

# **POLICY FOR ASEPTIC RECOVERY SURGERY ON USDA REGULATED SPECIES**

Adopted by the University Committee on Animal Resources  
July 15, 2009

The U.S.D.A Animal Welfare Act (9 CFR) requires use of aseptic technique when performing major and minor invasive recovery surgery on regulated species (typically primates, cats, dogs, rabbits, pigs, guinea pigs, hamsters, gerbils, wild mammals,...). Major invasive surgery includes penetration and exposure of the cranium, thorax, abdomen or any procedure producing permanent impairment of physical or physiological functions. Minor invasive surgery does not penetrate a body cavity and includes relatively minor operative procedures such as blood vessel cut down, corneal surgery and eye coil implantation. As required by the U.S. Public Health Service and the University Committee on Animal Resources (UCAR), all vertebrate animal-use protocols, regardless of the funding source, must comply with the guidelines stated in the Guide and the requirements of the USDA Animal Welfare Act.

Investigators who feel that their vertebrate animal experiments require exceptions to the Guide recommendations or USDA requirements should contact UCAR for assistance. Otherwise, investigators will be expected to follow this policy.

## **MAJOR INVASIVE SURGERY**

### **Pre-Operative Animal Preparation**

All animals must be fasted 4 to 20 hours prior to general anesthesia to empty the stomach of ingesta. Free choice water is made available with the exception of water scheduled animals which may over consume. Rabbits and regulated species of rodents (gerbils, hamsters, guinea pigs) do not require fasting unless there is a need to empty the stomach for an abdominal surgical procedure.

Anesthetic induction is accomplished using a squeeze cage for mechanical restraint of macaques or manual restraint of squirrel monkeys, dogs, cats, pigs and regulated species of rodents. Refer to the table below for anesthetics dosages and routes.

Animal preparation must be performed in a dedicated, physically separated area from the Operating Room. Hair must be removed from the surgical site with clippers, a razor or a medical depilatory. The surgical site must be disinfected with the following two-step process repeated three times:

1. Gross contamination should be removed by using a surgical scrub at the surgical site (chlorhexidine or povidone iodine scrub) using appropriately sized gauze sponges starting from the center of the shaved surgical site moving outward.
2. The surgical site should then be wiped povidone iodine or chlorhexidine solution using appropriately sized gauze sponges starting from the center of the surgical site moving outward. .

An optional final wipe of the surgical site may occur with 70% isopropyl alcohol.

## **Operating Room & Aseptic Technique**

Surgery must be conducted in an Operating Room – (O.R.) physically separated from the other functional zones (Animal Prep, Surgeon Prep, Instrument Prep and Recovery). Air pressure differential for the O.R. must be positive to all other adjacent spaces.

The temperature in the surgery room should be increased and/or the animal placed on a covered warming device (e.g. circulating warm water blanket) to prevent hypothermia.

A sterile drape is required over the surgical site to avoid sterile instruments, sterile gloves or exposed viscera from coming in contact with unprepped areas. The surgeon must wear scrubs, a sterile surgical gown, sterile gloves, shoe covers, a face mask and a head cover.

Monitoring of anesthesia must be documented using the ANESTHESIA/SURGERY LOG ([www.urmc.rochester.edu/vivarium](http://www.urmc.rochester.edu/vivarium)).

- **Submit completed anesthetic records to DLAM within 24 hours of completion of the procedure**

A dedicated anesthetist should observe mucous membrane color, respiratory rate and pattern, body temperature and observation for the loss of pedal, corneal and pinnal (external ear) reflexes. More sophisticated methods of patient monitoring including EKG, pulse oximetry, end tidal CO<sub>2</sub> blood pressure measurements, blood gas measurements are highly recommended.

The surgeon must maintain aseptic technique by only touching sterile instruments or sterile surfaces. If the surgeon breaks aseptic technique by touching a nonsterile surface, they must rescrub hands and don new sterile gloves.

The abdominal or thoracic body wall should be closed with absorbable suture material in a simple interrupted pattern. The skin should be closed with staples or with a nonabsorbable suture material in a simple interrupted pattern or absorbable sutures in a continuous subcuticular pattern. Absorbable sutures placed in a subcuticular pattern to close the skin need not be removed postoperatively since they are buried under the skin. All other skin sutures or staples should be removed seven to ten days after surgery.

## **Instrument Preparation and Area**

All instruments must be sterilized, but the method of choice may vary depending upon the surgical instruments or devices used. Acceptable sterilization techniques include autoclaving using steam under pressure or cold sterilization. Approved cold sterilization methods include: soaking instruments in 2.5 – 3.5% glutaraldehyde (e.g. Cidex Plus for 10 hrs. at 20-25° C) or 7.5% hydrogen peroxide (e.g. Sporox Sterilizing and Disinfection Solution for 6 hours at 20° C) according to manufacturer's instructions.

