Guidelines for Survival Rodent Surgery

These guidelines apply to all surgical procedures performed on rodents at Brooklyn College-CUNY in which the animals are expected to recover from anesthesia. Prior to performing any survival surgery techniques on rodents, an approved Animal Study Proposal must be in place with appropriately trained personnel and procedures available. Specific procedures to accomplish these guidelines can be obtained from your veterinarian.

According to the Guide for the Care and Use of Laboratory Animals (the 'Guide'), rodent surgery:

- Should include appropriate pre-operative and post-operative care of animals in accordance with established veterinary medical and nursing practices are required.
- Take place in a dedicated surgical facility is not required.
- All survival surgery will be performed by using aseptic procedures, including masks, sterile gloves, sterile instruments, and aseptic techniques.

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. **These techniques include asepsis, gentle tissue handling, minimal dissection of tissue, appropriate use of instruments, effective hemostasis, and correct use of suture materials and patterns.**

Procedures:

Personal Protective Equipment:

1. Clean lab coat or apron
2. Mask[1]
3. Surgical gloves[2]
4. Head cover.

Pre-Operative:

1. Surgery should be conducted in a dedicated area that is disinfected, and uncluttered to help promote asepsis during surgery (see Appendix, Table 1).
2. Prepare the animal by removing hair from the surgical site. Perform this procedure in an area separate from where the surgery is to be conducted.
3. Prepare the surgical site(s) with an appropriate skin disinfectant (see Appendix, Table 2).
4. Surgeons should wash and dry their hands before aseptically donning sterile surgical gloves.

Operative:

1. The animal must be maintained in a surgical plane of anesthesia throughout the procedure.
2. Begin surgery with sterile instruments and handle instruments aseptically (see Appendix, Table 3).
3. When using "tips-only" technique, the sterility of the instrument tips must be maintained throughout the procedure.
4. Instruments and gloves may be used for a series of similar surgeries provided they are maintained clean and disinfected between animals (see Appendix, Table 4).
5. Monitor and/or maintain the animal's vital signs.
6. Close surgical wounds using appropriate techniques and materials (see Appendix, Table 5).

Post-Operative:

[1] Because of the necessity of mouth pipetting, masks are not worn during embryo transfer surgeries.
[2] When using "tips-only" aseptic techniques, exam gloves may be used.

1. Move the animal to a warm, dry area and monitor it during recovery. Return the animal to its routine housing only after it has fully recovered from anesthesia.
2. Provide analgesics as appropriate and approved in your Animal Study Proposal.
3. Generally, remove skin closures 10 to 14 days post-operatively.
4. Maintain a surgical record (e.g., annotate cage card with procedure and date). Investigators are required to complete and maintain the **Surgical Procedure Record** found in **Appendix II** and can be downloaded on from the IACUC website.

References:

1. American College of Laboratory Animal Medicine Position on Rodent Surgery. [http://www.aclam.org/pub_rodent_surgery.html]

2. Animal Welfare, 9 CFR, Parts 1, 2, and 3.

3. Bradfield, JF, Schachtman, TR, McLaughlin, RM, and Steffen, EK. 1992. Behavioral and physiological effects of inapparent wound infection in rats. Lab Anim Sci 42(6): 572-578.

4. Brown, MJ, Pearson, PT, and Tomson, FN. 1993. Guidelines for animal surgery in research and teaching. Am J Vet Res. 54(9): 1544-1559.

5. Brown PA and Hoogstraten-Miller S. Principles of Aseptic Rodent Survival Surgery: Parts I & 2 In: Reuter J.D. and Suckow M.A. (Eds.), Laboratory Animal Medicine and Management. Ithaca: International Veterinary Information Service (www.ivis.org), 2004; Document No. B2514.0604. [http://www.ivis.org/advances/Reuter/brown1/chapter_frm.asp?LA=1] and [http://www.ivis.org/advances/Reuter/brown2/chapter_frm.asp?LA=1].

6. Guideline for Hand Hygiene in Health Care Settings. Morbidity and Mortality Weekly Report, October 25, 2002 / 51(RR16); 1-44.

7. Institute of Laboratory Animal Resources, National Research Council. Guide for the Care and Use of Laboratory Animals. Washington, DC: National Academy Press 1996; pp 556-70. [http://www.nap.edu/readingroom/books/labrats/]

8. Rutala, W.A. 1996. APIC guideline for selection and use of disinfectants. Am J Infect Control. 24:313-42.

Appendix I

This appendix includes definitions, tables of information, and references as a resource for investigators.

