Guidelines on the Performance of Surgery in Non-Rodent Mammals

Last Updated 1 November 2017

1. Purpose
   1. This document is intended to provide guidelines for investigators who perform surgical procedures in non-rodent mammals including dogs, cats, swine, ferrets, rabbits, ruminants and non-human primates.
      1. All surgical procedures, anesthetics, analgesics, antibiotics or other medications used on animals must be approved by the IACUC, described in the animal use protocol and performed by personnel listed on the protocol and appropriately trained for the surgical procedure.
   2. If you have questions or comments about this document, please contact the ULAM veterinary staff at ulam-vets@umich.edu or 734-936-1696.
   3. The ULAM training core (ulam-trainingcore@umich.edu or 734-763-8039) can be contacted to provide training in aseptic technique, anesthesia machine usage, documentation and performance of surgery at no charge.
   4. 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. Definitions
   1. IACUC: Institutional Animal Care and Use Committee.
   2. Procedure
      1. Any manipulation of an animal that does not involve an incision that needs closure made into the animal.
      2. Procedures can be performed for an experimental application, for examination purposes, or for treatment of an induced or spontaneous disease or condition. Examples of procedures include:
         1. Injections
         2. Bandaging/casting
         3. Imaging
         4. Antibody production
         5. Blood/fluid collection
         6. -Oscopies into natural opening that do not involve biopsy
         7. Non-invasive physiological monitoring
         8. Small tissue biopsy without cavity exposure
         9. Bone marrow aspirate
   3. Minor Recovery Surgery
      1. A surgical intervention that does not expose a body cavity or that does not ordinarily have the potential to result in impairment of a vital physical or physiological function.
      2. Examples of minor survival surgeries include:
         1. Cranial burr holes that do not expose dura or brain
         2. Subcutaneous implants
         3. Peripheral vessel cannulation (peripheral approach)
         4. Castration (scrotal or prescrotal approach)
         5. Oral surgery and tooth extractions not involving bone
         6. -Oscopies into natural openings that involve biopsy
         7. Small digit or tail amputation
         8. Surgical repair of superficial injury
   4. Major Recovery Surgery
      1. A surgical intervention that penetrates a body cavity (i.e. cranial, thoracic, abdominal, synovial, pelvic, ocular or orbital, skeletal, joint or bone marrow), involves extensive tissue dissection or transection, or has the potential for producing a substantial impairment of a physical or physiological function.
2. Examples of major survival surgeries include:
   1. Tendon/ligament repair or injury
   2. Ovariohysterectomy
   3. All --otomies (e.g., lararotomy, tracheotomy) and --ectomies
   4. -Oscopies that involve incision (e.g., laparascopy)
   5. Implantation of central devices
   6. Amputation
   7. Enucleation
   8. Eye surgery involving corneal incision
   9. Central cannulation (central approach)
   10. Musculoskeletal system repair, injury, or biopsy
   11. Extensive tissue dissection/transection (e.g., nerve or muscle cut-down)

3. Some surgeries may be classified as major or minor depending on various factors, so may be evaluated on a case-by-case basis.
   1. Factors that can influence the classification may include the duration of anesthesia, size and location of the incisions, amount of tissue dissection and characteristics of the animal to undergo surgery.

