Guidelines on the Performance of Surgery in Rodents

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1. Purpose
   1. This document is intended to provide guidelines for investigators who perform surgical procedure in rodents such as mice, rats, hamsters, gerbils, guinea pigs, etc.
      1. All surgical procedures, anesthetics, analgesics, antibiotics or other medications used on animals must be approved by the IACUC and described in the animal use protocol. Personnel performing the surgical procedure must be listed on the animal use protocol and appropriately trained in the technique prior to starting any surgeries.
      2. Any divergence from the recommendations in this document must be described in the animal use protocol prior to implementing the deviation.
   2. If you have questions or comments about this document, please contact the ULAM veterinary staff at ulam-vets@umich.edu or 34-936-1696. The ULAM training core (ulam-trainingcore@umich.edu or 734-763-8039) can be contacted to provide training in these techniques at no charge.
   3. For any concerns regarding animal health after work hours or on weekends, please contact DPS (3-1131) who will contact the on call veterinarian.

2. Responsibility
   1. Principal Investigator and Surgeon: Responsible to ensure appropriate surgical preparation, technique and monitoring for each animal as well as to oversee the animal's post-operative recovery period.

3. Definitions
   1. Post-Operative Period: The 7 to 10 days immediately following the initial day of surgery.

4. Procedures
   1. Documentation
      1. Post-surgical records are required for every rodent that has undergone surgery.
      2. An individual post-surgical record must be used for each rodent cage that contains post-operative animals. Multiple animals from the same cage can be contained on the same post-surgical record, as long as the animals have unique identification, and the post-surgical record is completed in a way that allows for individual animal observations to be clearly identified. Each animal must have their own observations recorded daily.
      3. Post-surgical records must be contained within the animal room or within close proximity to the animals and readably retrievable for review by laboratory, UCUCA, or veterinary personnel at all times.
      4. Post-surgical records must be kept and maintained until sutures/wound clips are removed or the animal is euthanized.
         1. If skin incisions are not closed with sutures or wound clips, records must remain near the animal for at least 7 days following surgery.
      5. Post-surgical records must include anesthetics and analgesics administered for the surgical procedure and after for post-operative care. They records must also include the frequency of monitoring by any laboratory and veterinary personnel during the post-operative period. The following information should be included for both anesthetics and analgesics:
         1. Dose
         2. Frequency of administration
         3. Route of delivery
      6. Once the post-operative monitoring period is over, records for mice and rats must be placed in the assigned folder within the animal room. Records will be stored as outlined in the Guidelines on Medical Records for Investigative Personnel.
   7. Records for animals other than those of the genus *Mus* or *Rattus* bred specifically for research must be stored and maintained in accordance with the ULAM Guidelines for Animal Medical Records.
2. Preparation of the Surgical Area
   1. According to the *Guide for the Care and Use of Laboratory Animals: Eighth Edition*, "For most survival surgery performed on rodents and other small species...the space should be dedicated to surgery and related activities when used for this purpose, and managed to minimize contamination from other activities conducted in the room at other times." (pg. 144)
   1. The surgical area should be a room or a portion of a room that is easily sanitized and not used for any other purpose during the time of surgery.
   2. Clean and disinfect the surface upon which the surgery will be performed with an approved environmental disinfectant before beginning the surgical procedure.

3. Preparation of the Surgical Supplies
   1. Surgical Instruments
      1. Use prepackaged aseptic surgical supplies whenever possible.
      1. Initial steam sterilization (autoclaving), plasma vapor sterilization, or ethylene oxide sterilization (for heat or pressure sensitive items) is required for all surgical instruments and items to be implanted.
   2. Drapes
      1. While not required, drapes are highly recommended in order to maintain a sterile surgical field.
      1. If drapes are not used, extra precautions must be taken in order to maintain appropriate aseptic technique including, gloves, surgical instruments, anesthesia equipment and suture.
      2. Used for wrapping the instrument packs and/or creating the sterile field around the incision site.
      3. Drapes can be cloth, paper, sterile stockinettes, 3M™ Steri-Drape™ Incise Drapes, or new and unused boxes of GLAD Press’n Seal® wrap.
      1. Sterilize drapes using an autoclave or ethylene oxide where appropriate (plastic products).

