



PURPOSE: This document details the minimum standards for recovery (survival) surgery in all laboratory rodent species.

RESPONSIBILITY: Prior to undertaking ANY surgical procedure, it is the responsibility of the principal investigator to ensure that staff carrying out those procedures are adequately trained and that provisions are made for post-operative care.

All surgery must be performed by qualified trained individuals having completed the requisite courses that apply to surgery. The following is the University Animal Care Committee (UACC) Policy for rodent surgery.

PROCEDURES:

1. Surgical areas will be dedicated to that use only while surgeries are being performed. Areas will be kept neat and orderly and all contamination including bedding, feces, blood, etc. will be cleaned prior to and after each surgery.
2. All species undergoing surgery should receive a similar level of care and attention. Recovery surgery in all species of animals should be performed using aseptic technique.
3. All surgeries will be conducted with clean, sterilized (autoclaved, gas or chemically sterilized) instruments and equipment following standard aseptic surgical technique. Note that alcohol is not considered a chemical sterilant, but only a disinfectant. Only chemical sterilants are considered acceptable based on the manufacturer instructions for sterilization. The use of a hot glass bead sterilizer for sterile tip surgery is acceptable to sterilize instruments between no more than 6 animals (per day) at which time instruments must be reautoclaved. Instruments must be washed between each use of the hot bead sterilizer.
4. The surgeon will wear at minimum a closed, clean lab coat or scrub top, sterile surgical gloves over scrubbed hands, head cover, surgical face mask or respirator during surgery unless the surgery takes place in a certified laminar flow hood.
5. The animal will be fully anesthetized and will exhibit no toe pinch reflex prior to and throughout the duration of the surgical procedure. Animals will be monitored and attended to throughout the duration of surgery and anesthetic recovery.
6. The surgical site(s) will be prepared by removing hair appropriate to the size of the surgical site and the area being prepared with a triple scrub of Betadine Scrub or Chlorhexidine Scrub followed by Alcohol or sterile saline.

7. Animals undergoing recovery surgery will be administered suitable analgesic agents as per the approved Animal Use Protocol.
8. Rodents will be recovered from surgery in a quiet area away from the surgical area and they will be continually monitored as needed until fully recovered.
9. Animals will be appropriately monitored during recovery and not mixed with conscious animals. Animals should receive supplemental heat, and adjunct nursing care including wound care. Many will also require fluids and analgesics. Gross contamination by blood, bedding, prep solutions, etc. will be cleaned as needed from wounds.
10. Animals with abnormal wound healing/closure or morbidity following surgery beyond the morbidity or mortality estimated in the Animal Use Protocol require consultation with the University Veterinarian and/or Clinical Veterinarian. The veterinarian will in consultation with the Principal Investigator decide the best course of action for the animal and these actions are the responsibility of the research staff.
11. A written record of the surgical details and condition of the animals following surgery will be maintained in the unit and be readily accessible throughout the post operative recovery period.

Approved by the UACC, 21 October 2009

Please see the attached pages for background information on these policy requirements.

POLICY: Surgical areas will be dedicated to that use only while surgeries are being performed. Areas will be kept neat and orderly and all contamination including bedding, feces, blood, etc. will be cleaned prior to and after each surgery.

The Canadian Council on Animal Care (CCAC) recommends that all survival surgery be performed in areas specifically designed for the purpose. A rodent surgical area can be a room or part of a room that is easily sanitized and not used for other activities when rodent surgery is in progress. This area should not be a high traffic area or immediately next to room ventilation.

POLICY: All species undergoing surgery should receive a similar level of care and attention. Recovery surgery in all species of animals should be performed using aseptic technique. ([Guide to the Care and Use of Experimental Animals Vol. 1 2nd edition, Canadian Council on Animal Care](#)).

The primary objective of aseptic surgical technique is to reduce microbial contamination of the incision and exposed tissues to the lowest possible practical level. The argument is still made that aseptic technique is not necessary for rodent surgery because mice or rats often survive surgical procedures performed using less than aseptic technique. However, survival alone is not a valid criterion for judgment of the acceptability of a rodent surgical technique. The criterion for acceptability should be the absence of untoward, unplanned alteration of physiological functions or behavior due to peri-operative infection.

