

University of Notre Dame Institutional Animal Care and Use Committee
Aseptic Survival Rodent Surgery: Preoperative, Perioperative and Postoperative Care Policy

Purpose

This is a description of the expectations for all survival rodent surgeries and survival anesthetic events. Any exceptions to this policy must be scientifically justified and approved by the IACUC prior to implementation.

Introduction:

The success of many types of surgical procedures depends on the efficacy of the preoperative, perioperative and postoperative care provided to the animal. This policy will describe the considerations and parameters for successful outcomes for both the surgery and the animal. Although the description is for survival surgeries, anesthesia is a significant physiological event for an animal. This document recognizes that some animals are used in procedures which involve anesthesia but not surgery. It is imperative that that proper care and monitoring of the animal occur at all stages of the procedure and be documented to allow the possibility of retrospective evaluation of the processes.

Aseptic Surgery Expectations:

1. Surgeons will wear sterile surgical gloves, particulate filter masks, and clean buttoned lab coats. For orthopedic or thoracic surgeries, it is recommended that a sterile surgical gown and hair cover be worn.
2. Those surgeons utilizing sterile tip surgical technique should start with sterile gloves.
3. Steam sterilized surgical instruments are required for surgery. Batch surgeries require instruments be wiped clean of organic material using an alcohol soaked gauze and sterilized in a hot bead sterilizer between animals. Full day batch surgeries require a fresh set of autoclaved instruments for the morning and the afternoon surgeries.
4. Instruments with obvious rust are not to be used for survival surgeries.
5. The surgical table/counter is prepared by cleaning the surface with disinfectant and wiping with alcohol.
6. Sterile drapes are suggested when opening a body cavity.
7. Use of expired sutures, antiseptic solutions, fluids or anesthetic/analgesic drugs is not acceptable veterinary practice and does not constitute adequate veterinary care as required under Animal Welfare Act regulations. Expired products may not be used in survival procedures.
8. Surgical areas will have hair removed either by shaving or depilatory cream, the exceptions being reptiles, amphibians or surgeries of the eye, mouth and anus.
9. Surgical incision sites will be prepared using an appropriate antiseptic and an alcohol rinse to remove hair and surface debris. A final wipe with antiseptic solution will act as an antimicrobial barrier.

Maintaining Asepsis

1. Gloved hands should be held elevated above the waist and below the shoulders and should touch only the surgical incision and sterile objects, i.e. sterile instrument tray, sterile drape. Do not touch gloves to your skin or clothes.
2. Once gloved, do not touch or lean over a non-sterile area.
3. Always lift an instrument from a sterile pouch or sterile surface. Do not drag instruments over the pack/drape edges because they can become contaminated.
4. Do not allow surgical instruments to fall below the edge of table. If an instrument does fall, the instrument is considered non-sterile. It must be re-sterilized prior to use.
5. Sterile surfaces are to be kept dry. Moisture can lead to contamination of the surgical area.
6. Draping of the animal is necessary when viscera or instruments can come into contact with unprepared skin or fur.
7. When working alone, sterile gloves or wraps can be placed on equipment to avoid contamination of the surgeon's sterile gloves. Alternately the surgeon can change gloves.

Preoperative Preparation of the Animal:

1. Fasting of rodents is not necessary. They do not vomit thus do not have the risk of intra or postoperative vomiting as in other species. The reason for fasting should be considered carefully and weighted against

the perturbation of normal metabolic processes needed for homeostasis. For example, fasting will not empty the rodent stomach unless it is for more than 24 hour, but will seriously deplete glycogen reserves in the liver.

2. Minimize loss of body heat by avoiding wetting the whole animal while preparing the surgical site.
3. Shave a generous area around the surgical site to prevent contamination of the surgical field with fur. Avoid taking too much fur as that will reduce the animal's ability to regulate body temperature. Remove clipped hair.
4. Apply antiseptic solutions with a swab or sponge (wet but not dripping). Never use a squeeze bottle or spray to apply antiseptics to the animal to avoid over wetting leading to hypothermia. Apply antiseptic alternating with alcohol wipes in a standard circular pattern starting at the incision and working toward the outer edges of the shaved area. For surgeries exposing the thoracic or abdominal cavities the scrubs should be repeated three times.
5. General anesthetics eliminate the blink response in animals. An ophthalmic ointment should be placed in the eyes to prevent damage to the cornea from drying.
6. Apply a drape. Drapes are available in a variety of types from cloth, paper and self-adhesive plastic. See FLSC veterinary staff for guidance.

