THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

SURGERY COMMANDMENTS

1. *Thou shalt carefully plan all aspects of surgical procedures in advance*
2. *Thou shalt insure the animal is appropriately anesthetized*
3. *Thou shalt use aseptic techniques*
4. *Thou shalt minimize tissue trauma*
5. *Thou shalt minimize blood loss*
6. *Thou shalt keep the patient warm*
7. *Thou shalt insure personnel have been sufficiently trained for all procedures*
8. *Thou shalt provide post-operative monitoring and supportive care*
9. *Thou shalt monitor and track outcomes; taking corrective action as necessary*
10. *Thou shalt smile under your mask, even though no one can see you*

Objectives:

1. General ideas to consider when planning survival surgery
2. Teach methods for instrument, patient and surgeon preparation
3. Teach identification of appropriate rodent anesthesia
4. Perform surgery using aseptic techniques (from incision to suturing)
5. Teach anesthesia administration and monitoring
6. Teach proper post-surgical monitoring and recording

✸ Instruments

All instruments should be cleaned shortly after use to prevent blood and organic materials from drying in any crevices. Scrubbing, using a soft brush, may be required. Prior to use, all instruments must be properly sterilized. A sterility indicator should be placed inside (eg: chemically treated paper or a vial containing bacterial spores) or on the surgical pack (eg: autoclave tape) to confirm proper sterilization. Acceptable methods of sterilization include [1, 4]:

1) Autoclave (generally, 15 minutes at 120°C is sufficient, provided the instruments are not wrapped too tightly).
2) Gas sterilization with ethylene oxide – NOTE: Ethylene Oxide is a carcinogen and must be handled carefully. All instruments must be appropriately aerated before use.
3) Cold sterilization (see the list below of FDA approved products. Ensure contact time as stipulated by the manufacturer is observed. Rinse all instruments thoroughly using sterile water prior to use).
4) Radiation – gamma radiation generally used for heat and chemical sensitive instruments.

Instruments should not be used on more than one rodent without sterilization. Instruments may be sterilized by using a hot bead sterilizer or flash autoclaving between rodents. Alternatively, a new sterile pack of instruments may be opened for each animal. [1]

✸ Surgical Area

1) The surgical area should optimally be isolated from active areas in the laboratory, doorways and ventilation supply ducts.
2) The area should be clean and uncluttered.
3) Surface areas should be easily sanitizable.
4) The surgery area should contain sufficient lighting.
5) A heat source should be available during an extended surgery, since rodents rapidly loose body heat under anesthesia.
6) Minimize the storage of cardboard and paper products directly above the surgery site. Sealable, plastic containers may be used for storage.
7) No cloth chairs are allowed in areas animals will be used.
8) An animal preparation and recovery area, separate from the surgical area, should be provided. If a separate preparation area is not possible due to space constraints, cover the surgical area with a towel or drape and discard this after the animal has been prepared. [1]

✸ Animal Preparation

1) Apply a bland ophthalmic lubricant to the eyes, since the blink reflex is lost in rodents under anesthesia. For extended procedures, reapplication of the ophthalmic lubricant should occur as needed in order to avoid corneal pitting due to drying of the eyes .
2) The area around the surgical site must be devoid of hair, since hair around the surgical site can act as a wick for bacterial infection. Hair removal may be achieved by either using a #40 clipper blade or a depilatory. In mice, plucking to remove hair is relatively easy once the mice are anesthetized.
3) To avoid contamination of the surgical area, prepare the animal in a remote area.
4) Prepare the surgical site by using ethyl alcohol or isopropyl alcohol, followed by an Iodophor solution or Chlorhexidine scrub (Chlorhexidine is known to be irritating to skin).
5) Using cotton tipped applicators or gauze, start first with the alcohol application. Follow the alcohol application with the first Iodophor or Chlorhexidine application.
6) Starting in the center of the incision site, spiral outward in concentric circles toward the margins of the prepared area (never go back and forth over a cleansed area with the same gauze).
7) Repeat the alcohol and Iodophor or Chlorhexidine step for a total of three times each.
8) When using Chlorhexidine as the skin disinfectant, flush the prepared site with sterile saline or sterile water to ensure complete removal of Chlorhexidine prior to making the incision.
9) Use a new gauze or cotton tipped applicator for each application. [1]