POLICY: The surgeon will wear at minimum a closed, clean lab coat or scrub top, sterile surgical gloves over scrubbed hands, head cover, surgical face mask or respirator during surgery unless the surgery takes place in a certified laminar flow hood.

Scrubbing hands prior to putting on sterile gloves is required. There are several acceptable methods but the key components are to use an antiseptic soap and to scrub all surfaces of the fingers, hands, wrists and arms up to the elbows. Rodent survival surgery requires a cap, mask, and sterile gloves, but a clean scrub top or lab coat may be substituted for a sterile gown. A surgical mask may not be required if using a properly functional positive pressure laminar flow hood

POLICY: All surgeries will be conducted with clean, sterilized (autoclaved, gas or chemically sterilized) instruments and equipment following standard aseptic surgical technique. If chemical sterilization is used the manufacturer's instructions for proper use of the sterilant must be strictly followed, particularly with respect to immersion time. Chemical sterilants must be removed from instruments with the use of sterile saline prior to be used on an animal. The use of a hot glass bead sterilizer for sterile tip surgery is acceptable to sterilize instruments between no more than 6 animals (per day) at which time instruments must be reautoclaved. Instruments must be washed between each use of the hot bead sterilizer.

Sterilization kills or renders inactive all microbial organisms. The common methods used are steam heat or ethylene oxide gas. Any item used for survival surgery must be sterilized: instruments; materials and devices such as catheters, flow probes, or electrodes; and all fluids used for flushing or injection. Special care is needed to ensure that multi-dose vials of drugs are not contaminated. If sterile-tip surgery is performed, all instruments must first be autoclaved and instruments which are cleaned of contamination and placed into a hot-bead sterilizer may be used on up to 6 rodents before they are required to be reautoclaved, provided that all surgeries are performed in one day. If multiple surgeries are performed over the course of two or more days, instruments must be autoclaved at the end of each day. Autoclaves should be appropriately maintained and tested for efficacy. The surgical site should be draped to isolate the surgical field from the surrounding areas. Drapes are positioned and fixed and should not be dragged across unsterile areas onto the surgical field. Even with rodents and other small animals, the surgical incision site should be draped.

Surgical procedures may be performed on multiple rodents during a single session using one sterile surgical pack, providing care is taken to minimize contamination and re-sterilization of the instrument tips between animals (as long as you do not touch the tips, your 'sterile' gloves may be used for multiple animals). The methods to accomplish this include:

- Heat the instrument tips in a glass bead sterilizer (approximately 15 seconds) and then cool the instrument tip using sterile saline or immersion in Cidex: Soak for a minimum of five minutes in between uses.
- Alcohol doesn't sterilize instruments.
- "Flaming" with alcohol does, although it increases the risk of fire.

Surgical Techniques: Proper surgical technique is important to prevent wound infection, promote wound healing, and ensure likelihood of a satisfactory outcome to the surgical procedure. Good surgical technique includes:

1. asepsis
2. gentle tissue handling
3. effective hemostasis
4. maintenance of sufficient blood supply to tissues
5. proper use of surgical instruments accurate tissue apposition
6. appropriate use of monitoring equipment
7. support of vital organ functions
8. expeditious performance of the surgical procedure

Aseptic technique is required at all times and all team members are responsible for monitoring for breaks in aseptic technique. "Asepsis is a chain which is only as strong as its weakest link." Potential sources of contamination include the team members, the patient, all articles used in the procedure, the surgical room or area, and other personnel entering the surgical area.

BASIC ASEPTIC PRINCIPLES

1. All articles must be sterilized before use in procedure.

2. If in doubt about sterility of item or person, assume it is not sterile.
3. All persons who touch sterile articles must be sterile.
4. Non-sterile persons never reach across a sterile field.
5. Draped tables are sterile only above the table level.
6. Moisture causes contamination.