Surgical Technique

1. Never use the anesthetized animal's body as a table. Do not rest your hands or instruments on the chest or abdomen. External pressure interferes with respiration and blood circulation.
2. Handle tissues gently to minimize tissue damage and hemorrhage.
3. Blood should be removed from the surgical area by blotting not wiping. Wiping will traumatize tissues and cause renewed bleeding.
4. Minimize blood loss: good surgical technique will prevent hypovolemia. Should blood loss occur fluid replacement is necessary. Fluids are warmed prior to injection to prevent inducing hypothermia.
5. Select the right suture needle for the type of tissue. In general:
 - Tapered needles are used for internal soft tissues
 - Cutting needles are used for skinConsult with the FLSC Veterinary staff for additional information on needle selection.
6. Select the right suture material for the type of surgery and tissue. In general:
 - Absorbable suture is used internally unless permanent ligatures are required.
 - Non-Absorbable is used in the skin exceptions include stainless steel clips and suture in animals that may chew at the incision.
 - Tissue adhesives are acceptable for skin closure only. Adhesives must be designed for tissue use. Use sparingly in the subcutaneous space (one drop 3-5 mm apart) and push the skin margins together. Adhesive on the skin surface or fur will cause the animal to self-traumatize and can lead to incision dehiscence.
 - Monofilament suture is recommended for friable tissue and skin.
 - Braided suture can be used internally and for areas where additional strength is required.
 - Metal clips or staples may be used for skin closure.
 - Special metal ligature clamps can be used for ligation of blood vessels within a body cavity.Consult with the FLSC Veterinary staff for additional information on suture material selection.
7. Suture layers and patterns are dependent on the type and placement of the incision.
 - Use simple interrupted sutures in the body wall. Never use continuous patterns.
 - Use a continuous pattern in the subcutaneous tissue for closure of the abdominal cavity.
 - Use a simple interrupted pattern for the skin. This, like the body wall, is to ensure that if one suture fails the incision will hold.Consult with FLSC for additional information or to schedule training on suturing and suture patterns.
8. Avoid drawing the sutures too tight. Excessively tight sutures will result in decreased blood supply to the tissues leading to swelling, necrosis, and dehiscence of the incision. Sutures that are overtightened result in incisional pain that can lead the animal to chew at the incision.

Perioperative Care of the Animal

1. Place animals on an insulating substrate to preserve body heat and use external warming sources when needed but avoid overheating the animal. Hypothermia is an important cause of death in rodents in the perioperative and postoperative periods.
2. Monitor body temperature for those surgical procedures that are longer than 10 minutes. This is accomplished using rectal temperature probes or thermometers placed next to the animal on the heat source.
3. Monitor anesthetic depth using multiple parameters such as toe pinch response, palpebral reflex, respiratory rate, heart rate, jaw tone, and tail pinch. The depth of anesthesia and the level of analgesia must be adequate to prevent the animal from feeling any pain in response to a surgical stimulus. Before making an incision, squeeze a paw firmly, but without injuring it, to test the animal's perception or sensation of pain. If the animal withdraws its leg or if respiration rate increases, then the anesthesia is too light.
4. Monitor respiration during anesthesia as an assessment of cardiovascular function. Visual observation of breathing can be difficult in a completely draped animal unless transparent drapes are used. Careful positioning of the animal on the surgical field is required to maintain airway patency. Observe mucous membranes and the skin of the ears and tail for signs of hypoxia. In instances of hypoxia the skin will develop a bluish tint indicating lack of oxygenation. Supplemental oxygen should be provided after checking for other causes such as inadequate oxygen flow rates and compression of the chest or abdomen.
5. Extended surgeries may require additional anesthesia. Re-dose injectable anesthetics at one quarter to one half of the original dose. Inhalation anesthesia concentration can be controlled and is recommended.
6. Preemptive analgesia is recommended as pain prevention strategy and as an adjunct to general anesthesia. The preemptive analgesia includes local analgesics topically at the incision line, nerve blocks, and infiltration at the surgical site.

