Institutional Animal Care and Use Committee

IACUC Policy 8: Rodent Survival Surgery

1. Facility
   
   A. A dedicated facility for rodent surgery is not required. A rodent surgical area can be a room or portion of a room that is easily sanitized. The immediate surgical area must not be used for other purposes during the time of surgery.
   
   B. Surgery must be conducted on a clean, uncluttered lab bench or table. The surface of the lab bench or table must be impervious to liquids. The work surface must be wiped with disinfectant before and after use or covered with a clean drape.
   
   C. The surgery area MUST be separate from the area where hair is removed from the animal.
   
   D. The area surgery is performed MUST be a laboratory that is not currently being used for bulk storage.

2. Training

   Professional and technical personnel and students who perform anesthesia, analgesia, and surgery must be trained to accomplish these tasks. The LARC Veterinarian is available to provide assistance with or training in, aseptic and surgical techniques and the proper administration of anesthesia and analgesia. All new technical staff and students to a protocol must be trained by the LARC.

3. Instruments

   A. Instrument Preparation

      All instruments must be cleaned and sterilized prior to use. First, all instruments must be cleaned of any debris by hand washing or by mechanical washer. Then, prior to surgery, the instruments must be sterilized using one of the following methods. The method of choice may be determined by the procedure, the delicacy of the surgical instruments or the devices being used. Steam autoclaving is the preferred method.

      1) Heat Sterilization

         a) Steam Autoclave: The instruments must be placed in a specially designed pack or wrapped in sterile drapes or cloths and secured with a thermo-sensitive tape. The use of such tape provides some indication that the autoclave procedure was effective. Instruments must be autoclaved at 121°C for 21 minutes in a vacuum autoclave. Once autoclaved, packs or wrapped instruments must be stored in closed cabinets or plastic bags. Autoclaved items must have a standard indicator to prove complete sterilization. Wrapped autoclaved items must be clearly labeled with the date of sterilization or expiration date. Items that are autoclaved in cloth wraps expire 6 months after autoclaving. Items that are autoclaved in plastic packs expire 1 year from the date of autoclaving.

         b) Flash Steam: Used to sterilize articles intended to be used immediately. The temperature must reach 132°C for three to five minutes.

      2) Cold (Chemical) Sterilization

         Cold sterilization of instruments is not acceptable for surgical procedures. All implants (pellets, tigon tubing, catheters, etc. MUST be sterile before implantation. Generally, this means individually wrapped and sterilized when purchased. Any implant made in-house must be sterilized by either ethylene oxide or vaporized hydrogen peroxide.

   B. Surgery on Multiple Animals

      If surgeries are to be performed on a group of animals, previously sterilized instruments can be “quick” sterilized using a glass bead sterilizer or “flash” autoclaved. Instruments should be thoroughly clean of blood or tissue prior to sterilization. No more than five successive surgeries can use instruments “quick”-disinfected as described above.
1) Sterile (Hot) Bead Sterilizer: This instrument will sterilize the tips of metal instruments in 15 seconds. Instruments and glass beads should be clean and free of tissue or blood. Only clean, cooled instruments may be used on the animals. After immersion in a hot bead sterilizer, instruments should be doused in sterile saline or sterile water (in a sterile container) before use on animals to prevent thermal injury.

NOTE: Most sterile bead sterilizers take thirty minutes to heat.
NOTE: This method of sterilization may not be used for the initial sterilization of instruments; it is only appropriate when performing 5 or fewer surgeries using a single pack.

4. Anesthesia and Analgesia Selection

Contact the Institutional Veterinarian for recommendations for appropriate anesthetics and/or analgesics for the species you are using.

The use of a single analgesic agent or combination will depend on the procedure performed. This table provides some guidelines for determining the expected degree of pain associated with various surgical procedures. For specific advice, please consult the Institutional Veterinarian.

<table>
<thead>
<tr>
<th>SURGERY TYPE</th>
<th>ANALGESIC</th>
<th>DURATION OF TREATMENT</th>
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<tbody>
<tr>
<td>Subcutaneous incision</td>
<td>NSAID or opioid + local anesthetic</td>
<td>Pre-emptive + 1 dose</td>
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<tr>
<td>Open abdomen</td>
<td>NSAID and opioid</td>
<td>Pre-emptive + 48 hours</td>
</tr>
<tr>
<td>Open thorax</td>
<td>NSAID and opioid</td>
<td>Pre-emptive + 48 hours</td>
</tr>
<tr>
<td>Musculoskeletal manipulation (e.g., fracture, muscle resection)</td>
<td>NSAID and opioid</td>
<td>Pre-emptive + 48 hours</td>
</tr>
<tr>
<td>Open cranium</td>
<td>NSAID and opioid + local anesthetic</td>
<td>Pre-emptive + 48 hours</td>
</tr>
<tr>
<td>Implant or device placement (e.g., indwelling catheter)</td>
<td>NSAID and/or local anesthetic</td>
<td>Pre-emptive + 24 hours</td>
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</table>