4. Preparation of the Animal
   1. Fasting is not required for rodents.
      1. Fasting longer than 6 hours must be scientifically justified in the approved IACUC protocol.
   2. Anesthesia
      1. Use an approved agent appropriate for the species AND the procedure.
      1. For more details on anesthetic and analgesic options, please refer to the *Anesthesia and Analgesia Drug Descriptions*.
      2. The animal must be maintained in a surgical plane of anesthesia throughout the duration of the procedure.
      1. For more information on determining the surgical plane of anesthesia and monitoring during anesthesia please refer to the *Anesthesia and Sedation Monitoring Guidelines*.
   3. Skin Disinfection
      1. Hair must be removed from the surgical site prior to disinfecting the skin. Animal clippers, razors, depilatory cream (Nair®) or manual plucking can be used to remove hair from the surgical site.
      1. Depilatory creams must be completely rinsed from the skin before disinfecting the skin.
      2. A recommended skin disinfectant such as chlorhexidine or iodine scrub alternated with warmed saline, sterile water, or alcohol must be used a minimum of three times after removal of visible debris.
      3. The drape is then placed around the surgical site after the skin has been appropriately disinfected.

5. Surgeon Preparation
   1. Wash hands thoroughly with a disinfecting soap such as chlorhexidine or iodine based surgical scrubs or 3M Avaguard® hand antiseptic.
   2. The surgeon must wear a mask, sterile gloves, and a clean scrub top, clean disposable PPE gown, or clean lab jacket during the surgical procedure.
      1. Sterile gloves must be wrapped in individual pairs and can include:
      1. Commercially available sterile surgical gloves
      2. Commercially available sterile exam gloves
      3. Regular exam gloves, packaged and autoclaved with appropriate quality assurance measures to ensure sterility (autoclave tape, etc.).
      2. New sterile gloves must be donned if aseptic technique is disrupted for any reason (repositioning of the animal, touching anything outside of the surgical field, etc.). Use of a non-sterile assistant can minimize the need to change gloves within a procedure.

6. Performing Multiple Rodent Surgeries in Series
   1.Investigators should begin with at least 2 sets of sterile instruments.
      1. Between animals, clean the instruments followed by disinfection with a hot bead sterilizer.
      2. No more than 5 animals should be used per pack of sterile instruments.
   2. A new drape should be used for each animal.
   3. New sterile gloves should be used for each animal.
   4. The surgical area should be cleaned with an appropriate disinfectant between animals.

7. Suture Materials and Wound Closure
   1. Surgery in which a body cavity such as the abdomen or thorax has been opened requires a two-layer closure to close the body wall separately from the skin.
   2. Select suture material (absorbable vs. non-absorbable; braided vs. monofilament) that is appropriate to the tissues, procedure, and activity of the animal.
   3. Wound clips and skin sutures must be removed 7-10 days after placement.

8. Post-Operative Monitoring and Care
   1. Animals must be visibly observed and monitored every 15 minutes during recovery from anesthesia until the animal is ambulatory.
1. Rodents should be housed individually until completely recovered to avoid cannibalism by cage mates.
2. Monitoring parameters and thermal supplementation should be continued throughout the recovery period. Please refer to the Anesthesia and Sedation Monitoring Guidelines for more information on post-operative monitoring and appropriate thermal support devices.
3. Post-operative medications including analgesics, antibiotics and/or anesthetic reversals should be administered during the early recovery period and according to the approved protocol or the advice of a ULAM veterinarian.
4. A yellow acetate with a Surgery Observation Sticker (SOS) must be placed over the cage card when the fully recovered animal is returned to the animal room. The acetate will be kept on the cage until skin sutures or wound clips are removed.
   1. The date of surgery must be recorded on the sticker as well as the date for removal of wound clips or skin sutures.
   2. All wound clips and skin sutures must be removed by 10 days after surgery unless described otherwise in an IACUC approved protocol or as recommended by a ULAM veterinarian to necessitate incomplete wound healing.
   3. If the skin is sealed with glue, a yellow acetate with a SOS must be placed over the cage card with the date of surgery recorded. The acetate will need to be removed 7 days after surgery.
4. The laboratory staff must examine all post-surgical animals at least once a day for 7 – 10 days, or until the skin sutures or wound clips are removed.
   1. Daily post-operative monitoring and health status of the animals must be recorded during the post-operative monitoring period and records must be maintained in the post-surgical documentation (see above – 4.a).

9. Non-Survival Surgery
   1. According to Policy #3 of the USDA Animal Care Resource Guide Policies, "Nonsurvival surgeries do not require aseptic techniques or dedicated facilities but should be performed in a clean area, free of clutter, and using acceptable veterinary sanitation practices equivalent to those used in a standard examination/treatment room. Personnel present in the area should observe reasonable cleanliness practices for both themselves and the animals."

5. Related Documents
   1. Anesthesia and Sedation Monitoring Guidelines
   2. Anesthesia and Analgesia Drug Descriptions
   3. IUM Policy on Analgesia in Animals Undergoing Surgery
   4. Guidelines on Medical Records for Investigative Personnel

6. Appendices
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