

# Essential VETERINARY SURGERY



Edited by  
Adeniran Adetunji

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**Adeniran Adetunji**

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## Preface

It is common knowledge that modern surgery is both an art and a science. This book, *Essential Veterinary Surgery*, seeks to clarify the underpinning principles needed for an understanding of surgical practice on animals. Thus, it deals mainly with the core concepts and skills germane to the practice of animal surgery, rather than details of operative procedures.

The book has been divided into three sections. Section 1 deals with Basic Concepts in Surgery. It considers surgery as a medical specialty, explains surgical terminology, and describes diagnostic techniques in surgery. Section 2 is on Principles of Operative Surgery. The section discusses various topics including surgical instrumentation, surgical asepsis, basic surgical techniques, anaesthesia, wound closure etc. Section 3 is on Principles of Supportive Surgical Care. Topics such as antimicrobials in surgery, pain management, fluid therapy, etc, are discussed under the section.

*Essential Veterinary Surgery* was conceived as a result of over two decades of producing course notes on "Introductory Surgery for veterinary undergraduates". Because the book originated as lecture notes, it is of necessity a 'sketch' instead of a 'full painting', while at the same time, it shows the key features of the subject. It is hoped that this format will make the text easily accessible and digestible, and user-friendly enough to browse through at any time and for any motive.

The main audience for *Essential Veterinary Surgery* is the fourth-year veterinary student who has to pass an examination. However, the text will also be useful to residents and other surgical trainees as an easy reference material for basic information, as well as to practising veterinary surgeons for updating their current knowledge. I wish to express my deep appreciation to Dr. F.M. Lawal for proof-reading the manuscript and 'steering' it into print. I also thank Miss Esther Duru for painstakingly typing the manuscript.

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## SURGICAL ASEPSIS

O.D. Eyarefe

- ❖ *glossary*
- ❖ *potential wound contamination*
- ❖ *sterilization and disinfection*
- ❖ *preparation of personnel*
- ❖ *preparation of the patient*
- ❖ *aseptic technique*

### A. Glossary

1. **Antisepsis:** prevention of infection by the destruction or inhibition of microbes using a chemical agent.
2. **Antiseptic:** chemical agent that kills pathogenic microbes or inhibits their growth in the body.
3. **Asepsis:** absence of pathogenic microbes in living tissues.
4. **Disinfectant:** germicide that kills microbes or inanimate objects e.g. surgical equipment.
5. **Disinfection:** destruction of the vegetative forms of microbes, but not their spores.
6. **Sepsis:** presence of pathogens and their products in tissues.
7. **Sterilisation:** complete destruction of pathogenic microbes and their spores by physical or chemical means.
8. **Aseptic technique:** includes all the steps taken to prevent tissue coming into contact with microbes.



## B. Potential Wound Contamination

### 1. Sources of contamination

#### (a) Operating theatre environment

- (i) Insanitary conditions.
- (ii) Operating room air.
- (iii) Excessive traffic and movement of personnel.

#### (b) Surgical equipment

- (i) Gross contamination.
- (ii) Inadequate sterilisation.

#### (c) Surgical team

- (i) Inadequate skin preparation.
- (ii) Contaminated hands or gloves during draping procedure.
- (iii) Punctured gloves, especially in orthopaedic surgery.
- (iv) Improper and wet facemasks.
- (v) Coughing, talking.

#### (d) Animal patient

- (i) Heavy haircoat.
- (ii) Improper skin preparation.
- (iii) Unprepared skin adjacent to surgical incision.
- (iv) Trauma to skin during shaving and clipping.
- (v) Surgical invasion of abscess cavities.
- (vi) Surgical invasion of gastro-intestinal, urogenital and respiratory tracts.
- (vii) High density of indigenous bacteria in perineal, vulval, preputial, anal and respiratory regions.

### 2. Prevention of contamination

#### (a) Preoperative period

- (i) Maintenance of the operating theatre.
- (ii) Sterilisation of surgical equipment.

#### (b) Operative period

- (i) Preparation of personnel.
- (ii) Preparation of the patient.
- (iii) Aseptic technique at operation.

#### (c) Postoperative period

- (i) Dressings to protect wound from contamination.
- (ii) Collars or other restraint devices to protect wound from self-trauma.
- (iii) Dressings over drains to prevent ascending microbial contamination.
- (iv) Wound dressing changes using aseptic technique.

## C. Sterilisation and Disinfection

### 1. Autoclaving

#### (a) Mode of action

- (i) Autoclaves operate by steam under pressure.
- (ii) Steam penetrates each surgical pack and porous articles and imparts heat to the materials by condensation.
- (iii) Only clean, oil-free instruments should be loaded.
- (iv) Loose arrangement and packing ensures steam contact and avoids air entrapment.
- (v) Packing wrappers are only permeable to steam but not to microbes.
- (vi) Recommended sterilisation time-temperature relationships should be strictly adhered to.
- (vii) Minimum exposure time and temperature of 15 min and 121°C (250°F), respectively, is required.