Species	Mouse	Rat	Gerbil	Hamster
temperature °F	98.9- 99.3	96.6 – 99.5	98.6 – 102.2	98.6 – 100.4
temperature °C	37.0 – 37.2	35.9 – 37.5	37.0 – 39.0	37.0 – 38.0
breaths/minute	80 – 220	70 – 140	85 – 140	40 – 110
total blood volume	1.5 – 2.4 ml	15 – 20 ml	3.8 – 6.0 ml	6.3 – 11.2 ml
shock risk volume 20% blood loss	0.3 ml	3.0 ml	0.76 ml	1.26 ml

Postoperative Care of the Animal

1. Postoperative analgesic is required unless scientifically justified and approved by the IACUC.
2. A supplemental heat source should be provided during the recovery period. Supplemental heat may be supplied by placing a clean cage on an electric heating pad on the low temperature setting. Be sure the heat source is on only one side of the cage to allow the animal to escape the heat if they wish. Circulating water type blankets are a good heat source since the temperature can be regulated with a thermostat. In addition increasing the room air temperature or providing the animal with a blanket or abundant bedding to conserve endogenous heat is useful. A heat lamp may be used. The bulb should be at a distance of 12 -18 inches (30 -45 cm) from the animal based on thermometer readings. Heat lamp use requires a thermometer placed at the level of the animal permitting evaluation of the temperature. Temperature should be maintained as close to normal body temperature as possible.
3. Supplemental fluids (usually administered IP or SQ in rodents) should be given to account for lack of fluid intake during anesthesia and loss of fluid by evaporation. Sterile physiologic saline, 2.5% dextrose or lactated Ringer's solution are typically used fluids. Volumes to be used would typically be 0.5 ml/2 hours IP for a mouse or 1.0 ml maximum divided in 0.3 ml per site SC for a mouse and 1.5 ml/2 hours IP or 6.0 ml maximum divided in 2.0 ml per site for a rat. Fluids should be heated to approximately body temperature prior to administration. (See the IACUC Fluid Administration Guidelines)

4. Animals should be monitored until full recovery. In the immediate recovery period, animals should be monitored at least every 10 - 15 minutes for respiratory depth and character, state of arousal, and vascular perfusion (as indicated by color of tongue, tail, nail beds or eyes in the case of albinos). Recovery is indicated by ambulation, normal posture, grooming and accessing food or water. Animals are recovered in a cage separate from cage mates that have not undergone surgery concurrently. Once the animal has regained normal mobility, it may be returned to the regular housing location in FLSC. The animal should then be checked daily by the investigator or his/her staff to assure normal behavior, appetite, apposition of suture lines, and mobility. Significant decreases in body weight beginning two days after surgery may also indicate clinical illness. Any problems should be reported to the FLSC veterinary staff.
5. Suture lines should be closely examined for signs of infection. A small amount of clear, serous drainage may be normal from a suture line, however thick drainage may indicate infection. Likewise, separation of the line or excessive reddening around the edges could suggest infection. Treatment with antibiotics might be appropriate in such cases, and the FLSC veterinary staff should be contacted if infection is suspected.
6. Skin closures are removed 7 – 10 days postoperatively. If an incision is not healed sufficiently in 10 days to allow removal of skin closures, a Veterinary Report of Illness must be generated unless the IACUC protocol specifically permits an exception to the policy.

Record-Keeping Requirements

1. Surgical record keeping for rodents is a regulatory requirement for AAALAC accreditation. These records should be available to visitors from regulatory and accrediting agencies and the IACUC during the semi-annual inspection.
2. The records will indicate the surgeon, dates, IACUC protocol number, note normal recovery or any problems and steps taken to correct problems.
3. Records should include monitoring and supplemental support that is provided to animals.
4. A form may be useful, although notes within a lab book are also acceptable.
5. Records are most useful for individual animals; however rodent records may describe the care provided for each group undergoing the procedure on individual days.

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