✸ Surgeon Preparation

Surgical personnel must wear a clean lab coat, mask bouffant cap, and sterile gloves. *All aseptic surgery requires sterile gloves to be worn. Information regarding the necessity of a new pair of sterile gloves for each surgery is controversial. It is best practice to perform multiple surgeries on animals donning a new pair of gloves between each surgery.[2, 3] [Literature supporting disinfection of gloves and instruments between surgeries with alcohol (70% ethyl alcohol or 85% isopropyl alcohol: a minimum contact time of 15 minutes is required) or other disinfectants prior to the next surgery is available [4,] as is information supporting the fact that the use of alcohol is not recommended as a disinfectant [1, 3, AAALAC Connection 2001]]

✸ Placement of Drape Material

The use of a drape is recommended to prevent contamination of the disinfected surgical site. This is especially true for procedures that require exteriorization of the viscera. Positioning of the drape over the surgical area should be done with sterile gloves or instruments in order to maintain sterility. *Some (micro) surgery may not require the use of drapes.

*To determine if your (micro) surgery requires the use of sterile gloves and/or drapes, please contact The Office of Animal Care and Use at 966-5569 for further information.

✸ Equipment Manipulation

During some rodent surgeries there may be a need to manipulate certain types of equipment (microscopes, anesthetic machines, drills, etc.). Such equipment should be disinfected before surgery. Once surgery commences, adjustments and handling of equipment outside of the sterile field must be made using a piece of sterilized gauze, aluminum foil or commercially available sterile sleeve [1].

✸ Surgical Closure

The abdominal muscle/peritoneal layer and the skin must be closed separately. A continuous or running suture may be applied to the muscle layer. However, an interrupted suture should be applied to the skin. Appropriate suture material for each layer should be used. Wound clips or surgical staples may be used in the skin. However, clips or staples should not be used for closing skin on the ventral surface, since they may catch on metal cages or become contaminated with bedding. If clips, staples, or non-absorbable sutures are used to close the skin, they should be removed seven to ten days after surgery.

✸ Post-operative Monitoring and Supportive Care:

1) Recover the patient in an area where it can be monitored until sternal recumbency has been achieved and the patient is ready to be returned to a clean housing cage.
2) Ensure that recovery occurs in a clean cage lined with a paper towel (rodents under the influence of anesthesia can aspirate corncob bedding and perish)
3) Keep the patient warm until ambulation.
4) Provide all analgesics and fluid therapy as approved in your animal application.
5) Monitor all animals for any visible signs of pain (eg: hunched posture, ruffled fur, lethargy, resentment to being handled, decreased appetite)
6) Monitor animals for any signs of infection (eg: swelling and redness around incision site, subtle change in behavior)

[NOTE: Some anesthetics (eg: Xylazine. Barbituates, and Medetomideine) may be reversed by administration of an anesthetic/sedative antagonist (eg: Yohimbine, Naloxone, or Atipamezole)].

✸ Suture Selection

SUTURE	CHARACTERISTICS
Vicryl, Dexon	Absorbable – 60-90 days. Suture tissues
PDS or Maxon	Absorbable – 6 months. Suture tissues
Prolene	Non-absorbable - Inert
Nylon	Non-absorbable – Inert. General Closure
Silk	Non-absorbable – Tissue reactive. May wick microorganisms into wound. Easy to use and knot. NOT ACCEPTABLE FOR SKIN SUTURE.
Chromic Gut	Absorbable – Versatile. Causes mild inflammation, yet rapidly absorbed. NOT ACCEPTABLE FOR SKIN SUTURE
Staples and wound clips	Non-absorbable – Requires special instrument for removal.

Suture Gauge Selection: Use smallest gauge suture material that will perform adequately.

Cutting and Reverse-Cutting Needles: Provides edge to cut through dense, difficult to penetrate tissue (eg: skin)

Non-cutting, taper point or round needles: No edges for cutting. Used for easily torn tissue (eg: peritoneum, intestine).

- **Factors influencing possibility of Infection:**
  1) Foreign materials (eg: non-absorbable suture, necrotic tissue, implants)
  2) Increased surgery time
  3) Use of incorrect suture (eg: silk and cotton suture may act as a wick for bacteria into incision site)
  4) Skin damage at surgical site (eg: razor, dull clippers)
  5) Not irrigating wound with sterile saline or antibiotic solution (this decreases the number of bacteria as well as removes blood clots and necrotic tissue)
  6) Patient health (eg: malnutrition, obesity, diabetes)
  7) Tissue damage (eg: improper insturument handling, heavy use of electrocautery)

http://www.fotosearch.com/photos-images/rodent_13.html

- **GLOSSARY (Merriam-Webster Online):**

Antimicrobial: "destroy or inhibit the growth of microorganisms"

Antiseptic: "preventing the growth of microorganisms"

Asepsis: "the methods of making or keeping aseptic"

Bactericide: "destroy bacteria"

Contamination: "process of infecting by contact or association"

Disinfect: "to free from infection especially by destroying harmful microorganisms"

Pathogen: "a specific agent (bacterium or virus) of disease.

