

## **CHAPTER 13**

### **GUIDELINES FOR RODENT OR AVIAN SURGERY**

The "Guide for the Care and Use of Laboratory Animals" states that survival surgery (or avian) should be performed using aseptic technique. The Guide further defines aseptic technique to include preparation of the patient, such as hair removal and disinfection of the operative site; preparation of the surgeon, such as the provision of decontaminated surgical attire, surgical scrub, and sterile surgical gloves; sterilization of instruments, supplies and implanted materials; and the use of operative techniques to reduce the likelihood of infection. The Guide states that non-survival procedures should at a minimum include surgical site clipped, use of gloves by the surgeon, and the surrounding area should be clean.

Major survival surgical procedures penetrates and exposes a body cavity or produces substantial impairment of physical or physiologic functions (such as laparotomy, thoracotomy, craniotomy, joint replacement and limb amputation). Major survival surgery on birds should be performed using aseptic technique as defined above. Appropriate anesthetic and analgesia are required.

Minor surgical procedures do not expose a body cavity and causes little or no physical impairment (such as wound suturing; peripheral vessel cannulation; and most procedures routinely done on an "outpatient" basis in veterinary clinical practice). Minor procedures are often performed under less stringent conditions than major ones but still require aseptic practices and instruments and appropriate anesthesia. Although laparoscopic procedures are often performed on an "outpatient" basis, appropriate aseptic technique is necessary if a body cavity is penetrated.

#### I. Procedures for Rodent or Avian Major Survival Surgery

These guidelines apply to all major surgical procedures performed on rodents or birds in which the animals are expected to recover from anesthesia

##### A. Area

1. A separate facility for rodent or avian surgery is not necessary. The rodent or avian surgical area can be any room or portion of a room that is easily sanitized. The immediate surgical area should not be used for other purposes during the time of surgery. Surgery should be conducted on a disinfected (Table 1), uncluttered area which promotes asepsis during surgery. Surgical table and support instruments, e.g. head frames or heating blankets, should be cleaned and wiped with disinfectant. Asepsis can be simplified by applying a drape over the surface.
2. Specific areas should be designated for animals awaiting surgery, prepping, surgery and recovery to prevent cross-contamination.

## B. Surgical Instruments

1. Surgical instruments, implants or supplies that come in contact with the animal must be sterilized for use in rodent or avian survival surgery. (Table 2) Several techniques (steam, dry heat, ethylene oxide, or chemical agents) can be used for sterilization (see Table 2 below). Quaternary ammonium compounds and alcohol are not acceptable. Be sure to follow the guidelines for each method.
2. For multiple surgeries, instruments should be disinfected between animals. After using a set of instruments, remove all organic material and then immerse the instruments in an appropriately diluted disinfectant. (Table 3) Be sure to follow the guideline for each method and rinse the instruments in sterile saline. One may also soak the instruments in 70% ethanol between animals. A glass bead sterilizer may also be used.
3. A new sterile instrument pack should be used after every 4 or 5 major surgical procedures.

## C. Preparation of the Animal

1. Prior to taking the animals to the surgery area, remove all hair for at least a centimeter on either side of the surgical site. Hair can be removed by clipping with a #40 clipper blade, shaving with a razor, plucking (in anesthetized mice or similar-sized rodents), or by using a depilatory cream. Then vacuum or otherwise remove loose hair.
2. Disinfect the skin by using 70% alcohol or a surgical iodine solution. (Table 4) Carefully scrub the area with a new clean surgical sponge or sterile cotton swab. Scrub in a gradually enlarging circular pattern from the center of the incision site to the periphery. The sponge or swab should not be brought back from the contaminated periphery to the clean central area. This process should be repeated a minimum of 3 times and the disinfectant should come into contact with the skin for a minimum of three minutes before the initial incision. To prevent hypothermia, try not to wet the animal any more than necessary.
3. Place lubricating ophthalmic ointment in the anesthetized animals' eyes to prevent drying.
4. Maintain body temperature using a circulating water blanket, warm water bottle, or equivalent external heat source taking care to not cause thermal burns to the animals' skin. The temperature of such devices should be set at 29-32°C (85-90° F).
5. Draping the animal with sterile drapes to avoid contamination of the incision, instruments and supplies is strongly recommended.