DEFINITIONS

ASEPTIC SURGICAL PROCEDURES: Surgery performed using procedures that limit microbial contamination so that significant infection or suppuration does not occur.

MAJOR SURGERY: Any surgical intervention that penetrates and exposes a body cavity; any procedure that has the potential for producing permanent physical or physiological impairment; and/or any procedure associated with orthopedics or extensive tissue dissection or trans-section.

MINOR SURGERY: Any surgical intervention that neither penetrates and exposes a body cavity nor produces permanent impairment of physical or physiologic function. Examples are superficial vascular cut down, and percutaneous biopsy.

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.

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.

Table 1. RECOMMENDED HARD SURFACE DISINFECTANTS (e.g., table tops, equipment)

AGENT	EXAMPLES *	COMMENTS
Alcohols	70% ethyl alcohol 85% isopropyl alcohol	Contact time required is 15 minutes. Contaminated surfaces take longer to disinfect. Remove gross contamination before using.
Chlorine	Sodium hypochlorite (Clorox ® 10% solution) Chlorine dioxide (Clidox®, Alcide®, MB-10®)	Corrosive. Presence of organic matter reduces activity. Chlorine dioxide must be fresh; kills vegetative organisms within 3 minutes of contact.
Quaternary Ammonium	Roccal®, Quatricide®	Rapidly inactivated by organic matter. Compounds may support growth of gram negative bacteria.
Phenolics	Lysol®, TBQ®	Less affected by organic material than other disinfectants.
Chlorhexidine	Nolvasan® , Hibiclens®	Presence of blood does not interfere with activity. Rapidly bactericidal and persistent. Effective against many viruses.

** Examples do not indicate a product endorsement.*

Table 2. SKIN DISINFECTANTS

Alternating disinfectants is more effective than using a single agent. For example, an iodophor scrub can be alternated three times with 70% alcohol, followed by a final soaking with a disinfectant solution. Alcohol, by itself, is not an adequate skin disinfectant. The evaporation of alcohol can induce hypothermia in small animals.

AGENT	EXAMPLES *	COMMENTS
Iodophors	Betadine®, Prepodyne®, Wescodyne®	Reduced activity in presence of organic matter. Wide range of microbicidal action. Works best in pH 6-7
Cholorhexidine	Nolvasan®, Hibiclens®	Presence of blood does not interfere with activity. Rapidly bactericidal and persistent. Effective against many viruses. Excellent for use on skin.

** Examples do not indicate a product endorsement.*

Table 3. RECOMMENDED INSTRUMENT STERILANTS

AGENT	EXAMPLES *	COMMENTS
Steam sterilization (moist heat)	Autoclave	Effectiveness dependent upon temperature, pressure and time (e.g., 121oC for 15 min. vs 131oC for 3 min).
Dry Heat	Hot Bead Sterilizer Dry Chamber	Fast. Instruments must be cooled before contacting tissue. Only tips of instruments are sterilized with hot beads.

** Examples do not indicate a product endorsement.*

Table 4. RECOMMENDED INSTRUMENT DISINFECTANTS

Always follow manufacturer's instructions for dilution, exposure times and expiration periods.

AGENT	EXAMPLES *	COMMENTS
Alcohols	70% ethyl alcohol 85% isopropyl alcohol	Contact time required is 15 minutes. Contaminated surfaces take longer to disinfect. Remove gross contamination before using. Inexpensive.
Chlorine	Sodium hypochlorite (Clorox ® 10% solution) Chlorine dioxide (Clidox®, Alcide®)	Corrosive. Presence of organic matter reduces activity. Chlorine dioxide must be fresh. Kills vegetative organisms within 3 min. Corrosive to instruments. Instruments must be rinsed with sterile saline or sterile water before use

** * Examples do not indicate a product endorsement.*

SUTURES

Sutures can be generalized as follows:

- absorbable or non-absorbable
- Monofilament or multifilament
- Biological or Synthetic

Each has their own pros and cons. Below are full descriptions of each category.