It is important to realize that none of the analgesics work immediately. Optimally, analgesics are provided pre-emptively to the painful event. This can be accomplished by administering the analgesics at the time of anesthetic induction. The specific analgesic choice and duration of administration to use is based on the severity of pain expected. These choices listed are not necessarily interchangeable. Please consult with the LARC Veterinarian for guidance. Analgesics may be given pre-emptively (preferred), intra-operatively to reduce inhalant requirements and provide additional analgesia, and post-operatively.

Mouse
- Buprenorphine 0.05-2.0mg/kg SQ every 6-12 hours SQ, IP, or IM
- Buprenorphine 0.05-2.0mg/kg every 6-12 hours SQ or IM + Carprofen 5mg/kg q 6-8 hours
- Buprenorphine 0.05-2.0mg/kg every 6-12 hours SQ or IM + Meloxicam 1-2mg/kg q 24 hours
- Extended-release buprenorphine 1.0 - 3.25 mg/kg SQ once
- Carprofen 5-10mg/kg PO or SQ q 6-8 hours; can be combined with opioids
- Meloxicam 1.0-2.0mg/kg SQ, IP daily; can be combined with opioids
- Local: lidocaine, lidocaine/bupivicaine, lidocaine patch, bupivicaine
5. Aseptic Preparation of the Animal

A. The animal must be anesthetized with a suitable anesthetic using the doses and procedure approved by the IACUC.

B. An ophthalmic lubricant must be applied to the eyes to prevent corneal drying.

C. Hair must be removed from the incision site with clippers, appropriate razor, and/or hair removal product (i.e., Nair) applied as directed and thoroughly rinsed off to prevent continual residue action. There should be a minimum of 1cm of shaved area surrounding the incision site.

D. Skin Preparation: The bare skin at the incision site must be thoroughly cleansed with a surgical scrub to clean the skin and create a sterile field around the incision site. Starting in the middle, and continuing in an outward spiral, apply the scrub at least three times alternating each scrub with 70% isopropyl or ethyl alcohol, sterile water, or saline. New gauze or applicators should be used for each cleansing.

Note: Copious application of topical alcohol in rodents will soak the animal and lead to hypothermia. The use of cotton tip applicators is ideal during the skin preparation process. OB/GYN swabs with large heads work well.

These surgical antiseptic agents may be used:

1) Povidone iodine scrub: A good choice for a surgical preparation with a broad spectrum of activity, including Mycobacterium. Antiseptic activity is rapid and persistent if not removed.

2) Chlorhexidine scrub: The 4% aqueous preparation effectively cleans the skin with a rapid onset of activity and a broad spectrum of activity with minimal loss of antiseptic activity.

NOTE: A scrub is different than a solution. A scrub contains a soap, and therefore has cleaning properties that a solution does not have. Scrubs are not to be mixed or diluted with water.

Antiseptic agents must be rinsed from the skin with sterile water, sterile saline or alcohol prior to surgery.

6. Preparation by Surgeon

A. Hands must be washed with an antiseptic soap or a surgical detergent/scrub (iodophors or chlorhexidine) and rinsed with water. Sterile surgical gloves must be worn.

B. Gowns or a clean lab coat and surgical gloves are required. Sterile gloves should be donned in such a way that no skin is showing at the sleeve end. The sleeves of lab coat/gown should not come in contact with the sterile field.

C. A new pair of sterile surgical gloves must be used for each animal. Alternatively, surgeons may wipe their gloves for 30 seconds with sterile gauze pads soaked in 70% alcohol, or with chlorine dioxide for 3 minutes. Gloves must be wiped with 70% alcohol after the 3-minute chlorine dioxide application. Glove contaminated with blood or tissue should be changed.

D. If working alone, the surgeon must have the animal anesthetized and positioned prior to gloving.

E. The first layer of a double-wrapped, sterile-packed instrument must be opened before gloving.

F. The survival surgery surgical site must be covered with a sterile drape after the surgeon has donned sterile gloves.
7. Intraoperative Monitoring
   A. The animal must be monitored carefully during the surgical procedure. Specifically, the animal's respiratory rate and characteristic response to noxious stimuli (e.g., toe pinch, and when possible the heart rate and body temperature) will be monitored.
   B. The surgical team must be trained by LARC personnel to be able to respond to the most common emergencies associated with the type of procedure being performed.

