

RESEARCH AND TEACHING SURGERY GUIDELINES FOR MSU-OWNED ANIMALS

I. Purpose/Scope

These guidelines apply to all surgical procedures performed on animals at Mississippi State University in which the animals are expected to recover from anesthesia. Prior to performing any survival surgery techniques on animals, an approved Animal Use Protocol must be in place with appropriately trained personnel and procedures available. Specific procedures to accomplish these guidelines can be obtained from the attending veterinarian.

II. Sources

Guide for the Care and Use of Laboratory Animals (1996)
Animal Welfare Regulations (2002)

III. Definitions

- A. Survival surgery – a surgical procedure from which the animal regains consciousness after anesthesia. Also known as chronic surgery.
- B. Nonsurvival surgery – a surgical procedure after which the animal is euthanized before it regains consciousness. Also known as terminal or acute surgery.
- C. Aseptic surgical procedures – surgery performed using procedures that limit microbial contamination so that significant infection or suppuration does not occur. Aseptic techniques include
 1. Clipping (#40 blade) and a surgical scrub of the field
 2. Requires the surgeon(s) to wash hands and to wear sterile surgical gloves, gown, shoecovers, cap, and face mask (other persons in the dedicated surgical suite must wear scrubs, cap, and mask)
 3. Requires separate sterile instrument pack or group of instruments for each animal surgery, except in some multiple rodent surgeries.
- D. Aseptic rodent surgery – surgical procedures in which requirements are less stringent than those of other mammals; however, requirements do include:
 1. Appropriate preparation of the surgical site
 2. The use of sterile instruments and supplies
 3. Wound closure materials and gloves
 4. Wearing a surgical mask and cap is recommended, but not mandated.
 5. Surgical procedures may be performed on multiple animals during a single session using one sterile surgical pack, provided care is taken to avoid contamination. When working with multiple animals in a single session, a “hands-off” approach is helpful with only the “working” ends of the instruments (not the gloved finger) contacting the animal’s tissues.
- E. Major surgery – any surgical procedure that penetrates and exposes a body cavity; has the potential for producing permanent physical or

physiological impairment; and/or any procedure associated with orthopedics or extensive tissue dissection or transaction. Examples include: laparotomy, endoscopy, thoracotomy, craniotomy, joint replacement, and limb amputation. Although technically considered minor procedures, the implantation of chronic catheters (e.g., jugular, anterior vena cava) and joint injections may present potentially severe post surgical complications and may be considered major procedures. The IACUC requires that these procedures be performed following rigorous aseptic technique.

- F. Minor surgery – any surgical procedure that neither penetrates and exposes a body cavity nor produces permanent impairment of physical or physiologic function. Examples include: wound suturing, short-term catheterization of a peripheral blood vessel, implantation of subcutaneous pellets or osmotic pumps, superficial vascular cut down, and percutaneous biopsy.
- G. Multiple major survival surgery – two or more major survival surgical procedures performed on a single animal, when both surgeries are experimental procedures. This can be permitted by the IACUC under special circumstances, such as when surgeries are essential and related components of a single study. Major survival surgery followed by a major terminal surgical procedure is not counted as multiple major survival surgery. Cost alone is not an adequate reason for performing multiple survival surgeries on a single animal.
- H. Distress – an aversive state in which an animal cannot adapt completely to stressors and therefore the animal shows maladaptive behaviors.
- I. Pain – an unpleasant sensory and emotional experience associated with potential or actual tissue damage, or described in those terms. Pain is a subjective analysis of CNS activity.
- J. Sterilization – the process whereby all viable microorganisms are eliminated or destroyed. The criterion of sterilization is the failure of organisms to grow if a growth supporting medium is supplied.
- K. Disinfection – the chemical or physical process that involves the destruction of pathogenic organisms. All disinfectants are effective against vegetative forms of organisms, but not necessarily spores.