#### (b) Applications

- (i) Surgical instruments.
- (ii) Linen packs - drapes, gowns, swabs.
- (iii) Most rubber articles.
- (iv) Glassware.
- (v) Some plastic goods.

#### (c) Disadvantages

- (i) Repeated use may dull delicate cutting edges of instruments.
- (ii) Inapplicable to heat-sensitive articles.

- (iii) Unsuitable for most lensed instruments.
- (iv) Cannot sterilise grease and oils.

## 2. Dry heat

### (a) Mode of action

- (i) Dry heat is produced from hot air oven.
- (ii) Dry heat kills microbes by causing oxidative destruction of bacterial protoplasm.
- (iii) It requires 1 to 2 h at a temperature above 3200F to be effective.

### (b) Applications

- (i) Glassware.
- (ii) Cutting instruments.
- (iii) Ophthalmic instruments.
- (iv) Drill bits.
- (v) Powders and oils.

### (c) Disadvantage

Easily damages fabrics, rubber goods and plastics

## 3. Gamma irradiation

### (a) Mode of action

- (i) This employs heavily shielded, intense gamma radiation source.
- (ii) Microbes are destroyed by exposure to gamma rays.
- (iii) Its use is limited to manufacturers' sterilisation of disposable items and implants.

### (b) Application

Pre-packed items, such as catheters, syringes, suture materials etc.

### (c) Disadvantages

- (i) Expensive.
- (ii) Radiation exposure potential.
- (iii) May alter some plastics and pharmaceuticals.

## 4. Ethylene oxide (EtO) gas

### (a) Mode of action

- (i) This gas is available in simple, airtight container.
- (ii) EtO is capable of destroying all known bacterial spores, fungi and larger viruses.
- (iii) EtO inactivates cellular DNA and prevents cell replication.
- (iv) Sterilisation is followed by air drying for several days to avoid diffusion of residual gas from the materials into tissues.

### (b) Applications

- (i) Fibreoptic equipment.
- (ii) Plastic catheters and syringes.
- (iii) Anaesthetic tubings.
- (iv) Optical instruments.

### (c) Disadvantages

- (i) Hazards of personnel exposure; mutagenic, carcinogenic.
- (ii) May damage some acrylic plastic materials and certain lensed instruments.

## 5. Disinfectant solutions

### (a) Alcohol

- (i) This is available commercially as either isopropyl alcohol (50%, 70% solution) or ethyl alcohol (70% solution).
- (ii) Alcohol causes protein denaturation, metabolic interruption and cell lysis.
- (iii) Bactericidal and effective against vegetative bacteria only.
- (iv) Ineffective against spores, fungi, viruses.
- (v) Useful for spot cleaning and injection site preparation.

### (b) Glutaraldehyde (Cidex)

- (i) This is available as 2% alkaline solution.
- (ii) Causes protein and nucleic acid alkylation.

- (iii) Bactericidal, fungicidal, virucidal, sporicidal (i.e. sterilises).
- (iv) Requires long (3 h) exposure time to produce sporicidal effect.
- (v) Useful for disinfecting lenses and delicate instruments.
- (vi) Associated with odour and tissue reaction (rinse instruments well before use).

(c) *Chlorhexidine (Nolvasan)*

- (i) This causes cell membrane disruption and cellular protein precipitation.
- (ii) Bactericidal, fungicidal, but has variable activity against viruses.
- (iii) Not sporicidal.

(d) *Povidone-iodine (Betadine)*

- (i) Causes metabolic interference.
- (ii) Bactericidal, virucidal, fungicidal, but poorly sporicidal.
- (iii) Subject to some inactivation by organic debris.

(e) *Hexachlorophene (pHisoHex)*

- (i) Causes cell wall destruction.
- (ii) Bactericidal, but has poor activity against spores, viruses and fungi.
- (iii) Has prolonged residual activity with repeated use.
- (iv) Has slow onset of action.
- (v) Inactivated by alcohol.
- (vi) Neurotoxic.

## D. Preparation of Personnel

### 1. Non-sterile barriers

#### (a) Scrub suits

- (i) Consist of separate shirts and trousers made of woven, lint-free, durable material.
- (ii) By design, they should effectively cover the surgeon from neck to ankle, leaving the arms exposed.

- (iii) The shirt is tucked into the trousers, which in turn is tucked into the shoe covers.
- (iv) Scrub suit is worn to replace contaminated street clothing before entering the theatre.
- (v) The scrub suit serves as an occlusive barrier that prevents shedding of skin debris and microbes into the theatre.
- (vi) When worn outside the theatre, scrub suit should be covered with a lab coat.

#### (b) Head coverings

- (i) These are available as reusable and disposable caps or hoods.
- (ii) They serve to cover the hair, which is the primary source of bacterial contamination.
- (iii) Caps should properly cover all head and face hairs; sideburns and/or beards require hood for complete coverage.
- (iv) Single use, disposable caps are relatively less expensive than the purchase and laundry costs of re-usable cloth caps.