8. Post-Surgical Care
   A. Post-surgical care must include observing the animal to ensure uneventful recovery from anesthesia and surgery, administering analgesics, providing adequate monitoring of the surgical incision(s), and maintaining appropriate medical records.
   B. Administration of analgesia is required, except when specific IACUC approval has been granted.
   C. To prevent hypothermia, place the animal(s) in a warm room or cage. To prevent suffocation, it is recommended to recover the animal in a cage with no bedding. The cage may be placed on a heat source (only ½ of the cage should be on a heating pad in order to allow the animal to move away from the heated area when ready. **Heat lamps are not allowed for use with rodents.**
   D. Fluid replacement is recommended for all surgical procedures. Warmed sterile physiologic saline can be given subcutaneously to rodents.
   E. During the recovery process, animals must be monitored continually until they gain the righting reflex.
   F. If recovery from the anesthetic will be prolonged (i.e., over one hour), the animal must be rotated from side to side every 15-30 minutes to minimize atelectasis (collapse) of the lungs. This practice must be continued until the animal regains the righting reflex.
   G. Animals must be evaluated daily for at least five days by a member of the principal investigator's staff to whom post-operative care has been delegated. Animals must be monitored for evidence of excessive inflammation at the incision site, suture dehiscence (incision line failure or separation), infection, behavioral abnormalities indicative of illness (anorexia, listlessness, lethargy, dehydration, ruffled coating, lack of movement, weight loss greater than 10%). If evidence of wound infection or illness is noted, then LARC vet services must be contacted for evaluation and treatment, or the animal must be euthanized as soon as possible.
   H. External sutures, staples, and wound clips must be removed 10-14 days after surgery, unless otherwise approved in the protocol or approved by the Institutional Vet.
   I. If infections or complications occur, the LARC veterinary staff must be notified immediately.

9. Surgical Records
   A. A “Rodent Surgery Card” should be placed on the cage of post-surgical animals and remain until sutures/staples are removed. These cards are available from the LARC in each facility.
   B. A "Surgical Record" must be completed immediately after the surgical procedure is performed. Records may be somewhat abbreviated and in composite format and can be included as part of the research data collected, but must also be available for review.
   C. Records must identify the type of surgical procedure performed, the date of the procedure, the person who performed the procedure (or initials), information on all drug administration (including anesthesia and analgesia), and peri-operative monitoring, and must be maintained by the laboratory. This information must be available for review by regulatory bodies, including the IACUC.
10. Suture Selection

Surgical wounds should be closed using appropriate techniques and materials. The following table is a guide to the types of sutures that are available. For rodents 4-0 size is optimal for most procedures.

<table>
<thead>
<tr>
<th>Suture</th>
<th>Characteristics and Frequent Uses</th>
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<tbody>
<tr>
<td>Vicryl®, Dexon®</td>
<td>Absorbable; 60-90 days. Ligate or suture tissues where an absorbable suture is desirable.</td>
</tr>
<tr>
<td>PDS®, Maxon®</td>
<td>Absorbable; 6 months. Ligate or suture tissues especially where an absorbable suture and extended wound support is desirable.</td>
</tr>
<tr>
<td>Silk</td>
<td>Nonabsorbable. (Caution: Tissue reactive and may wick microorganisms into the wound). Excellent handling. Preferred for cardiovascular procedures. Must not be used to suture skin.</td>
</tr>
<tr>
<td>Chromic Gut</td>
<td>Absorbable. Versatile material. Because gut is highly reactive to tissues, its use is discouraged.</td>
</tr>
<tr>
<td>Stainless Steel Wound Clips, Staples</td>
<td>Nonabsorbable. General skin closure.</td>
</tr>
<tr>
<td>Cyanoacrylate surgical glue</td>
<td>Generally used in addition to skin sutures or incisions less than 1 cm in length. Note that many rodents will rip the glue out, along with large areas of skin, making it difficult to close the incision. Thus, surgical glue is not recommended.</td>
</tr>
</tbody>
</table>

11. Exceptions

All planned deviations from this policy must be approved by the IACUC prior to the performance of the surgical procedure. Emergency situations that involve deviations from IACUC-approved procedures must be reported to the Institutional Veterinarian and the IACUC within one week of its occurrence.