IV. Policy

- A. General – the following principles described in the Guide for the Care and Use of Laboratory Animals apply to animal surgery:
 - 1. Appropriate pre-operative and post-operative care of animals in accordance with established veterinary medical and nursing practices are required.
 - 2. Surgical principles
 - a. Clean and disinfect all surfaces and equipment in the dedicated surgical suite or surgical area.
 - b. Ensure that all required materials are ready and at hand.
 - c. Minimize traffic flow in the surgical suite/area.
 - d. Sterilize all instruments, gauze, drapes, etc. prior to surgery.

B. Surgical Facilities

1. Major survival surgeries on mammals (other than rodents and agricultural animals used for agricultural purposes) must be conducted in properly designed surgical facilities. Generally, a three-room suite that allows physical separation of animal preparation, surgeon preparation, and the operating room is required. The layout of such rooms must allow the fully gowned surgeon to enter the operating room without becoming contaminated.
2. Aseptic rodent surgery does not require a dedicated surgical suite but instead requires a clean, uncluttered area of a laboratory that can be disinfected and must not be used for other activities during the surgery.
3. All survival surgery will be performed by using aseptic procedures, including masks, sterile gloves, sterile instruments, and aseptic techniques.
4. The Guide states that it is important for research personnel to be appropriately qualified and trained in all procedures to ensure that good surgical technique is practiced. This includes:
 - a. Asepsis
 - b. Gentle tissue handling
 - c. Minimal dissection of tissue
 - d. Appropriate use of instruments
 - e. Effective hemostasis
 - f. Correct use of suture materials and patterns

C. Recordkeeping

1. Individually written records are required for all invasive procedures, anesthetic and analgesic use, and postoperative care. These records must be maintained for 3 years and must be readily available for review by veterinarians and inspectors, if requested. Records should include the animal's ID, the name of the surgeon, anesthetist, person providing postoperative care, date and time of procedure, the procedure performed, physiologic data, and drugs administered. A written description of times examined and postoperative recovery and treatment aspects are also required.
2. Records for rodent surgeries do not need to be individualized; however, they should include a general description of the procedures, dates, drugs, the total number of animals used, and a record of postoperative observations.

D. Animal Acclimation and Stabilization before Surgery

1. Animals should be allowed to stabilize in weight, temperature, eating behavior, and physical state before chronic, survival surgery.
 - a. Rodents, rabbits, and amphibians: at least 72 hours after arrival.
 - b. Cats and dogs: at least one week after arrival. This may not always occur with humane society animals for MDL surgery labs, but must occur before USDA animal use.
 - c. Swine and ruminants: at least 2 weeks after arrival.

d. Preoperative drug use (e.g., analgesics) must be considered.

E. Animal Handling and Restraint

1. Proper handling and restraint will prevent injury and minimize stress to animals and personnel. Investigators must ensure that all personnel handling animals are trained properly. Laboratory Animal Resources offers periodic training sessions for technical and research personnel.

F. Preoperative Care

1. Perform a complete veterinary preoperative evaluation (physical exam, bloodwork, etc.).
2. Some animal species should be fasted overnight before administration of a general anesthetic to prevent problems associated with a distended intestinal tract, such as vomiting, bloat, and regurgitation. These species include dogs, cats, ruminants, and swine. For rodents, a much shorter or no fast should be imposed. A period of water deprivation may be indicated before some surgeries and in some species, such as ruminants.
3. Preemptive analgesics are administered unless analgesics cannot be used for valid, IACUC-approved, scientific reasons.
4. Once the animal is anesthetized, ophthalmic ointment should be applied to both eyes to prevent corneal desiccation.
5. Prepare the animal by removing hair from the surgical site. An area twice the size of the expected surgical field should be shaved with electric clippers. Remove all loose hair and debris from the animal.
6. The surgical area should be cleaned with gauze and a disinfectant scrub (e.g., povidone iodine or chlorhexidine) to remove the majority of debris from the surgical site.
7. In the case of non-rodent surgery, a final aseptic skin preparation must be performed once the animal is in the dedicated surgical suite.

