

University of Southern California
Institutional Animal Care and Use Committee
Surgery and Post-Operative Care

A. Background

This policy clarifies the current requirements for performing survival and non-survival surgeries at USC.

B. Definitions

Major Survival Surgery: is defined as such that penetrates and exposes a body cavity, produces substantial impairment of physical or physiological functions, or involves extensive tissue dissection or transection. For example: Laparotomy, craniotomy that penetrates the dura, arthrotomy, amputation, spinal cord transection, or enucleation.

Minor Survival Surgery: does not expose a body cavity and causes little or no physical impairment. For example: wound suturing, peripheral vessel cannulation, single percutaneous biopsy, or cutaneous mass removal.

Non-survival Surgery: A surgery where the animal never recovers or awakens from surgery prior to euthanasia.

Non-USDA covered species: Animals that are not covered under the USDA, these include mice of *Mus* genus, rats of *Rattus* genus, avian species, fish, reptiles, and amphibians.

USDA rodent: Mice and rats that do not fall under the genus *Mus* or *Rattus*. This applies at USC to mice and rats of the genus *Acomys* and *Dipodomys*.

C. Applicability

This policy applies to all individuals performing surgeries to ensure adequate veterinary care and record keeping compliance per the USDA Animal Welfare Act, the Public Health Service Policy on Humane Care and Use of Laboratory Animals, and The Guide for the Care and Use of Laboratory Animals.

D. Policy

Survival surgery in non-USDA covered species and USDA rodents

Surgical space

Surgery on non-USDA covered species and USDA rodents, can be performed in any room or portion of a room that is easily disinfected and free from excessive air drafts. This would include, but is not limited to, a clean, uncluttered lab bench, table, or in a laminar flow, HEPA-filtered hood. If surgery is to be performed outside of the animal facility procedure rooms, this location must be listed and approved in the USC IACUC protocol.

The dedicated surgical area should not be used for any other purposes during the time of surgery.

Prior to and between surgeries, the surface upon which surgery will be performed must be cleaned and properly disinfected (quaternary ammonium disinfectants or 70% alcohol are good choices) ensuring adequate contact time.

Animal preparation and aseptic technique

Surgical Instruments

Surgical and other instruments must be sterilized for use in all species undergoing survival surgery. Steam, dry heat, gas (ethylene oxide), chemical sterilant (e.g., glutaraldehyde, used in accordance with USC Safety Department guidelines) and radiation can be used to sterilize instruments.

Sterilizing instruments between surgeries when performing surgery on multiple animals is required. **Wiping tips of instruments with 70% alcohol between animals is not acceptable.** If repeated use of surgical instruments is anticipated, a dry, hot bead sterilizer is recommended as the safest and convenient option. Understand that the instrument handles are no longer considered sterile and thus should never touch the animal. If a dry, hot bead sterilizer is used for instruments between animals, the maximum amount the instruments may be used is 5 sequential surgeries. After 5 sequential surgeries a new set of sterile instruments must be used.

Animal preparation

Only animals that appear to be free of clinical disease and illness should be considered for surgery.

Aseptic technique includes preparation of the animal, such as hair removal by clipping the fur and disinfection of the operative site. This must always be performed with 3 repeated scrubs of surgical iodine (betadine) or chlorhexidine alternating with three scrubs of 70% alcohol. The use of depilatory cream for hair removal is discouraged and must be approved in the USC IACUC protocol with justification.

Application of sterile ophthalmic lubricant is required for any anesthetic event.

Pre-emptive analgesia such as Buprenorphine XR, NSAIDs, and/or local anesthesia, must be given prior to making the surgical incision to prevent wind-up pain. It is recommended to give this at least 30 minutes prior to the procedure, if possible. All anesthetics and analgesics must be approved on the protocol.

The surgical field must be kept as sterile via a sterile cloth or paper drape or other materials (food grade saran/cling wrap, foil, etc).

Surgeon Preparation

Any individual performing surgery on non-USDA covered species and USDA rodents must be approved on the protocol to perform surgery (section 16). Modified aseptic technique is acceptable but must include the provision of decontaminated surgical attire (e.g., a clean lab coat or surgical scrubs), as well as wearing a mask, hair cover, and sterile surgical gloves (clean latex examination gloves swabbed with 70% alcohol are an acceptable alternative to sterile gloves if using a dry hot bead sterilizer for instruments).

Anesthetic monitoring

Animals can quickly become hypothermic during anesthetic procedures. Body temperature must be maintained throughout the procedure by providing supplemental heat by a recirculating water blanket, electric heat pad, or heat lamp. An insulating layer such as a towel or drape must be placed between the animal and the heat source. Monitoring of animal body temperature is recommended.

Electric heat pads should be used with caution and only on the “low” setting. They are prone to heating unevenly and can cause thermal burns or the animal to overheat and become hyperthermic.