Instruments may be cleaned, wrapped and sterilized in a room separate from the animal prep room and the O.R. or may share the surgeon prep room as long as a different sink is used for each function.

## **Surgeon Pre-Operative Preparation and Area**

The surgeon pre-operative preparation area must be physically separated from the pre-operative animal preparation area and the operating room. The area may be shared with instrument preparation but using a different sink.

The surgeon must wear a face mask, cap, shoe covers and surgical scrub top and bottom before scrubbing hands.

The surgeon must wash his/her hands with an antiseptic surgical scrub for a minimum of three minutes using ten scrubs per surface working from the finger tips down and then aseptically put a sterile gown followed by sterile gloves.

## **Animal Recovery and Area**

The animal recovery from a surgical plane of anesthesia may be staged with first steps occurring in the Operating Room where physiological parameters (heart rate, PO<sub>2</sub>, respiratory rate, return of reflexes, ..) may be safely monitored. Final stages of recovery may occur in the animal room enclosure (e.g. primates) or in the animal preparation area in a recovery transport cart (e.g. dog, cat, swine) before being returned to the animal housing room.

Criteria for assessing when it is safe to remove the endotracheal tube include: an easily elicited tracheal cough, an increase in jaw tone and resumption of swallowing activity.

Animals should be recovered from anesthesia in a warmed environment. Post procedural or anesthetized animals may not be left unattended until fully recovered, able to ambulate, with pink mucous membranes and stable respirations. Close observation provides the opportunity for early detection and response to potentially life-threatening problems.

The responsible individual must record the time the animal is returned to housing on the DLAM POST-OP RECORD ([www.urmc.rochester.edu/vivarium](http://www.urmc.rochester.edu/vivarium)). The person must also describe the animal's condition by recording the quality and/or rate of respirations, mucous membrane color and/or capillary refill time and the response of various reflexes (e.g. palpebral, corneal, righting reflexes, quality of jaw tone). Pertinent intra-operative complication, post-operative orders or other observations should be recorded on the Post-Op Chart. The individual writing post-operative orders must make sure that antibiotic and/or analgesic agents, dosages, routes and treatment intervals are included on the chart. Investigators must designate who is responsible for providing post-op medication (DLAM or PI's Staff). Post-op orders must be the same as those stated in the UCAR protocol. The Post-Op Chart must be delivered to DLAM office (G6726) during working hours or the Animal Report Form mailbox after business hours.

The DLAM veterinary staff routinely monitors all post-op USDA regulated animals for a minimum of three days. The investigator will be informed of any complications observed before the animal is taken off post-op rounds.

## **MINOR INVASIVE RECOVER SURGERY**

Minor invasive surgery does not penetrate a body cavity and includes relatively minor operative procedures such as Lasik™ corneal surgery and eye coil removal.

Pre-operative animal and surgeon preparation and intra-operative procedures for minor invasive surgery on regulated species does not require a dedicated room. Surgeons must wear sterile gloves and use sterile surgical instruments. Animal preparation techniques, aseptic procedures, anesthetic depth monitoring, recovery methods and the associated documentation must be followed as described for major invasive surgery above.

## **Anesthetics and Analgesics**

Anesthetics and Analgesics must be administered as described in the UCAR approved protocol. Systemic analgesics should be considered for all species experiencing major survival surgical procedures as well as for animals undergoing minor procedures that may result in post-op discomfort. Analgesics administered prior to the surgical manipulation are beneficial for pain relief in laboratory animals. If there is potential for postoperative pain, the animal is given the benefit of the doubt and analgesic therapy should be initiated. It is necessary that drugs be given at the dosing interval stated in the UCAR protocol. The decision to discontinue analgesic therapy should be made based on the observation that the animal appears to be comfortable at the end of the previous dosing interval (i.e. when the next analgesic treatment is due).

### **Anesthetics and Analgesics used in Gerbils**

<b>Anesthesia in Gerbils</b>	<b>Dose &amp; Route</b>
Telazole (Tiletamine/zolazepam)	60 mg/kg IP (use lower dose for restraint)
Ketamine + xylazine or acepromazien	60-90 mg/kg + 4 - 8 mg/kg or 1-2 mg/kg IP
Ketamine + medetomidine	75 mg/kg + 0.5 mg/kg SQ or IP
Ketamine + medetomidine	40 mg/kg + 0.5 mg/kg SQ or IP
Ketamine + xylazine	50-70 mg/kg + 2 - 3 mg/kg SQ or IP
Ketamine + Diazepam	100 mg/kg + 5 mg/kg SQ or IP
Sodium Pentobarbital	60-90 mg/kg IP. <i>Recommended to dilute commercial product 1:1 with sterile saline to provide larger margin of safety</i>
Isoflurane	0 - 5 % to effect
<b>Analgesia in Gerbils</b>	
Buprenorphine (Buprenex)	0.1 mg/kg SQ every 6 - 8 hours
Flunixin (Banamine)	2.5 - 5.0 mg/kg SQ every 12 - 24 hours. <i>Five day maximum for treatment</i>