Gentle handling of tissues will help minimize post-surgical pain. Tissues should not be cut or separated without reason and tissue dissection is usually done along fascial planes. Exposed tissue must be protected from drying or contamination. Effective hemostasis and maintenance of blood supply allows visualization of the surgical field while preserving the total blood volume. Hemostasis is achieved by ligation, pressure, electrocoagulation and avoiding damage to major vessels. Only the vessel to be occluded should be incorporated in a ligature or clip. In using electrocoagulation, a high frequency current is applied to a small area of tissue (the bleeding vessel) and electric energy is converted to heat, resulting in coagulation of tissue and sealing of the vessel. To avoid excessive tissue damage, only the vessel to be occluded is in contact with the electrode. Electrocoagulation can be used for minor hemorrhage; large vessels should be ligated. Proper use of surgical instruments minimizes trauma. For example, vascular forceps are used to occlude blood vessels when flow is to be reestablished; hemostatic forceps, which crush, are applied to vessels through which blood will no longer flow.

Accurate tissue apposition enhances healing and promotes rapid return to normal function. Retraction and dissection of tissue can produce pockets known as dead space. Dead space can delay healing and serve as a site for bacterial growth and fluid accumulation. As tissues are returned to their normal positions, dead space needs to be obliterated by careful suture placement to appose tissue and/or placement of drains to prevent fluid accumulation.

As a procedure is concluded, tissues are replaced to their normal anatomic positions. Most tissues should be apposed with minimal amount of tension and sutures must not devitalize the tissue in which they are placed. Type of suture material and pattern to be used will be dictated by the tissue involved and forces applied to those tissues. Behavior of animals also might influence the choices; some animals are more prone to chew or remove certain types of suture materials or devices such as surgical staples. Most animals will be fully mobile within 1 hour after a surgical procedure and the incision line must be able to withstand the twisting, bending and stretching, which will occur!

POLICY: The animal will be fully anesthetized and will exhibit no toe pinch reflex prior to and throughout the duration of the surgical procedure. Animals will be monitored and attended to throughout the duration of surgery and anesthetic recovery.

Intra-operative patient support and monitoring: Accepted medical and veterinary surgical practice requires assessment of the physiologic status of the animal on a regular basis. Vital time for resuscitation can be lost by failure to notice life-threatening physiologic or metabolic problems.

The degree of monitoring sophistication depends on the species, the extent and duration of the surgical procedure, and whether it is a survival or terminal procedure. Monitoring can be qualitative, using the anesthetist's sense of touch, sight and hearing to evaluate the patient; and/or quantitative, using instruments for periodic measurement of specific vital organ performance.

The anesthetic record provides a detailed account of the course of anesthesia and intra-operative events. It is important to record data from the pre-operative period, the induction period, the anesthetic/surgical period and the immediate post-operative period. Later measurements may be written on the individual animal's monitoring sheet.

Expeditious performance of the surgical procedure implies that the surgical team will have sufficient training and competence to perform the surgical procedure in the least required amount of time. A rapid response to unplanned or emergency situations is the result of good organization and coordination of team members.

Only in-date anesthetics and analgesics must be used. If volatile (inhaled) anesthetics are being used, an appropriate scavenging system must also be in place.

POLICY: The surgical site(s) will be prepared with hair being removed appropriate to the size of the surgical site and the area being prepared with a triple scrub of Betadine Scrub or Chlorhexidine Scrub and Alcohol or sterile saline.

Immediately prior to surgery, the surgeon and assistants should wash their hands. It is advisable to wear clean, non-sterile gloves at all times the animal is being handled. Ideally, in a preparation area physically separate from the location where the surgery will be performed, the animal should be anesthetized and prepped. Hair over the surgical site and surrounding area should be removed and the loose hair removed. Hair removal should be done carefully to avoid causing small skin abrasions. Hair should be removed over a liberal area to anticipate any surgical emergency and minimize wound contamination from adjacent areas. After removing the hair, the skin should be washed with an antiseptic surgical scrub, containing soap, to remove remaining hair and dirt. The surgical area is cleansed two more times with antiseptic scrub and the scrub solution rinsed away with alcohol. A final antiseptic solution (devoid of soap) may be sprayed or swabbed along the proposed incision and is not rinsed. The site should be covered with clean gauze sponges or cotton, saturated with the antiseptic solution devoid of soap, if the animal is transported a long distance to the operating area. Care should be taken to avoid soaking the animal in disinfectant, as wetting the hair and skin can result in hypothermia. For very small animals such as mice, a small cotton applicator should be used rather than large gauze sponges.

POLICY: All animals undergoing recovery surgery will be administered suitable analgesic agents as per the Animal Use Protocol.