5. Non-Recovery Surgery
   1. A surgical intervention in which an animal is euthanized before recovery from anesthesia.

3. Procedures
   1. Documentation
      1. In order to assure that veterinary care is properly provided, anesthetic and post-surgical monitoring records are required for non-rodent mammals covered by the USDA.
      2. Records must be contained within the animal room or immediately adjacent to the animal room until sutures/wound clips are removed or the animal is euthanized.
         1. If skin incisions are closed with tissue adhesive or intradermal or subcuticular sutures, records must remain in the animal room or immediately adjacent for 7-10 days (provided incision is adequately healed).
      3. Records should include: full names of all drugs/substances administered during the procedure/surgery, dosage and frequency of administration, and frequency of monitoring by laboratory or veterinary personnel.
         1. If "as needed" analgesics are withheld, there must be documentation that the animal is not in pain or distress.
         2. Sample monitoring records are provided in Appendix A.
      4. Once the post-operative monitoring period is over, records must be copied and sent to the ULAM veterinary technician office for filing with the animal's permanent medical records in accordance with the Guidelines on Medical Records for Investigative Personnel.
   2. Preparation of the Procedure/Surgical Room
      1. For major recovery surgeries, a dedicated IACUC approved surgery room is required. This room will have separate area(s) for preparation of the patient and surgeon and a separate area for surgical recovery.
      2. For minor recovery surgeries, a IACUC approved procedure area is required, with separate prep and recovery areas strongly recommended.
      1. There must be a physical separation of activities during the minor recovery surgery (i.e., a dedicated procedure room that has no other simultaneous activities present).
      3. All major and minor procedure and surgical rooms should be kept clean and maintained in a manner to minimize traffic flow.
      4. It is imperative that the surgical room be at an appropriate level of hygiene before its use for major survival surgery.
   3. Preparation of Instruments, Devices, or Supplies for Aseptic Procedures/Surgeries
      1. All instruments or medical devices used in minor or major recovery surgeries must be sterilized either with steam sterilization, vaporized hydrogen peroxide, or ethylene oxide. Alternatively, some instruments can be purchased already sterilized, which may be by other methods (e.g. gamma irradiation).
      1. Vaporized hydrogen peroxide or ethylene oxide can be used to sterilize heat or pressure sensitive instruments, devices, or supplies.
      2. Appropriate sterilization indicators should be used with all methods of sterilization for validation. Appropriate testing and maintenance should be performed for all sterilization equipment.
      3. When performing multiple aseptic procedures or recovery surgeries in series, surgeons must begin with a fully sterilized pack of instruments for each surgical animal. Ideally, an extra pack should be available in case of unexpected contamination.
      4. Surgical Drapes:
         1. Sterile drapes may be used for wrapping the instrument packs and/or creating the sterile field about the incision site.
         2. Drapes can be cloth, paper, or 3M™ Steri-Drape™ Incise Drape or other suitable sterile material.
      3. Drapes and similar materials must be sterilized prior to use on the animal.
   4. Preparation of the Animal
      1. Fasting: See the species-specific anesthesia and analgesia guidelines and/or discuss with the faculty veterinarian for recommendations.
      2. Anesthesia
         1. Information regarding appropriate anesthetic choice and minimal monitoring requirements can be found:
            1. Anesthesia and Analgesia Drug Descriptions
            2. Anesthesia and Sedation Monitoring Guidelines
2. Several non-rodent mammal species specific anesthetic and analgesic guidelines are available and include more detailed information on anesthetic/analgesic doses as well as recommended routes of administration. These guidelines are located:
   1. Guidelines on Anesthesia and Analgesia in Dogs
   2. Guidelines on Anesthesia and Analgesia in Cats
   3. Guidelines on Anesthesia and Analgesia in Ferrets
   4. Guidelines on Anesthesia and Analgesia in Guinea Pigs
   5. Guidelines on Anesthesia and Analgesia in Hamsters
   6. Guidelines on Anesthesia and Analgesia in Nonhuman Primates
   7. Guidelines on Anesthesia and Analgesia in Rabbits
   8. Guidelines on Anesthesia and Analgesia in Ruminants
   9. Guidelines on Anesthesia and Analgesia in Swine

3. Hypothermia Prevention: An external heat source (such as a circulating water blanket or Bair-Hugger®) MUST be provided when the duration of anesthesia will be >10 minutes or for any procedure in which a body cavity will be exposed.
   1. More information on appropriate thermal supplementation and monitoring can be found in the Anesthesia and Sedation Monitoring Guidelines.

4. Sterile Ophthalmic Ointment (such as Puralube) MUST be applied to the eyes when animals are anesthetized for >5 minutes.

5. Vascular access: Animals undergoing anesthesia for periods longer than 30 minutes should have available vascular access by way of an IV catheter.
   1. Isotonic fluids (such as LRS or 0.9% NaCl) at a rate of 5-10 mL/kg/hour should be given if prolonged body cavity exposure or significant blood loss is expected.

6. Hair Removal: Remove hair from the surgical site with animal clippers, razor or a depilatory cream (Nair®)
   1. Surface area and contact time should be minimal when using a depilatory cream to prevent chemical irritation and increased risk of infection.
   2. Depilatory cream must be thoroughly rinsed off before disinfection of the skin.

7. Skin Disinfection at Surgical Site: Clean and disinfect the animal's skin using appropriate surgical preparation technique and a recommended skin disinfectant (chlorhexidine, iodine, etc.).
   1. Alternating circular (inside to outside) scrubs of disinfectant (chlorhexidine scrub, iodine scrub, etc) and rinse (warmed sterile saline, sterile water, or alcohol) should be performed for a minimum of three times after removal of visible dirt and debris.

8. Placement and Draping:
   1. Make sure the animal is appropriately secured on a covered surgery surface before covering with a sterile drape.
   2. Use of a cushion(s) on pressure points is recommended for larger species to decrease likelihood of associated neurological trauma.
   3. To position the animal, leg ties, positioning pads, sand bags, disposable foam cushions, etc may be used.

5. Personnel Preparation

   1. For Major Survival Surgeries:
      1. The surgeon must wear clean scrubs, shoe covers, mask, surgical cap or bonnet, sterile surgical gown, and sterile gloves.
      2. All jewelry must be removed from your hands, wrists and arms. Earrings that hang down loosely must be removed.
      3. While surgery is in progress, others present within the room must wear a dedicated outer covering, shoe covers, mask and surgical cap or bonnet. Gloves must be worn if touching the animal or the animal’s biological substances.