### **Anesthetics and Analgesics used in the Syrian Hamster**

<b>Anesthesia in the Syrian Hamster</b>	<b>Dose &amp; Route</b>
Ketamine + Xylazine	150 - 200 mg/kg + 10 mg/kg IP
Sodium Pentobarbital	60-90 mg/kg IP. <i>Recommended to dilute commercial product 1:1 with sterile saline to provide larger margin of safety</i>

Isoflurane	0 - 5 % to effect
<b>Analgesia in the Syrian Hamster</b>	
Buprenorphine (Buprenex)	0.1 mg/kg SQ every 6 - 8 hours
Flunixin (Banamine)	2.5 - 5.0 mg/kg SQ every 12 - 24 hours. <i>Five day maximum for treatment</i>

### Anesthetics and Analgesics used in Guinea Pigs

<b>Anesthesia in Guinea Pigs</b>	<b>Dose &amp; Route</b>
Ketamine + xylazine	35 mg/kg + 5 mg/kg IP
Ketamine + xylazine	40 - 80 mg/kg + 5 - 10 mg/kg IP
Ketamine + medetomidine	40 mg/kg + 0.5 mg/kg SQ or IP
Sodium Pentobarbital	35 - 45 mg/kg IP
Isoflurane	0 - 5 % to effect
<b>Analgesia in Guinea Pigs</b>	
Buprenorphine (Buprenex)	0.05 mg/kg SQ every 6 - 12 hours
Meperidine (Demerol)	10 - 20 mg/kg SQ or IM every 2 - 3 hours
Morphine	2 - 5 mg/kg SQ or IM every 4 hours
Flunixin (Banamine)	2.5 - 5.0 mg/kg every 12 - 24 hours. <i>Five day maximum for treatment</i>

### Anesthetics and Analgesics used in Ferrets

<b>Anesthesia in Ferrets</b>	<b>Dose &amp; Route</b>
Ketamine + Xylazine	25 mg/kg + 2.5 mg/kg IM
Isoflurane	0 - 5 % to effect
<b>Analgesia in Ferrets</b>	
Buprenorphine (Buprenex)	0.01 - 0.03 mg/kg SQ, IM or IV every 8 - 12 hours
Butorphanol (Torbugesic)	0.1 – 0.5 mg/kg IM every 12 hours
Flunixin (Banamine)	0.5 – 2.0 mg/kg SQ, IV 12 - 24 hours
Meperidine (Demerol)	5 - 10 mg/kg SQ, IM, IV every 2 - 4 hours

### Anesthetics and Analgesics used in Rabbits

<b>Anesthesia in Rabbits</b>	<b>Dose &amp; Route</b>
Ketamine + Xylazine	44 mg/kg + 5 mg/kg SQ* or IM. SQ is preferred route of administration
Ketamine + Xylazine	35 - 50 mg/kg + 5-10 mg/kg SQ* or IM. SQ is preferred route of administration
Sodium Pentobarbital	20 - 60 mg/kg IV. Apnea is common
Fentanyl + Droperidol	0.04 - 0.2 mg/kg + 2-10 mg/kg IM
Fentanyl + Droperidol	(0.4 mg/ml + 20 mg/ml) given at 0.3 – 0.5 ml/kg IM provides anesthesia. Dosage of 0.125 ml/kg IM provides sedation vasodilatation for easy blood collection from central ear artery.
Acepromazine	0.25 – 0.75 mg/kg IM for blood collection from central ear artery

Isoflurane	0 - 5 % to effect
<b>Analgesia in Rabbits</b>	
Buprenorphine (Buprenex)	0.01 - 0.05 mg/kg SQ every 6 -12 hours
Butorphanol (Torbugesic)	0.1 - 0.5 mg/kg SQ, IV, IM every 2 - 4 hours
Flunixin (Banamine)	1 - 2 mg/kg SQ every 12 - 24 hours
Meloxicam (Metacam)	0.2 mg/kg SQ or 0.3 mg/kg PO once a day

