GUIDELINES FOR RODENT SURVIVAL SURGERY

The following guidelines for performing survival surgery on rodents are based on recommendations in the Guide for the Care and Use of Laboratory Animals (1) and other applicable references (2-9). Survival surgery is defined as any surgical procedure from which the animal is allowed to recover from anesthesia. Issues of asepsis, surgical technique/training, anesthesia, monitoring and support, analgesia and postoperative care are all addressed in the Guideline.

The following guideline is intended to provide useful information regarding rodent survival surgery at SLU. At a minimum, policies must be followed whenever a research study involves survival surgery on rodents. Exceptions to these guidelines for scientific reasons may be made if documented in the protocol and approved by the Animal Care Committee prior to study initiation. Failure to comply with the guidelines set forth may result in protocol sanctions.

Preoperative Care

1. **Health Status** - Animals should be in optimal health at the time of surgery. An acclimation period of 3 days is required to allow for general health evaluation and physiologic and psychological stabilization. Exceptions can be granted at the request of the PI and approval by a member of the CM veterinary staff. Exceptions will be considered on a case-by-case basis. Rodents should be weighed pre-operatively in order to allow accurate dosing of drugs and to provide a base-line for post-operative monitoring.

2. **Anesthesia** – The depth and duration of anesthesia must be appropriate to the surgical procedure being performed. Signs of adequate surgical anesthetic depth in rodents include: pink ears and mucous membranes, minimal or absent pedal reflex (i.e., the animal does not withdraw the foot when the toes are firmly pinched) Frequent assessment of anesthetic depth must be performed to ensure appropriate depth. Movement in response to surgical manipulation indicates inadequate anesthesia.

   Preoperative fasting is rarely necessary. Withholding food for a short period, (1-4 hrs, not over night), before surgery may be useful to reduce the gastrointestinal contents. Fasting for more than a few hours is simply an additional stressor. There is seldom any reason for withholding water. Any intent to withhold food or water prior to surgery must be defined (duration) in the animal use protocol.

   Anyone administering anesthetics must be adequately trained/experienced in the anesthetic regimen selected. The correct anesthetic drug, dose, and
route must be considered based on several factors including the species, surgery, and duration. Assistance in selecting an appropriate anesthetic can be obtained from consultation with a Comparative Medicine veterinarian.

3. **Analgesia** – While the degree of post-operative pain varies with the procedure and tissue manipulation, pain is an invariable sequela of surgery. Analgesics are used to minimize intra-operative and post-operative pain and discomfort. Appropriate analgesics will be provided at the dose level, frequency and duration required to ameliorate post-operative distress. Exceptions to analgesic use must be justified by the investigator, and reviewed and approved by the Animal Care Committee.

4. **Surgical Site Preparation** – The surgical site must be free of hair. The shaved area should provide a wide perimeter exceeding the operative field. A #40 blade on an electric clipper is suitable. The surgical area should be washed with an approved surgical scrub followed by application of a surgical antiseptic. Suggested products include povidone-iodine (Betadine®), chlorhexidine (Nolvasan® or Hibiprep®), or enhanced chloroxylenols (Techni-Care®). Swabs, gauze or small sponges should be used to apply the surgical scrub. A surgical antiseptic will be applied to the area with fresh gauze square, and allowed to remain as a final prep. Use care to avoid applying surgical antiseptics to the eyes as this may result in ocular irritation. **Exception:** *Mice used for transgenic production need not be clipped if an antiseptic is applied to the surgical site and extreme care is taken to avoid carrying hair into the wound.*

**Surgical Care**

1. **Surgeon** - Anyone performing surgery must be adequately trained/experienced in the procedures being performed. The Department of Comparative Medicine can offer consultation and training for most surgical procedures. The surgeon's hands must be surgically scrubbed before donning sterile surgical gloves. Anyone touching sterile surgical equipment or the surgical site must wear sterile gloves. Once gloved, the surgeon should touch only the prepared surgical site, sterile field and sterile instruments. A clean scrub top will reduce the risk of contamination. Long sleeves are likely to increase the risk of contaminating the sterile field and should be avoided. If working alone, the surgeon should have the animal anesthetized and positioned, and the surgical site prepared **before** opening the instrument pack and donning sterile gloves. The surgeon will change sterile gloves as necessary to avoid contamination of the surgical field.
2. **Surgical Facility** - Rodent survival surgery does not require the use of a dedicated operating room. However, the room/space must be remote from high traffic, easily sanitized and not used for other purposes during the time of surgery. The area, including operating surface should be physically disinfected before and after surgery to completely remove accumulations of blood, feces, urine, hair, etc. Adequate space should be provided to permit establishment of a sterile field for instruments and for patient draping. Adequate light must be used to fully illuminate the surgical site.