Where protocols include the use of narcotic or other analgesics, it is the responsibility of the Principal Investigator to ensure that analgesics are used and that the records are maintained in the laboratory for perusal by the UACC or University and/or Clinical Veterinarian. Analgesics should be administered pre-operatively **or** peri-operatively to achieve maximally effective pain relief in the post-operative period.

Where the use of controlled drugs is required, it is the responsibility of the Principal Investigator to maintain proper control and administrative record keeping by recording the date, time, animal identification, dose, resulting balance, and a signature of the individual administering the dose. Controlled drugs must be kept in a locked storage drawer, cabinet, or safe.

POLICY: Rodents will be recovered from surgery in a quiet area away from the surgical area and they will be continually monitored as needed until fully recovered.

The postoperative period consists of 3 overlapping phases: anesthetic recovery, acute and long-term postoperative care. Adequate postoperative care enhances the animal's recovery by improving its physiologic status and minimizing pain and distress. Recovery from anesthesia is the critical time because it is a period of physiologic disturbance during which crises can arise. Frequent observation and monitoring is required. Body temperature needs to be maintained. Heat lamps or supplemental heat are often used. Animals should be individually caged during this time period. Rodents should not be returned to group cages until each and every individual in the cage has regained normal mobility. In addition to intraoperative analgesia it may be necessary in some cases to provide postoperative analgesia. Acute postoperative care includes the time the animal is maintained in the recovery area until it is ready to be moved to standard housing. Analgesics, antibiotics and additional fluids might be needed during this time period. Rodents should be returned to clean cages with fresh bedding to prevent fecal contamination of the fresh surgical incision. Rodents who are still anesthetized should be protected from breathing in small particles of bedding by placing them on a clean cloth substrate such as a paper towel or surgical towel. If there is danger of injury from other animals, animals should be individually housed.

Long-term postoperative care requires careful observation of body temperature, food intake, locomotion, behavior, and signs indicating pain. Research staff must examine the surgical site daily, monitor for signs of infection, and remove sutures or other devices at the correct time (generally 7-10 days). The surgical site should be observed for signs of infection, incision breakdown (dehiscence), or self-inflicted trauma. At least once a day, catheters should be examined and may need to be cleaned and flushed. Monitoring food and water intake through the evaluation of body weight is important for successful recovery. Oral or parenteral supplementation may be necessary to maintain normal hydration and anabolic state. Special diets and/or water supplements may be indicated during the recovery period. The quantity and character of urine and feces should be monitored, because changes could indicate complications such as paralytic ileus, acute renal failure, or intestinal hypermotility caused by irritation.

POLICY: Animals will be appropriately monitored during recovery and not mixed with conscious animals. Animals should receive supplemental heat, fluids, analgesics, and adjunct nursing care including wound care. Gross contamination by blood, bedding, prep solutions, etc. will be cleaned as needed from wounds.

When animals are placed directly on metal surgery tables, body heat is lost, therefore insulating materials or warming devices should be placed between the table and the animal. Circulating warm water heating pads or warm water bottles should be used, since electric heating pads are likely to burn. When heat lamps are used, avoid placing the animal in the direct beam. If possible, reflect the heat lamp off of a metal surface and place the animal in the reflected beam. Hypothermia is the most common cause of post-surgical mortality. Prevent heat loss during surgery by placing an insulating material underneath the animal (to minimize heat loss by conduction). Post-operative care should include an external heat source while the rodents recover from anesthesia.

Fluids should be provided to replace losses from respiration, blood loss, increased urination, etc. A rodent undergoing major surgery may need continued fluid support if they are not consuming appropriate amounts of fluid. Supplemental fluid sources, such as Transgel[®], should be provided to animals that cannot or will not reach their water source.

There is **no** requirement for post operative antibiotics, if proper aseptic technique is followed.

POLICY: Animals with abnormal wound healing/closure or morbidity following surgery require an inspection by the University Veterinarian and/or Clinical Veterinarian. The veterinarian in consultation with the Principal Investigator will decide the best course of action for the animal and these actions are the responsibility of the research staff.

POLICY: A written record of the surgical details and condition of the animals following surgery will be maintained in the unit and be readily accessible throughout the post operative recovery period.

Animals must be observed to monitor their recovery, and the observations should be recorded at least every 15 minutes. It is recommended to use a surgical log to document these observations.