   2. For Minor Survival Surgeries:
      1. The surgeon must wear a mask, surgical cap or bonnet, sterile gloves, and a clean scrub top, clean disposable PPE gown, or clean lab jacket during the procedure.
      2. All jewelry must be removed from your hands, wrists and arms. Earrings that hang down loosely must be removed.

   3. Investigators and laboratory personnel working with pregnant ewes must wear an appropriate respirator in place of a surgical mask and sealed eye protection.
      1. For more information, please refer to Procedures to Reduce Human Exposure to Q Fever and the EHS website (http://ehs.umich.edu/wp-content/uploads/sites/37/2016/11/Protective_Clothing_for_Animal_Care_and_Use.pdf).

4. Investigators and laboratory personnel working with nonhuman primates must wear sealed eye protection and 2 layers of gloves. A respirator should be used for activities that create an aerosol risk.
   1. For more information, please refer to the EHS website (http://ehs.umich.edu/wp-content/uploads/sites/37/2016/11/Protective_Clothing_for_Animal_Care_and_Use.pdf).

5. If radiation will be used during the procedure, appropriate training and shielding must be utilized.
   1. For more information, please refer to the EHS website (https://ehs.umich.edu/research-clinical-safety/radiation).

6. Suture Materials & Wound Closure
3. Select sterile suture material (absorbable vs. non-absorbable; braided vs. monofilament) that is appropriate to the tissues, procedure and activity of the animal.

2. Surgery in which a body cavity is opened requires a two to three layer closure in which the body wall is closed separately from the skin.

7. Post-operative Monitoring and Care

1. Animals must be visibly observed and monitored continuously until removal of the endotracheal tube and then every 15 minutes during recovery until the animal is fully ambulatory.
   1. Required and recommended post-operative monitoring parameters can be found in the Anesthesia and Sedation Monitoring Guidelines.
   2. External thermal supplementation should be continued during the post-operative recovery period. More information regarding appropriate external devices can be found in the Anesthesia and Sedation Monitoring Guidelines.
   3. Detailed information for normal physiologic parameters can be found in the species specific anesthesia and analgesia guidelines.

2. 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 on the advice of a ULAM veterinarian.

3. The yellow acetate with Surgery Observation Sticker 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 and the incision is adequately healed.
   1. The date of surgery must be recorded on the sticker as well as the date for removal of wound clips, staples, or skin sutures.
   2. If the skin is sealed with glue, a yellow acetate with a Surgery Observation Sticker must be placed over the cage card with the date of surgery recorded and the date the yellow acetate will be removed. The acetate will need to be removed 7-10 days after surgery provided the incision is adequately healed.
   3. Wound clips, staples or skin sutures must be removed within 7-10 days (provided the skin incision is adequately healed) unless described otherwise in a IACUC approved protocol or as recommended by a ULAM veterinarian to necessitate incomplete wound healing.
   4. Adequate healing is described as apposed wound edges without signs of dehiscence, increased redness, discharge, odor or overt swelling.

5. 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 animals’ surgical documentation records.
   1. The full name of the drug/substance administered, dose administered, and route of administration must be listed on the post-operative records.
   2. As needed analgesic therapy - If the animal is not showing clinical signs of pain, this must be documented in the record during the post-monitoring period (e.g., “No clinical signs of pain observed, analgesics not administered.”)

8. Non-Survival Surgery

1. At a minimum the surgical site should be clipped, the surgeon should wear gloves, and the instruments and surrounding area should be clean and free of clutter.

2. For non-survival procedures of extended duration, attention to aseptic technique may be more important in order to ensure stability of the model and a successful outcome. The requirement to utilize forms of aseptic technique, surgical monitoring, and a IACUC approved surgery suite will be evaluated on a case-by-case basis by the ULAM veterinarian(s) and IACUC prior to approval.

4. Related Documents

1. University of Michigan Policy on Analgesia in Animals Undergoing Surgery
2. Guidelines on Medical Records for Investigative Personnel
3. Anesthesia and Sedation Monitoring Guidelines
4. Procedures to Reduce Human Exposure to Orf and Q Fever
5. Anesthesia and Analgesia Drug Descriptions
6. Anesthesia, Analgesia and Surgery
7. Macaque Monkey Bite, Scratch, Exposure Standard Operating Procedures
8. Guidelines on Anesthesia and Analgesia in Dogs
9. Guidelines on Anesthesia and Analgesia in Cats
10. Guidelines on Anesthesia and Analgesia in Ferrets
11. Guidelines on Anesthesia and Analgesia in Guinea Pigs
12. Guidelines on Anesthesia and Analgesia in Hamsters
13. Guidelines on Anesthesia and Analgesia in Nonhuman Primates
14. Guidelines on Anesthesia and Analgesia in Rabbits
15. Guidelines on Anesthesia and Analgesia in Ruminants
16. Guidelines on Anesthesia and Analgesia in Swine

5. Appendices

1. Appendix A: Non-Rodent Mammal Post Op Record
2. Appendix B: Intra-Operative Monitoring Form