3. **Surgical Equipment** - All surgical instruments, drapes, sutures, catheters or any other supply, device or equipment which comes into contact with the surgical site must be sterilized by an appropriate method before use. Steam autoclaving is an appropriate method of sterilizing most surgical instruments. Items that are heat-sensitive, such as catheters, can usually be sterilized by exposure to ethylene oxide (gas sterilization). The Department of Comparative Medicine will provide advice and assistance with instrument maintenance, packaging and sterilization.

   a. A suitably large sterile towel, drape or tray should be used as a sterile field to maintain instruments and supplies during the procedure. To further limit contamination, instruments used for opening the skin and subcutaneous tissues should be kept separate from those used for deeper penetrations and procedures. Separation can be achieved with a second tray or by using a distinct area of a larger towel or instrument pad.

   b. Multiple surgeries using the same instruments can present special problems. Under these circumstances, extra effort is needed to maintain the sterility of the instruments: animals should be clipped and prepared in a different area; care must be taken not to contaminate the instruments when a new animal is being positioned; the instruments should be wiped clean of blood and body fluids between each case, and may be further wiped with a small amount of alcohol or disinfectant kept in a sterile bowl for the purpose. Use of a hot bead sterilizer is encouraged if available. For long procedures, gloves should be changed between each procedure. For short procedures gloves should be changed every 3 – 5 cases, or when contaminated.

   c. Draping - Draping is important for all survival surgical procedures. Surgical drapes cover a wide area beyond the wound in order to prevent contamination from the adjacent skin and hair, as well as from the surrounding bench and equipment. For rodent surgery, custom made cloth drapes work well, but are expensive and must be washed and re-sterilized with each use. Paper drapes made from disposable autoclave wrappers, with a fenestration for the surgical site, are inexpensive, disposable, and easy to prepare and to sterilize. They are, however, somewhat stiff and light, and may be somewhat clumsy until familiarity is gained. Regardless of the material, a drape must be large enough to cover the animal and to
provide a wide sterile working area. **Exception:** *Mice used for transgenic production need not be draped if aseptic procedures are applied to the surgical instruments, operating environment and technique.*

4. **Intraoperative Support** - Loss of body heat and fluids is of particular concern during rodent surgery. Good surgical technique requires keeping exposed tissue moist with warm sterile saline. Body temperature must be maintained during surgery and recovery. An external heat source, such as a warm water circulating pad, gel-filled pads are acceptable. Electric heating pads are acceptable, **but require particular attention to avoid burns and hyperthermia.** Additional measures to reduce heat loss include additional padding to reduce conductive heat loss, draping to reduce convective heat loss, warm subcutaneous fluid to compensate for evaporative losses, and good surgical technique to minimize surgical and anesthesia time.

5. Rodents undergoing general anesthesia often develop exposure keratitis because their eyes are not completely closed and they cannot blink. This is easily prevented by applying a small amount of a bland ophthalmic ointment to the eyes at frequent intervals until blinking reflexes return. The ointment may be obtained from the Department of Comparative Medicine operating room or nursing staff.

**Postoperative Recovery**

1. **Anesthetic Recovery** - Anesthesia is, in itself, a stressor. Some anesthetics induce prolonged hypothermia, fluid loss, and can result in prolonged post-operative recovery. During the anesthesia recovery period, the animals must be kept warm, dry, clean and comfortable. Rodents should be placed on a soft, warm surface, such as a folded cloth towel, or other compliant material. Direct contact with normal cage bedding is discouraged as it tends to cause eye injuries and respiratory and intestinal blockage in recovering animals.

   Supplemental heat and supplemental fluids will reduce the metabolic demands on the animal and speed recovery. Many anesthetics impair thermoregulation for prolonged periods after recovery. Animals must be fully recovered from anesthesia (ambulatory, alert and active) prior to being returned to their home cage.

2. **Clinical Recovery** - Animals must be monitored post-operatively, at least once daily for 3 to 5 days including weekends and holidays by the investigator and/or animal care personnel. A plan for post-operative observations and care should be instituted together with a means for recording observations and treatments. A written record of postoperative observations and treatments must be kept.
Care should be taken to ensure adequate food and water intake, administer analgesics if post-operative pain/distress is evident, and to clean and dress surgical sites as needed. Body weights should be recorded at regular intervals until recovery is clearly evident.

Antibiotics should not be used unless approved in the Animal use Protocol and/or by a CM veterinarian or designee. In the event that antibiotics are indicated for medical or scientific reasons, the drug, dose, and duration should be selected in accordance with good medical practice to achieve efficacy against the offending bacterial pathogen.


Reviewed and approved by the Saint Louis University Animal Care Committee, Sep 2006.