Aseptic Rodent Surgery

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Aseptic Surgery for Rodents

- Regulatory requirements
- Location for rodent surgery
- Establish a sterile field
- Surgeon preparation
- Patient preparation
- Surgery
- Post-surgical considerations
- Special considerations in rodent surgery

Regulatory Requirements

Animal Welfare Act and Regulations
Animal Welfare Information Center
United States Department of Agriculture
Agricultural Research Service
National Agricultural Library
### Regulatory Requirements

**PHS Policy & The Guide:**
- Aseptic surgery: Techniques that reduce microbial contamination to the lowest possible practical level.
- Includes preparation of the patient, surgeon, instruments, supplies and implanted materials.
- Includes operative techniques to reduce the likelihood of infection.
- Pre-surgical planning is necessary!

The Guide says:
- Appropriate pre-operative and post-operative care of animals IAW established veterinary medical and nursing practices.
- All survival surgery performed by using aseptic procedures, including sterile gloves, masks, sterile instruments, & aseptic techniques.
- A dedicated surgical facility is not required for rodents, but surgery must be performed using aseptic techniques.

The Guide says, that good technique includes:
- Pre-procedure (and procedural) asepsis
- Gentle tissue handling
- Minimal dissection of tissue
- Appropriate use of instruments
- Effective hemostasis
- Correct use of suture materials and patterns
What is a rodent?

Location Requirements

- Isolated from other activities (during sg)
- Easy to sanitize
- Separate anesthesia and hair removal
- Out of air flows and traffic paths

The Guide states:
“For most rodent surgery, a facility may be small and simple, such as a dedicated space in a laboratory appropriately managed to minimize contamination from other activities in the room during surgery” and rodent surgery “should be conducted only in facilities intended for that purpose.”

Sterile Field – The goal …
Asepsis - freedom from infection; the prevention of contact with microorganisms.

Aseptic Technique - methods by which contamination with microorganisms is prevented.

Clean - to remove all visible dirt and organic matter (reduces microbial numbers but does not disinfect nor sterilize).

Disinfect - to chemically or physically destroy all pathogenic microorganisms except spore-bearers.

Sterile - free of microorganisms, including spores.

Sterile Field Arrangement (single)

Sterile Instruments Required

Sterilize instruments and supplies:
- Begins with cleaning
  - Thoroughly clean surfaces
    - Washing to remove tissue, blood or oils
    - Brush to clean the lock, hinge and grasping or cutting surfaces of instruments.
Sterilization

**DOWNWARD DISPLACEMENT STERILIZER**
- Air is heavier than steam
- Steam forces air out
- Valve closes

**CRITICAL ISSUES**
- CAREFUL WRAPPING!
- CAREFUL LOADING!

- Heat between 121 to 134 degrees centigrade
  - 15 minutes @ 121°C
  - 3 minutes @ 134°C

**PRE-VACUUM STERILIZATION**
- More rapid and efficient steam penetration
- Pulls air (out) – vacuum
- When the wrapper is carefully opened, it provides a sterile surface for the instruments during the surgical procedure.

**FLASH STERILIZATION** is performed when a non-sterile item needs to be sterilized quickly.
- Item is placed unwrapped in a perforated metal tray and sterilized according to the manufacturer's time and temperature recommendations.
- The sterilized items are transported to the OR in the metal tray.
- Difficult to deliver flash-sterilized devices aseptically (tray is hot, wet and instruments are unwrapped)

**DRY HEAT STERILIZATION:**
- Best to use forced air
  - 2 hours @ 160°C (320°F) ... or ...
  - 6 minutes @ 190°C (374°F) for unwrapped objects
  - 12 minutes @ 190°C (374°F) for wrapped objects

- Dry heat is best for powders and metals
Sterilization

- Chemical sterilization:
  - Bench top soaking:
    - Required time frame can be quite long
    - 30 hours for 70% ethyl alcohol
    - 24 hours for povidone iodine
    - 10 hours for glutaraldehyde.
  - Peracetic Acid:
    - Fully automated and the residual can go down the drain safely.
    - Rinse chemically sterilized instruments with either sterile saline or sterile water prior to use; chemicals may be irritating to skin and tissue!
    - Chemical sterilant solutions are usually changed weekly. More frequent changing is recommended if the solution becomes contaminated with blood or other fluids.

Sterilization

- Ethylene oxide
  - Effective sterilizing agent (kills everything)
  - Mixed with carbon dioxide
  - Items that cannot withstand the extremes (endoscopes, cameras, plastics, power cables, transducers and catheters).
  - Should be aerated in a well-ventilated area for minimum of 7 days or 12-18 hours in an aerator.
  - Items should be clean and dry prior to sterilization since moisture and organic material bonds with ethylene oxide and leaves a toxic residue.