Depth of anesthesia must be checked prior to making incision and at regular intervals to assess adequate surgical plane. This can be performed by firm toe pinch

with hemostats or fingertips to assess pedal reflex. Any response to the pinch indicates an increased dose of the proper amount of anesthesia is needed.

If using injectable anesthetics and additional anesthesia is needed, a ¼ dose of the initial dose given is recommended.

Monitor the animal carefully during the surgical procedure at regular intervals. Parameters that surgeons or surgical assistants should assess include response to surgical stimulus, the animal's heart rate, respiratory rate and pattern, mucous membrane color, and body temperature.

For non-USDA covered species and USDA rodents, a record that the animal(s) were monitored may be checked off on a provided template at the end of surgery.

Postoperative care

In the immediate post-operative period, place the animal in a clean cage in sternal recumbency. It is recommended to place the animal on a clean paper towel to prevent bedding getting into the incision site and/or animal aspirating on bedding during recovery.

Prevent hypothermia by placing the animals in a warm room or cage. Supplemental warmth may be supplied by a recirculating water blanket, a heat lamp (located at least 8-12 inches from the animal), or warm water bags located next to the animal. If heating pads are used, they should be insulated from the animal using towels or drapes, so the animal does not overheat. If animals are in a cage, place the cage ½ on the heat pad so the animals can move away from the heat if desired.

The animal must be monitored during this period at regular 5–10-minute intervals for signs of recovery and this information must be documented. Animals should not be returned to the animal facility until they are awake and ambulatory.

Post-surgical animals must be observed at a minimum once daily for three days by a member of the investigator's staff or other individual to whom post-operative care has been delegated. External sutures or wound clips must be removed 10-14 days after surgery by the lab personnel. The post-operative monitoring checks and suture/wound clip removal must be documented on the post-op monitoring card (See Appendix).

Records

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DAR Anesthesia and surgical records are required for ALL survival surgical procedures.

DAR Anesthesia and surgical records are strongly encouraged, but not required for non-survival surgical procedures.

DAR Anesthesia and surgical records are not required but may be used for non-surgical anesthetic procedures such as tail venipuncture, adult genotyping, or terminal procedures < 5 minutes in duration such as cardiac bleeds.

A peri-operative record must be kept in the laboratory with any other animal records.

A composite record may be used for a group of non-USDA covered species or USDA rodents. Such a record should be consulted and verified by DAR veterinary staff and must include at minimum:

- Surgery Date
- PI
- Protocol #
- Species
- Animal IDs
- Weights
- Surgical procedure
- Surgeon
- Anesthetic agent(s), dose(mg), route
- Analgesic agent(s), dose(mg), route
- Additional fluids/therapeutics given, doses, routes
- Notes of any complications or abnormal observations

Records should be kept current during the immediate post-operative period (e.g., 14 days or until all wounds have healed and all sutures/wound clips have been removed) and should include dates for study completion and animal euthanasia.

The Post-Op Monitoring Cage Cards provided by DAR (see Appendix), must be utilized cage side, and filled out completely for each non-USDA covered species and USDA rodent cage undergoing surgery. All observations must include a date, time, and initials of the individual checking the animals. Once the sutures or staples have been removed in 14 days then the card can be removed and must be stapled or electronically attached to the animal record for a complete record. Alternatively, the card can be left on the cage behind the main cage card for the duration of the animal's life.

Researchers may use their own monitoring cards, but it is highly encouraged to consult and get verification from DAR veterinary staff. The monitoring cards must be maintained on the cage, and include at minimum:

- Surgery Date
- Procedure

- Protocol #
- Animal Weight(s)
- Anesthetic agent(s) used
- Analgesic agent(s), dose(mg), route
- Space for minimum 3 days of observation including date, time, initials, and comments
- Space to record additional post-operative analgesic doses and times given (if applicable)
- Emergency contact name and cell phone number

Training

It is incumbent on the PIs to ensure that their laboratory staff is appropriately trained in their surgical protocols and that the training is documented. Foundational surgical knowledge includes anesthesia administration and monitoring, asepsis, tissue handling, proper instrument handling, hemostasis, and proper suture/staple use. PIs and their staff can always contact DAR veterinary staff at vetmed@med.usc.edu for general surgical training and planning.

Nonsurvival Surgery in Non-USDA covered species and USDA Rodents

It may not be necessary to follow all the techniques outlined in survival surgery section when performing a nonsurvival surgery. At a minimum, the surgical site should be clipped, the surgeon should wear clean gloves, and the instruments and surrounding area should be clean. For nonsurvival procedures of an extended duration, attention to aseptic technique may be more important to ensure the stability of the model for a successful outcome. Anesthetic depth must be monitored throughout the procedure.

Survival surgery in USDA covered species

The same standards apply in terms of monitoring and care with non-USDA covered species in addition to the following specifics.