- D. Preparation of the Surgeon
1. Surgeons should wear a clean scrub shirt or a lab coat. Surgeons should also wear a surgical mask and sterile gloves.
  2. Surgeons should wash their hands with an appropriate surgical scrub (e.g. Betadine Scrub, Nolvasan Scrub). Surgeons should wear sterile gloves. Surgeons may wipe their gloves for 30 seconds with sterile gauze pads soaked in 70-90% alcohol between animals.
- E. During Surgery
1. The animal must be maintained in a surgical plane of anesthesia throughout the procedure (i.e. absence of pedal reflex).
  2. Begin the surgery with sterile materials and handle them aseptically. The sterile field must be kept sterile throughout the procedure. Sterile instruments must be prevented from contacting non-sterile surfaces. Instruments must be placed on the sterile surface when not in use.
  3. Monitor and/or maintain the animal's vital signs.
  4. Close the body wall with absorbable suture material. Close the skin with a separate layer, using tissue adhesive, staples, wound clips or a non-absorbable suture material in a simple interrupted pattern. Do not use silk for skin closure. Use a 3-0 or 4-0 monofilament non-absorbable suture for rats and 5-0 or 6-0 for mice..
- F. Postoperative Care
1. After surgery the animal should be placed back in a cage that is lined with an absorbent pad. Animal bedding should not be present since the unconscious animal may aspirate bedding. Prevent hypothermia by placing the animals in a warm room or cage. Supplemental heat can be provided beneath the animal's cage or by a heat bulb above the cage. The cage should be warmed to no greater than 25° C (85° F). To prevent hyperthermia, animals must be provided a means to migrate away from the heat source once they are awake.
  2. Warmed (25-27 ° C) fluids administered during or after the surgical procedure can hasten recovery and reduce the risk of anesthesia induced hypothermia and dehydration. Warmed saline or balanced electrolyte solution given intraperitoneally will speed recovery. Give .25-.5 ml to mice and 3-5ml to rats.
  3. Return the animal to its routine housing only after it has fully recovered from anesthesia. They should be sternal and clearly beginning to wake up. To prevent cannibalism or suffocation, house rodents individually until they are ambulatory. Birds should also be housed individually to prevent injuries.

4. Analgesics should be administered during surgery or immediately postoperatively. Analgesics should be repeated as necessary as long as the animal is likely to show post-operative pain which is usually up to 48 hours.
  5. Remove skin sutures or staples 7 to 10 days post-operatively.
  6. Members of the investigator's staff or other individuals to whom postoperative care has been delegated should oversee the animal daily until all sutures, wound clips or other implanted devices have been removed.
- G. Records
1. Maintain a surgical record. List the procedure and date either on the cage card or in a file maintained in the animal's room. Note suture or staple removal. Maintain the records as long as the protocol is active.
- H. Tables
1. Recommended Hard Surface Disinfectants
  2. Recommended Instrument Sterilants
  3. Sterilization Procedures
  4. Recommended Instrument Disinfectants
  5. Suture Selection

**Table 1.** Recommended Hard Surface Disinfectants (e.g. table tops, equipment)

| Agent               | Examples*   | Comments   |
|---------------------|---|--|
| Alcohols            | 70% ethyl alcohol<br>85% isopropyl alcohol                            | Contact time required is 15 minutes. Contaminated surfaces take longer to disinfect. Remove gross contamination before using. Inexpensive.                     |
| Quaternary Ammonium | Roccal, Cetylcide   | Rapidly inactivated by organic matter. Compounds may support growth of gram negative bacterium.  |
| Chlorine            | Sodium hypochlorite (Clorox 10%)<br>Chlorine dioxide (Clidox, Alcide) | Corrosive. Presence of organic matter reduces activity. Chlorine dioxide must be fresh (<14 days old); kills vegetative organisms within 3 minutes of contact. |
| Aldehydes           | Glutaraldehyde (Cidex, Cide Wipes)                                    | Rapidly disinfects surfaces. Toxic. Exposure limits have been set by OSHA.   |
| 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.                                       |

\*Always follow manufacturer's instructions.

**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 2.** Recommended Instrument Sterilants

| Agent   | Examples*  | Comments  |
|---|--|---|
| Physical:<br>Steam<br>sterilization<br>(moist heat) | Autoclave  | Effectiveness dependent upon temperature, pressure and time (eg. 121°C for 15 min vs. 131°C for 3 min)  |
| Dry Heat  | Hot Bead Sterilizer<br>Dry Chamber               | Fast. Instruments must be cooled before contacting tissue.  |
| Gas<br>Sterilization                                | Ethylene oxide                                   | Requires 30% or greater relative humidity for effectiveness against spores. Gas is irritating to tissue; all materials require safe airing time.                |
| Chemical**  | Sporicidin, clidox, Sporclenz                    | Presence of organic matter reduces activity. Must be freshly made (<14 days).   |
| Aldehydes**   | Formaldehyde (6% soln)<br>Glutaraldehyde (Cidex) | For all aldehydes, many hours are required for sterilization. Corrosive and irritating. Glutaraldehyde is less irritating and less corrosive than formaldehyde. |

\*Always follow manufacturer's instructions.