Sterilization

- Used BETWEEN procedures
  - 10 – 30 seconds
  - Cool in sterile saline!
  - Use for rodents ONLY!
Sterile Field

- Ionizing Radiation:
  - Pre-packaged
  - Sutures
  - Spongers
  - Disposable items
  - Powders
  - Petroleum goods

Sterile Field

- Plasma Sterilization:
  - Low-temperature sterilization that uses reactive ions, electrons, and neutral atomic particles
  - One form is vapor phase hydrogen peroxide sterilization
  - Aeration is not required
  - Items must be wrapped in polypropylene, nonwoven fabric
  - Not all items that can be sterilized safely with plasma:
    - Linen
    - Gauze
    - Wood (including paper)
    - Some plastics
    - Liquids
    - Items with copper
    - Silver solder or diphenele A epoxy
    - Tubes and catheters greater than 12 inches
    - Tubes and catheters less than 3mm in diameter

Sterile Field

- Packs will stay sterilized longer if the pack is wrapped
- Wrap them before sterilization to prevent contamination
- Wrappers must be sufficiently porous to allow penetration of sterilant while protecting from particulate contamination.
- Sterile packs are usually marked with the date of autoclaving.
- There are a variety of expiration dates from weeks to months to a year based upon the type of wrapper, the method of sealing and the method of storage.
- Some labs use an indefinite shelf life based upon event-related sterility.
- The basis is that events not time contaminate products.
- If items are packaged, sterilized and handled properly, they remain sterile unless the package is opened, wet, torn, has a broken seal or is damaged in some other way (i.e., event-related expiration).
- To use an event-related expiration system, appropriate protocols for sterilizing and handling items must be adopted.
What does the tape stripping mean?

Internal indicator

External indicator

What does the color change mean?

BACTERIAL SPORES (Bacillus subtilis)
MYCOBACTERIA (Mycobacterium tuberculosis)
NONLIPID OR SMALL (NON-ENVELOPED) VIRUSES (polio, parvo)
FUNGII (Trichophyton spp.)
VEGETATIVE BACTERIA (Pseudomonas aeruginosa, Staphylococcus aureus)
LIPID OR MEDIUM-SIZED (ENVELOPED) VIRUSES (herpes simplex, hepatitis B, HIV)

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Sterile Field

Bowie-Dick Test:
- Evaluates vacuum systems
- Does not measure efficacy of sterilization

Surgeon Preparation

The Effective Surgeon:
- Good technique (overall)
  - Asepsis
  - Gentle tissue handling
  - Minimal dissection of tissue
  - Appropriate use of instruments
  - Effective hemostasis
  - Correct use of suture materials
- Good technique (standard):
  - Face mask
  - Scrub top or clean lab coat
  - Head cover
  - Surgical gloves
- Good technique (for tips only procedures):
  - Surgical gloves
• Long fasting is not appropriate for rodents!
• Rodents cannot regurgitate.
• Fasting (if used) does not include water!

Gas Anesthesia Requirements
Some anesthetics such as ketamine abolish the blink reflex!
Apply ophthalmic ointment in the eyes to prevent the corneas from drying during anesthesia.
Peri-operative Considerations

Monitoring:
- Visually inspect mucous membranes and exposed tissues
  - Bright pink to red
  - Not dusky gray or blue.
- Respiratory pattern and frequency
- Core body temperature
- Pulse oximetry
- Electrocardiograms
- Capnography

Intra-operative Considerations

Pedal reflexes slow and gradually disappear with depth of anesthesia
Intra-operative Considerations

- DO NOT USE EYE REFLEXES:
  - Eye reflex is not consistent
  - Adnexal reflex is not consistent
  - Pupil location is not consistent
  - Pupil size is not consistent
  - Pupil movement is not consistent

Intra-operative Considerations

- Heat loss is a concern:
  - Ratio of body surface to mass is great in small rodents
  - Greatest heat loss are the ears, the tail, and the soles of the feet
  - Concerns with intra-operative
    - Tissue heat loss
    - Decreased metabolism
  - Heat loss can be counteracted:
    - Circulating hot water
    - Circulating air blanket
    - Hot water bottles
    - Incandescent lamp
    - Use of insulating surface
  - AVOID: Electric heating pads!!!

Intra-operative Considerations

- Fluid loss is important!
  - Maintaining fluid balance is especially important to ensure proper detoxification and/or excretion of injectable anesthetic agents.
  - Suggestions for fluid replacements:
    - Sterile, Isotonic, Warmed to B. Temp.
    - 3 to 5% of the animal’s body weight
    - Subcutaneous (SC) fluids will provide for a smoother, quicker recovery period.
    - Administered during or following surgery
    - SC absorption is rapid in rodents
Intra-operative Considerations

Preoperative: Animal Prep

Intra-operative Considerations

Intra-operative Considerations

Wound Closure
- Large incisions
  - use multiple layer closure
- Skin closures
  - staples
  - wound clips
  - sutures
Intra-operative Considerations

• Routinely administering systemic antibiotics after surgery is NOT necessary if good aseptic technique has been practiced!
• Water provided antibiotics & neophobia
• Guinea pigs & hamsters cannot receive penicillin
• Antibiotic administration for treatment of infection should be guided by clinical situation, the result of bacterial culture and determination of antibiotic sensitivity!

Post-surgical Considerations

• Postoperative analgesia is based on the protocol, veterinary evaluation of the patient, or historical (variable related) experience
• Assessment parameters include:
  • Food and water intake
  • Activity
  • Postural adjustments
  • ‘Attitude’
  • Vocalization
KEY: YOU MUST KNOW NORMAL!!!

• If analgesics are administered, the treatment, date, and time should be recorded and initialed!
Post-surgical Considerations
Abdominal incisions:
- Will be in direct, constant contact with bedding material …
- Consider increased cage changing frequency as an aid in wound care

Why is aseptic technique important?
- Rodents can develop post-operative infections.
- Infections may confound or alter experimental results
- Antibiotics may confound or alter experimental results
- GPs and hamsters are intolerant of many antibiotics

Monitoring Incisions:
- Incisions should be examined daily
- Signs of infection: redness, swelling, oozing, dehiscence
Special Considerations

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Questions