Surgical space

Major survival surgical procedures must be performed in a dedicated surgical facility, which is approved, by the attending veterinarian and IACUC.

Aseptic technique

Strict aseptic technique must be used for all surgical procedures. All personnel must wear hair cover, surgical mask, sterile gown, and sterile surgical gloves. Sterile

surgical instruments and supplies are required by autoclave or Ethylene Oxide, as well as maintenance of an aseptically prepared surgical field.

Animal preparation and anesthetic monitoring

USDA covered species (except rabbits) should be fasted prior to anesthesia and surgery to prevent vomiting, aspiration, and problems associated with abdominal distension. It is recommended to consult with a veterinarian on appropriate fasting times for the species prior to planning the surgery. Pre-surgical evaluations must be performed and baseline physiologic parameters such as body temperature, respiration, and heart rate should be recorded before anesthetic administration.

Body weight must be measured for proper drug dosages. Anesthesia dose and route must be determined prior to surgery.

Pre-emptive and then post-op analgesics should be administered routinely with written or electronic documentation of such administration, including the date and time. Clinical observations of the animal should be recorded.

Intra-operative monitoring should include measured and visual observation of heart rate, respiratory rate, capnography, oxygen saturation of the blood, non-invasive blood pressure (systolic and diastolic), body temperature, and any notations of anesthetic or surgical events. This must be documented every 5 minutes. For non-survival surgeries involving USDA covered species, this interval should also be **every 5 minutes**.

Post-operative care

The use of post-surgical treatments, including analgesics, fluids, and antibiotics must be documented with the date and time of administration and animals should be monitored. Observations of animal condition including but not limited to, abnormal behavior, pain, appetite, excretions, body temperature, respiration, or heart rate are also to be recorded and should include the observer's initials with the date and time the observation was made. Sutures/staples must be removed 10-14 days post-surgery.

Records

For all USDA covered species, anesthesia monitoring and records must be kept using electronic or written documentation available upon inspection. It is recommended to use DAR's USDA anesthesia monitoring form or equivalent to ensure all the necessary

information is documented (see Appendix). All records should be maintained and available for a minimum of 1 year post euthanasia or final disposition of that animal.

E. References

1. ACLAM Position Statement on Non-USDA covered species Surgery, 2016.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5113888/>
2. ACLAM Position Statement on Pain and Distress in Research Animals, 2016.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5113887/>
3. Animal Welfare Act, 7 U.S.C., Sections 2131-2159. Animal Welfare Regulations, 9 CFR Chapter 1, Subchapter A, Parts 1-4.
<https://www.ecfr.gov/current/title-9/chapter-I/subchapter-A>
4. Holdridge, J. A., Nichols, M. S., Dupont, W. D., Jones, C. P., & Shuster, K. A. (2021). The Effectiveness of Hot Bead Sterilization in Maintaining Sterile Surgical Instrument Tips across Sequential Mouse Surgeries. *Journal of the American Association for Laboratory Animal Science: JAALAS*, 60(6), 700–708
<https://doi.org/10.30802/AALAS-JAALAS-21-000047/>
5. ILAR, Guide for the Care and Use of Laboratory Animals
<http://nap.edu/12910>
6. Public Health Service (PHS). 1986. Public Health Service Policy on Humane Care and Use of Laboratory Animals. Washington, D.C.: U.S. Department of Health and Human Services.
<https://olaw.nih.gov/policies-laws/phs-policy.htm>

F. Appendix

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POST-OP MONITORING CARD			
Procedure: _____		Date Performed: _____	
		Protocol # _____	
Anesthetic: Ket/Xyl <input type="checkbox"/> Iso/Sevo <input type="checkbox"/> Other: _____		Animal weight/s (g): _____	
Analgesics: Bup XR <input type="checkbox"/> Other: _____		Analgesic dose (mg) given: _____	
		Route: SC <input type="checkbox"/> PO <input type="checkbox"/> IP <input type="checkbox"/>	
Ketoprofen <input type="checkbox"/> Carprofen <input type="checkbox"/> Meloxicam <input type="checkbox"/>		Analgesic dose (mg) given: _____	
		Route: SC <input type="checkbox"/> PO <input type="checkbox"/> IP <input type="checkbox"/>	
Record your observations each day and when analgesics were given (if applicable) in the boxes below. Use back of card for more space.			
Date	/ /	/ /	/ /
Post-Op OBS	Time: _____ Initial: _____	Time: _____ Initial: _____	Time: _____ Initial: _____
	Incision <u>site</u> OK? Y / N	Incision <u>site</u> OK? Y / N	Incision <u>site</u> OK? Y / N
	Comments: _____	Comments: _____	Comments: _____
Analgesic Time	<input type="checkbox"/> : : AM <input type="checkbox"/> : : PM	<input type="checkbox"/> : : AM <input type="checkbox"/> : : PM	<input type="checkbox"/> : : AM <input type="checkbox"/> : : PM
Date to Remove Suture/Clips (10-14d post-op): _____ Removed: <input type="checkbox"/> Experiment end date: _____			
Notes: _____			
Emergency contact: _____ Cell #: _____			