### Anesthetics and Analgesics used in Cats

<b>Anesthesia in Cats</b>	<b>Dose &amp; Route</b>
Sodium Pentobarbital	25 mg/kg IV calculated dose to effect. Atropine 0.04 mg/kg IM or IV prevents bradycardia
Ketamine	10 mg/kg IM. Chemical restraint only for noninvasive procedures or for induction
Ketamine + diazepam	10 mg/kg + 0.5 mg/kg IV (mix together). Give 50% dose, then give smaller volumes as needed for induction
Ketamine + xylazine	4.6 mg/kg + 0.23 mg/kg IM
Isoflurane	0 - 5 % to effect
<b>Analgesia in Cats</b>	
Morphine	0.1 mg/kg SQ every 4 - 6 hours
Buprenorphine (Buprenex)	0.004 - 0.01 mg/kg SQ every 8 -12 hours
Butorpanol (Torbugesic)	0.1 - 0.4 mg/kg SQ every 6 hours
Meloxicam (Metacam)	0.2 mg/kg PO, IV, SQ on Day 1; then 0.1 mg/kg once a day subsequent days

### Anesthetics and Analgesics used in Dogs

<b>Anesthesia in Dogs</b>	<b>Dose &amp; Route</b>
Sodium Pentobarbital	25 mg/kg IV calculated dose to effect. Atropine (0.04 mg/kg IM or IV prevents bradycardia
Ketamine + diazepam	10 mg/kg + 0.5 mg/kg IV – <i>mix together and give 50% dose, then in small increments as needed – for induction</i>
Isoflurane	0 - 5 % to effect
<b>Analgesia in Dogs</b>	
Meperidine (Demerol)	2 - 10 mg/kg IM or SQ every 2 - 3 hours
Buprenorphine (Buprenex)	0.01 - 0.04 mg/kg SQ every 8 -12 hours
Flunixin meglumine (Banamine)	1 mg/kg IV or IM every 24 hours. <i>Five day maximum treatment</i>
Butorphanol (Torbugesic)	0.2 - 0.4 mg/kg SQ or IM or IV every 2 - 5 hours
Meloxicam (Metacam)	0.2 mg/kg PO, IV, SQ on Day 1; then 0.1 mg/kg once a day for subsequent days

## Anesthetics and Analgesics used in NHP

<b>Anesthesia in the NHP</b>	<b>Dose &amp; Route</b>
Sodium Pentobarbital (25 mg/kg)	IV calculated dose given to effect, Atropine (0.04 mg/kg) IM or IV prevents bradycardia.
Ketamine + diazepam	10 - 15 mg/kg + 0.25 - 0.5 mg/kg IM for CHEMICAL RESTRAINT ONLY FOR NONINVASIVE PROCEDURES or FOR INDUCTION
Isoflurane	0 – 5 % to effect
<b>Analgesia in the NHP</b>	
Tylenol Pediatric Suspension	10mg/kg orally every 6-12 hours
Meloxicam (Metacam)	0.1 – 0.2 mg/kg IM, PO, SQ once a day (0.2 mg/kg on day one, then 0.1 mg/kg)
Flunixin	1.1 mg/kg IM, SQ every 12 - 24 hours
Buprenorphine (Buprenex)	0.01 – 0.04 mg/kg SQ every 6 -12 hours
Meperidine (Demerol)	2 - 4 mg/kg IM every 8 – 12 hours
Butorphanol (Torbugesic)	0.1 – 0.2 mg/kg IM every 12 - 48 hours

## Anesthetics and Analgesics used in Pigs

<b>Anesthesia in Pigs</b>	<b>Dose &amp; Route</b>
Ketamine + Acepromazine	22 mg/kg + 1.1 mg/kg IM
Sodium Pentobarbital	20 mg/kg IV calculated dose given to effect. Atropine 0.04 mg/kg IM or IM prevents bradycardia
Isoflurane	0 – 5 % to effect
<b>Analgesia in Pigs</b>	
Meperidine	2 -10 mg/kg IM or SQ every 2 – 4 hours
Buprenorphine (Buprenex)	0.005 - 0.01 mg/kg SQ every 6 -12 hours
Flunixin meglumine (Banamine)	0.5 – 1.0 mg/kg SQ, IV every 12 - 24 hours. <i>Five day maximum treatment</i>
Butorphanol (Torbugesic)	0.1 – 0.3 mg/kg IM or IV every 8 -12 hours

### Anesthetic Waste Gas

The NIH Guide for Care and Use of Laboratory Animals (National Academy Press, 1996) states: “Exposure to anesthetic waste gases should be limited. This is usually accomplished by using various scavenging techniques.”

For surgical procedures, when animals are maintained on isoflurane anesthesia. Anesthetists must take appropriate actions to prevent exposure to waste anesthetic gases. For example:

- Check the equipment before use to make sure all lines are free of leaks.
- Make sure the exhaust line for the anesthesia equipment is vented into a chemical fume hood or a ducted biological safety cabinet.

- Make sure the induction chamber is closed except for placing animals in to the chamber or removing them.

Should personnel believe they are exposed to waste anesthetic gases, please contact EH&S to arrange for chemical monitoring.

If anesthetic waste gas is scavenged by other methods, this must be reviewed and approved by EH&S and described in your protocol.