Table 5. Wound Closure Selection

CATEGORIES	DESCRIPTIONS
Absorbable	**Made of materials that are broken down by the body after implementation. A main advantage of absorbable sutures is that no foreign body is left permanently in the patient which could precipitate long term problems. Conversely, the main disadvantage of absorbable sutures would be the fact that they are needed to support a tissue for as long as it's necessary. If the suture absorbs too quickly, it could lead to wound failure.**
Non-absorbable	**Made from materials which are not broken down by the body; instead they remain in place permanently. Sometimes, some materials are included in this category which can eventually be broken down. For example, silk is broken down by the body over a period of years but it is still considered to be non – absorbable. An advantage of this type of suture is that it can be used to suture tissues which need long term support, thus providing permanent wound support. However, these sutures have their disadvantages; particularly the fact that non – absorbable suture is that a foreign body that is left in the patient. The presence of such foreign bodies as these can cause an abscess to form.**
Monofilament	**Considered an ideal suture because they have a smooth surface. The smooth surface allows this type of suture to easily pass through tissue without drag or causing damage. This can be important when there must be minimal tissue damage to ensure a leak proof seal at the site of the suture. Monofilament sutures are also considered ideal because they lack any tiny spaces between strands in which bacteria can congregate and go undetected by the patients' immune system. A disadvantage of this type of suture centres on the stiffness of the single strand and the difficulties this presents to handling during surgery.**
Multifilament	**Have a (braided) construction and are thus inherently strong. An advantage to using this type of suture is that they are extremely soft and pliable which provides excellent handling and knots are unlikely to slip. Unfortunately some disadvantage of this suture is in the fact that its braided construction can cause more traumas to tissue because of the surface roughness. Additionally, the construction of braided materials means that small spaces exist within which can harbour bacterial cells. Coating can eliminate or drastically reduce many issues multifilament sutures present. Coating seals off the spaces within the suture, preventing the presence of bacterial harbours. Coatings can also reduce friction and drag as the suture is pulled through the tissue, minimizing trauma.**
Synthetic	**Man – made, produced by industrial processes. They can be absorbable or non-absorbable. The advantage of synthetic non-absorbable materials is that they do not elicit tissue reaction as they are not absorbed. Synthetic absorbable sutures are polymers which resemble sugars in their chemical structure; therefore they are eliminated easily which presents itself as an advantage. Another advantage of synthetic sutures is in the fact that they tend to be stronger than their biological equivalents for similar gauge sizes. Unfortunately, they can be more difficult to handle.**
Biological	**Derived from naturally occurring sources such as animal and plant tissues. They can be absorbable or non-absorbable. These sutures have a few advantages including being quite economical and having good handling and knotting characteristics. Their disadvantage is in the fact that they (like most biological material) are identified by the body as foreign proteins, and will cause a tissue reaction in the region of the implanted material which can produce pain and discomfort.**

Table 6. Examples of Wound Closure Material

EXAMPLES	CHARACTERISTICS
Silk	Multifilament, non-absorbable Excellent handling. Preferred for cardiovascular procedures. (Caution: Tissue reactive and may wick microorganisms into the wound).
Gut	Biological. Absorbable. Versatile material. (plain, chromic, fast) Gut sutures are drerived from animal gut, usually sheep or cow.
Polyester	Multifilament. Synthetic. Non-absorbable. (e.g. Surgidac® Ethibond®)
Polyglactin	Absorbable. Multifilament. (e.g. vicryl®)
Polyglycolic	Absorbable. Multifilament. (e.g. Dexin-Plns®)
Polyprolene	Synthetic. Nonabsorbable. (e.g. Surgilene®, Prolene®)
Polydroxanone	Synthetic. Absorbable. (e.g. PDS®)
Stainless Steel Wound Clips, Staples	Nonabsorbable. Requires instrument for removal.
Cyanoacrylate (Skin glue)	For non-tension bearing wounds. (Vetbond®, Nexaband®)

Suture gauge selection: Use the smallest gauge suture material that will perform adequately.

Cutting and reverse cutting needles: Provide edges that will cut through dense, difficult to penetrate tissue, such as skin.

Non-cutting, taper point or round needles: Have no edges to cut through tissue; used primarily for suturing easily torn tissues such as peritoneum or intestine.

Appendix II

Surgical Procedure Record

Date:	
Principal Investigator:	
Surgical Procedure:	
IACUC #	**Study/Group name:**
Surgeon(s):	
Species &Strain *(if applicable):*	
Pre-Surgical Evaluation *(brief description of the animal condition prior to surgery (i.e. active, well-groomed, etc)*:	
Anesthesia:	**Dose & Delivery site:**

Animal #	Body Weight	Total anesthesia given	Antibiotic given (Drug/Dose/Route)	Analgesic given (Drug/Dose/Route)	Notes

Post Procedure Record

This is to be completed subsequent to any procedure up to the date the animal(s) begin an experiment

Procedure:_____ Date:_____

DATE	Animal#	Feces present	Weight increase	Behavior normal	Clean incisions	Staples/ Sutures removed	Case Closed	Comments (include Animal Condition*)

***Animal Condition: 1=Active 2=Inactive 3=Moribund 4=Found dead**