G. Intraoperative Care

1. Aseptic conditions must be maintained during all survival procedures.
2. The animal must be maintained in a surgical plane of anesthesia throughout the procedure. Anesthetics reduce the ability of animals to maintain adequate body temperature. An external heat source must be provided during anesthesia by means of a circulating water pad or carefully used heating lamp. Additional intraoperative analgesia must be considered.
3. When moderate to extensive blood loss is anticipated or the animal is anesthetized for longer than 30 minutes, the animal should be administered fluids such as saline or lactated Ringer's solution. Fluids are administered generally subcutaneously to rodents or by intravenous drip to larger animals immediately before or during the procedure.
4. Adequate patient monitoring during anesthesia and surgery is fundamental to a successful outcome.

- a. Parameters should be documented at least every 15 minutes.
 - b. Rodents: rodents should be monitored continuously for respiratory function (rate and pattern), pulse rate, body temperature, color of mucous membranes and paws (pink is normal), and reflex response to the toe-pinch and palpebral stimulation. Other parameters such as oxygen saturation by pulse oximetry and electrical activity of the heart by electrocardiogram (EKG) may be helpful in preventing poor perfusion.
 - c. Non-rodent mammals: In addition to the above, chest auscultation, end-tidal CO₂ concentration, capillary refill time, jaw tone, and arterial blood pressure may be monitored.
5. Use efficient surgical planning to decrease surgical time, tissue contamination, and tissue damage. Handle tissues gently. Use a scalpel blade or scissors to make the smallest possible incisions.

H. Postoperative Care

1. The postoperative period can be divided arbitrarily into 4 stages:
 - a. Early Anesthetic Recovery Period:
 - 1) Observe the animal continuously and monitor temperature, heart rate, and respiratory rate at least every 15 minutes until the animal can maintain a patent airway and sternal recumbency, and temperature is 99 degrees F.
 - 2) Animal is unconscious or semi-conscious, unable to sit or maintain sternal recumbency.
 - 3) Once the swallowing reflex has returned, the endotracheal tube cuff is deflated and gently removed (extubation).
 - 4) Adequate body temperature is maintained.
 - 5) Additional fluids are administered, if indicated.
 - 6) Analgesics are used unless use is clearly not justified. The term "analgesics as needed" must be addressed with more specific signs or terms.
 - b. Late Anesthetic Recovery Period
 - 1) Animal is conscious, can right itself or sit, but cannot stand.
 - 2) When the animal resists handling, or becomes aroused when handled, it can return to its cage. Rodents should be placed in a clean, unoccupied cage free of bedding (to prevent aspiration pneumonia).
 - 3) Animals are observed several times throughout the day
 - 4) Attitude and degree of activity are noted.
 - 5) Pain level is monitored. Analgesics are continued with any behavioral or physiologic indication of pain or distress.

- c. Acute Postoperative Period
 - 1) Animal can stand and move about; not yet eating and drinking normally. This is normal for the first 1-2 days post-procedure.
 - 2) Attitude and level of activity, food and water consumption, and elimination, body temperature, condition of the operative site are monitored.
 - 3) Analgesic use continues, unless indicated otherwise.
 - d. Chronic Postoperative Period
 - 1) Animal is active, alert, eating and drinking normally, with skin sutures in place.
 - 2) Continue to examine daily as above and administer prescribed medications.
 - 3) Remove skin sutures at 10-14 days after surgery.
 - 4) Change any bandage/dressing as indicated.
 - 5) Maintain vascular catheters daily. Record body weights at least weekly until full recovery, and observe for any abnormal behaviors.
2. Unless otherwise approved in the protocol, animals undergoing surgery for chronic research protocols should be allowed to stabilize for at least 48-72 hours postoperatively before experimental data is collected.