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USC Department of Animal Resources

NON-USDA SPECIES ANESTHESIA AND SURGICAL RECORD TEMPLATE

Date:	PI:	Protocol#:	Tag#/ID(s):	Species:	Weight:
Procedure:			Surgeon:		
Anesthetic Agent(s): Concentration (mg/mL) of stock (if injectable):			Analgesic agent(s): Concentration (mg/mL) of stock:		
Dose and route of administration:			Dose (mg) and route of administration:		

<u>Surgery Notes and Observations</u>	
<input type="checkbox"/> Survival surgery	<input type="checkbox"/> Non-Survival (terminal) surgery
<input type="checkbox"/> Surgeon - head cover, gown, mask <input type="checkbox"/> Anesthesia administered <input type="checkbox"/> Surgical area clipped, or hair removed <input type="checkbox"/> Surgical site cleaned with betadine/iodine & alcohol, 3 alternating rounds of each <input type="checkbox"/> Ophthalmic ointment applied <input type="checkbox"/> Analgesic given pre-operatively <input type="checkbox"/> Heat source provided <input type="checkbox"/> Bi-Pedal reflex (hind toe pinch) checked before incision made <input type="checkbox"/> Surgical area clean, sterile field, sterile instruments <input type="checkbox"/> Surgeon - hands washed, sterile surgical gloves <input type="checkbox"/> Animal fully recovered and ambulating before placed back in cage	<input type="checkbox"/> Surgeon - head cover, gown, mask <input type="checkbox"/> Anesthesia administered <input type="checkbox"/> Surgical area clipped, or hair removed <input type="checkbox"/> Bi-Pedal reflex (hind toe pinch) checked before incision made <input type="checkbox"/> Surgical area clean, clean instruments* <input type="checkbox"/> Surgeon - hands washed, clean gloves *Non-survival surgeries of extended duration may need more attention to aseptic technique/instruments to ensure stability of the surgical model
Time Surgery Started: Time Surgery Ended:	Time Surgery Started: Time Surgery Ended:

Intraoperative monitoring notes:

Assessments taken included: anesthetic depth (toe pinch) Respiratory rate Other: _____

Frequency of assessments conducted within individual surgery: _____

Additional fluids, emergency agents (if applicable, include dose/route/time): _____

Describe any anesthetic, surgical, or post-operative complications: _____


- Please refer to anesthesia and analgesic document on <http://dar.usc.edu/resources/> for anesthetic and analgesic doses.
- Please note, if using ketamine/xylazine or injectable anesthesia and animal needs additional sedation, re-dose with ¼ - ½ of the initial dose and document all doses.

Suture or wound clip removal date (10-14 days post-operatively): _____

Edited by Dr. Lynlee Stevey DVM 5/2/2022

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Department of Animal Resources

1540 Alcazar St, CHP 234
Los Angeles, CA 90033
www.usc.edu/dar

323-442-1689: O

Date:	PI:	Protocol:	Species:	USC ID:
Primary Surgeon:			Sex:	Age:
Veterinarian: <input type="checkbox"/> Aycock-Williams <input type="checkbox"/> Simonek <input type="checkbox"/> Galang <input type="checkbox"/> Stevey				
Tech:				

PRE-SURGICAL EVALUATION
 General Condition (circle one): All body systems WNL or Other _____

	Medications	Dose (mg)	Dose (mL)	Route	Time
Induction Start Time : :	Sedatives				
	Acepromazine				
	Dexmedetomidine				
	Ketamine				
Procedure Start Time : :	NSAIDs				
	Carprofen				
	Antibiotics				
	Cefazolin				
Anesthesia End Time : :	Local Anesthetics				
	Bupivacaine				
	Opioids				
	Buprenorphine SR				
	Buprenorphine HCL				
Reversals					
	Atipamezole				
	Flumazenil				
Miscellaneous					

IV Fluids	mL/hr	Total (mL)

Gas Administration	
O ₂ <input type="checkbox"/>	
Anesthetic (circle):	Iso Sevo
IPPV <input type="checkbox"/>	If checked, fill in below
Tidal Volume (L/min):	
Breaths Per Minute:	

Surgery/Procedure:	
Surgery Notes/Complications:	

Survival Non-Survival Nails Trimmed

Recovery Notes:		
Extubated @	am	pm
Ambulatory @	am	pm
Eating (if applicable) @	am	pm

Veterinary Signature: _____

Surgery Flow Sheet Rev 6/2021 LS

