre-Operative:
Rodents do not vomit, so it is not necessary to fast them prior to surgery.

1. Surgery should be conducted in a disinfected, uncluttered area that promotes asepsis during surgery (Table 1).
2. Prepare the animal by removing hair from the surgical site.
If a depilatory is used, thoroughly rinse the chemical from the rodent's skin or apply a neutralizing agent. Whenever possible, perform this procedure in an area separate from where the surgery is to be conducted.
3. Administer analgesics (preemptive analgesia) as appropriate and approved in your Animal Study Proposal.
4. Protect the corneas from drying out by applying an ophthalmic ointment.
5. Take measures to minimize hypothermia by providing heat.
6. Prepare the surgical site(s) with an appropriate skin disinfectant (Table 2).
If using a stereotaxic frame, the rodent should be placed in the frame *before* the skin disinfectant is applied.
Alternating disinfectants is more effective than using a single agent. For example, an chlorhexidine scrub can be alternated three times with 70% alcohol, followed by a final soaking with a disinfectant solution. Alcohol, by itself, is not an adequate skin disinfectant.
7. Surgeons should wash and dry their hands before aseptically donning sterile surgical gloves.
Nitrile examination gloves can be autoclaved.
8. When feasible, the surgical site should be draped aseptically with sterile material prior to making an incision to create a sterile surgical field. Draping is especially important when suture material will be used
9. Instruments, suture material, suture needle, etc. must never touch outside of the sterile surgical field.
• When working alone and manipulation of non-sterile objects (e.g. anesthesia machines, microscopes, lighting, etc.) is required, it may be helpful to use sterile aluminum foil or sterile plastic covers to manipulate the objects.

C. Operative:

1. The animal must be maintained in a surgical plane of anesthesia throughout the procedure.
a.) If using the pedal withdrawal reflex to test depth of anesthesia, the rear paw has been shown to be more reliable than the forepaw.
b.) If neuromuscular blocking agents (e.g. pancuronium, succinyl choline) are used, monitoring of autonomic nervous system responses (e.g. heart rate, blood pressure) should be used to monitor anesthetic depth.
2. Begin surgery with sterile instruments and handle instruments aseptically (Table 3)
3. When using “tips-only” technique, the sterility of the instrument tips must be maintained throughout the procedure.
4. Instruments and gloves may be used for a series of similar surgeries in the same session, provided they are maintained clean and disinfected between animals (Table 3). You may dip gloves in alcohol for 30 seconds between surgeries to sanitize them
5. Clean instrument of blood and organic material prior to bead sterilizer or alcohol soak. Assure instruments are cooled after bead sterilizing, before touching tissue
6. Monitor and maintain the animal's vital signs and hydration.
7. Ensure hemostasis and minimize blood loss.
8. Close surgical wounds using appropriate techniques and materials.

D. Post-Operative:

1. Move the animal to a warm, dry area and monitor it during recovery. Return the animal to its routine housing only after it has recovered from anesthesia (i.e., the animal can maintain itself in sternal recumbency).
2. Provide analgesics as appropriate and approved in your Animal Study Proposal.
3. If appropriate, consider giving fluids and/or nutritional support.
4. Generally, remove skin closures 7 to 14 days post-operatively after verifying that the wound has healed.
5. Maintain a surgical record with important operative and post-operative information (e.g., annotate cage card with procedure and date, body weight on the day of surgery, analgesic administration, wound closure removal, etc.).
6. Continue daily monitoring of the animal until it is stable (e.g., body weight, body condition, activity, grimace scale, nesting behavior, turgor, etc.).

Surgical Record:

Creating and maintaining a surgical record with important operative and post-operative information (e.g., annotate cage card with procedure and date, body weight on the day of surgery, analgesic administration, wound closure removal, etc.) is required.

Table 1. Recommended Hard Surface Disinfectants

AGENT	EXAMPLES*	COMMENTS**
Alcohols	70% ethyl alcohol 85% isopropyl alcohol	Contact time required is 15 minutes. Contaminated surfaces take longer to disinfect. Remove gross contamination before using.
Quaternary Ammonium	Roccal®, Quatricide®	Rapidly inactivated by organic matter. Compounds may support growth of gram negative bacteria.
Chlorine	Sodium hypochlorite (Clorox ® 10% solution) Chlorine	Corrosive. Presence of organic matter reduces activity. Chlorine dioxide must be fresh; kills vegetative organisms within 3 minutes of contact.
Glutaraldehydes	Glutaraldehydes (Cidex® Cetylcide®, Cide Wipes®)	Rapidly disinfects surfaces.
Phenolics	Lysol®, TBQ®	Less affected by organic material than other disinfectants.
Chlorhexidine	Nolvasan® , Hibiclens®	Presence of blood does not interfere with activity. Rapidly bactericidal and persistent. Effective against many viruses.
Hydrogen peroxide Peracetic acid Acetic acid	Spor Klenz	Contact time 10 minutes.
*The use of common brand names as examples does not indicate a product endorsement ** Always follow manufacturer's instructions for dilution and expiration periods		

Table 2. Skin Disinfectants

AGENT	*EXAMPLES	COMMENTS
Iodophors	Betadine®, Prepodyne®, Wescodyne®	Reduced activity in presence of organic matter. Wide range of microbicidal action. Works best in pH 6-7.
Chlorhexidine	Nolvasan®, Hibiclens®	Presence of blood does not interfere with activity. Rapidly bactericidal and persistent. Effective against many viruses. Excellent for use on skin.
*The use of common brand names as examples does not indicate a product endorsement.		

Table 3. Recommended Sterilant For Surgical Instruments & Equipment

AGENT	*EXAMPLES	COMMENTS
Steam Sterilization (moist heat)	Autoclave	Effectiveness dependent upon temperature, pressure and time, e.g. 121°C for 15 min vs 131°C for 3 min. Appropriate sterilization indicators should be used to ensure sterility.
Dry Heat	Hot Bead Sterilizer Dry Chamber	Fast Instruments must be cooled before contacting tissue. Only tips of instruments are sterilized with hot beads.
Alcohol	Ethanol or Isopropanol	Alcohol is neither a sterilant or high-level disinfectant. May be acceptable for some procedures, if prolonged contact time are used.[19,20]

Surgery to correct Experimental Complications

Only one major surgical procedure (involving entry of abdomen or thorax) may be performed per animal, unless indicated on an approved protocol. Therefore, major surgery intended to correct complications arising after a major experimental procedure is not permitted without prior approval. In such cases, euthanasia should be performed. Procedures such as repair of dehiscence and wound cleaning/debridement for treatment of infection may be performed following notification of the veterinary staff or the attending veterinarian for the facility.