Sanitize: "to make more acceptable by removing unpleasant or undesired features"

Disinfectant**:** "a chemical that destroys vegetative forms of harmful microorganisms (as bacteria and fungi) especially on inanimate objects"

Sterilant: "to free from living microorganisms"

Sterile: "free from living organisms and especially microorganisms"

Sterilization: "to make sterile"

✸ Sterilants and Disinfectants

FDA-Cleared Sterilants and High Level Disinfectants: http://www.fda.gov/cdrh/ode/germlab.html

Alcohol is acceptable as a skin disinfectant, however is generally not recommended for the preparation of surgical instruments: AAALAC Connection 2001
http://research.unc.edu/nlac/documents/Using_Alcohol_Disinfectant.pdf

Chlorhexidine Gluconate Scrub is an antiseptic/antimicrobial skin cleanser:
http://www.gcamerica.com/ifu/Hibiclens10_04.pdf

Spor-Klenz is a hard surface antimicrobial product:
http://www.steris.com/documents/2415224548_1.pdf

✸ References:

[1] Laboratory Animal Welfare Training Exchange: (Subscription required).
http://www.lawte.org/exchg_descrip.cfm#9 Aseptic Techniques Course

[2] American Association for Laboratory Animal Science: (Subscription required).
https://www.aalaslearninglibrary.org Aseptic Technique for Rodent Survival Surgery

[3] *Guide for the Care and Use of Laboratory Animals*, Surgery, Pages 60 – 64
"Alcohol is neither a sterilant nor a high-level disinfectant (Rutala 1990)"

[4] Office of Animal Care and Use (ACU) of the National Institutes of Health (NIH)
http://oacu.od.nih.gov/ARAC/surguide.pdf Guidelines for Survival Rodent Surgery

✸ Relevant Links:

- Surgery - Multiple Run Rodent Guidelines: http://research.unc.edu/iacuc/sop/index.php **Multiple-run Rodent Surgeries, Aseptic Technique**
- Single-Run Survival Rodent Surgery: http://research.unc.edu/iacuc/sop/index.php **Single-run Survival Surgery in Rodents**

For any further assistance or information, please contact an Office of Animal Care and Use Training and Compliance Co-Ordinator at 966-5569.

✸ Supply and Vendor Information

Braintree Scientific 781-843-2202
www.braintreesci.comwww.braintreesci.com
Instruments, lab equipment, isothermal pads, tattoo paste

Fisher Scientific 800-766-7000
www.fishersci.comwww.fishersci.com
Lab equipment, chemicals, instruments, pharmaceuticals

Henry Schein 800-872-4346 www.henryschein.com
Veterinary supplies, instruments, pharmaceuticals
Need Vet License

JA Webster 800-225-7911 www.jawebster.com
Veterinary supplies, instruments, pharmaceuticals
Need Vet License

Kent Scientific 888-572-8887 www.kentscientific.com
Surgical equipment, telemetry equipment

Med-Vet International 800-544-7521
www.shopmedvet.comwww.shopmedvet.com
Veterinary supplies and instruments (discounted)
Need Vet License

National Band and Tag 859-261-2035
www.nationalband.comwww.nationalband.com
ID tags, ear tags

Roboz 800-424-2984 www.roboz.com
Specialize in instruments

TW Medical 888-787-4487 www.twmedical.com
Veterinary supply (Bill Forrester)

UNC-CH Materials Management and Distribution 966-5671
Scientific Storeroom, General Storeroom, Chemical Storeroom

Veterinary Medical Supply 800-533-8674
Veterinary Supplies out of Zebulon, NC
Need Vet License

Southern Anesthesia 800-456-0757 http://www.sasvet.com/
This is a human source company that has a Veterinary division, will set up an account without a vet license.

The University of North Carolina at Chapel Hill
IACUC Training Record

Aseptic Techniques

Performed?	Technique	Comments
	Scrubbing and Gloving	
	Incision Site Preparation	
	Incision and Suturing	
	Wound Clip / Staple placement	
	Wound Clip / Staple removal	
	Instrument Preparation	Instruments are prepared ahead of time for the class. Please consult with a Training and Compliance member for individual training.
	Proficiency Rating	**I** **II** **III**

Please add email address if you are a Lab Animal Coordinator: _____

Phone #: _____

I certify that I have received the above training:

Signature: _____ PID: _____

Print Name: _____ PI: _____

Instructor Signature: _____ Date: _____