\*\* Instruments must be rinsed thoroughly with sterile water or saline to remove chemical sterilants before being used.

**Sterilization:** The process whereby all viable microorganisms are eliminated or destroyed.

Sterilization procedures:

1. High pressure/temperature steam sterilization using an autoclave and appropriate monitoring systems to assure sterility.
2. Gas sterilization with ethylene oxide, using an approved gas sterilizer and appropriate monitoring systems to assure sterility and personnel safety.
3. Dry heat sterilization utilizing devices manufactured for bench-top sterilization of instruments. These devices heat a vessel of glass beads to a stable temperature of 250 degrees F. Instruments must be free of surface contamination. They sterilize in 10 seconds and are invaluable for maintaining asepsis during "batch" surgery of multiple animals.
4. Chemical sterilization:

Effective and proper use of chemical sterilization is dependent on many factors, including:

- a. The use of chemicals classified as sterilants. Those classified as disinfectants are not acceptable.
- b. The physical properties of the item(s) being sterilized. Items must be relatively smooth, impervious to moisture, and be a shape that permits all surfaces to be exposed to the chemical sterilant.
- c. The assurance of proper exposure.
  - Items must be free of all surface contamination (i.e., clean) and arranged to assure total immersion. All interior and exterior surfaces must be exposed to the chemical (tubing must be filled, etc.)
  - Items must remain in the chemical for a sufficient time period. Exposure times must follow the recommendations of the chemical manufacturer for sterilization.
  - Use of active solution. The chemical sterilants have finite shelf lives and use of them must be limited to within these guidelines, which is

generally one to four weeks. Furthermore, the solutions must be protected from contamination.

- d. Rinsing the chemicals from the sterilized items prior to their use. Sterile water or saline should be used to rinse the instruments, implants and tubing (inside and outside) prior to use to avoid tissue damage to the animals.

**Table 3. Recommended Instrument Disinfectants**

| <b>Agent</b>  | <b>Examples*</b>   | <b>Comments</b>   |
|---------------|--|---|
| Alcohols      | 70% ethyl alcohol<br>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%soln)<br>Chlorine dioxide (Clidox, Alcide) | Corrosive. Presence of organic matter reduces activity. Chlorine dioxide must be fresh (<14 days old); kills vegetative organisms within 3 min. |
| Chlorhexidine | Nolvasan, Hibiclens  | Presence of blood does not interfere with activity. Rapid bactericidal and persistent. Effective against many viruses.                          |

\*Always follow manufacturer's instructions.

\*\* Instruments must be rinsed thoroughly with sterile water or saline to remove chemical sterilants before being used.

**Table 4. Skin Disinfectants**

| Agent         | Examples*           | Comments  |
|---------------|---------------------|---|
| Iodophors     | Betadine, Propodyne | Reduced activity in presence of organic matter. Wide range of microbicidal action. Works best at pH 6-7.  |
| Chlorhexidine | Nolvasan, Hibiclens | Presence of blood does not interfere with activity. Rapidly bactericidal and persistent. Effective against many viruses. Excellent for use on skin. |

\*Always follow manufacturer's instructions.

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

**Table 5. Suture Selection**

| Suture                               | Characteristics and Frequent Uses  |
|--------------------------------------|--|
| Vicryl, Dexon                        | Absorbable, 60-90 days. Ligate or suture tissues where an absorbable suture is desired.  |
| PDS or Maxon                         | Absorbable, 6 months. Ligate or suture tissues especially where an absorbable suture and extended wound support is desirable.                      |
| Prolene                              | Nonabsorbable; inert.  |
| Nylon                                | Nonabsorbable; inert.  |
| Silk                                 | Nonabsorbable. (Caution: Tissue reactive and may wick microorganisms into the wound.) Excellent handling. Preferred for cardiovascular procedures. |
| Chromic Gut                          | Absorbable. Versatile material.  |
| Stainless Steel Wound Clips, Staples | Nonabsorbable. Requires instrument for removal.  |

- 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, intestine or blood vessels.