#### (c) Face masks

- (i) These are made of washable, lint-free material or disposable synthetic fibers.
- (ii) They are fitted over the mouth and nose and secured in a manner that prevents venting.
- (iii) Face masks function to filter and contain droplets of microbes expelled during talking, coughing and sneezing.
- (iv) *Face masks must be worn by all personnel entering the operating theatre at any time.*

#### (d) Shoe covers

- (i) Shoe covers are generally made of reusable or disposable material that is water-repellant and also resists tearing.



- (ii) They serve to prevent microbes from outdoor shoes contaminating the theatre environment.
- (iii) Shoe covers must be donned prior to entering the theatre, and removed immediately on leaving.

## 2. Surgical scrub

### (a) Purpose

- (i) To mechanically remove gross dirt and oil from the surgeon's hands and arms.
- (ii) To reduce the transient microbial count of the skin to the barest minimum.
- (iii) To establish prolonged depressant effect on the residual microflora of the hands and arms.

### (b) Scrub soaps

- (i) *Chlorhexidine gluconate* - has residual activity by binding to keratin and is not inactivated by organic material.
- (ii) *Hexachlorophene* - its cumulative effect is nullified by alcohol and it may be neurotoxic.
- (iii) *Iodophors* - it is inactivated by organic material and requires minimum of 2 min of skin contact to be effective.

### (c) Scrubbing procedure

- (i) Scrub each of the four sides of each finger and thumb.
- (ii) Scrub the back of the hand.
- (iii) Scrub the palm.
- (iv) Scrub the wrist and forearm.

**NB:** Scrub routine is based on either a "timed procedure" or the "counted brush stroke method".

## 3. Sterile barriers

### (a) Gowns

- (i) Gowns form the final barrier between the surgeon's skin and the patient.
- (ii) Ideally, surgical gown should be impervious to fluids and bacteria, lint-free, durable and comfortable.
- (iii) Gowns are available as disposable (single use) or re-usable.
- (iv) The gown's sleeves have cuffs that can be completely overlapped by gloves.
- (v) Back of the gown has wrapabout design to further limit contamination.

### (b) Gloves

- (i) Gloves are usually made of latex, supplied sterilised in single pair packets in assorted sizes.
- (ii) Gloves are worn to create further barrier between the surgeon and the patient.
- (iii) Choice of appropriate glove size ensures adequate finger tip sensitivity; too small sizes create trampoline effect; too large sizes present redundant finger tips.
- (iv) Glove powders help provide lubrication, but are irritant to tissues.
- (v) Gloves are rinsed with sterile fluid prior to the time of incision to remove glove powder.

## E. Preparation of the Patient

### 1. Hair removal from operative site

#### (a) Purpose

- (i) To decrease deposition of foreign objects within the operative wound.
- (ii) To enhance removal of pathogenic microbes from operative site by skin antiseptics.
- (iii) To increase visibility during skin incision.
- (iv) To improve skin apposition during wound closure.

**(b) Timing of hair removal**

- (i) Hair should be removed immediately before surgery; the incidence of wound infection increases as the interval between hair removal and surgery increases.
- (ii) Hair may be removed before anaesthesia in large animals, or after anaesthetic induction in small animals.

**(c) Methods of hair removal**

- (i) *Clipping* - the use of No. 40 clipper blade causes the least skin trauma and is currently recommended.
- (ii) *Shaving* - this is not recommended because it results in multiple, small lacerations with increased postoperative infection rates.
- (iii) *Depilatories* - these are not routinely used in veterinary surgery because of their high cost and also their poor action on the coarse hair of animals.

**(d) Guidelines for hair removal**

- (i) Clip liberally the operative field to allow extension of the incision at operation.
- (ii) For a limb procedure, the whole limb is clipped.
- (iii) Cover a pre-existing wound with saline-moistened gauze sponges or water-soluble gel to minimise contamination of the wound with loose hair or debris.

**2. Antiseptic preparation of skin****(a) Purpose**

To reduce the number of skin bacteria without damaging the skin.

**(b) Procedure**

- (i) First apply surgical scrub solutions that have antiseptic and detergent properties, e.g. povidone-iodine, chlorhexidine, quaternary ammonium compounds, or hexachlorophene.
- (ii) Do the scrubbing in a circular manner, starting at the incision site and working outward in enlarging concentric circles.
- (iii) Apply or spray an antiseptic solution e.g. 70% alcohol plus chlorhexidine or povidone-iodine to give residual bactericidal activity.
- (iv) Perform final skin disinfection after positioning the patient on the operating table in the theatre.

**3. Draping the operative site****(a) Purpose**

To isolate and protect the operative site from microbes and debris from adjacent skin.

**(b) Draping materials**

- (i) Draping material must remain impermeable and securely fastened to the skin, despite moisture or manipulation.
- (ii) Both re-usable and disposable drapes are used in veterinary surgery.
- (iii) Orthopaedic stockinets are used to cover the animal's paws with a high resident bacterial population.

**(c) Technique**

- (i) Usually, a minimum of three layers of drapes are applied.
- (ii) *First layer* consists of four primary drapes placed at the boundary between clipped and non-clipped skin areas; these serve to isolate a rectangular area containing the proposed incision site.

- (iii) *Second layer* consists of skin drapes attached directly to incision edges; these serve to keep the skin out of view of the surgeon.
- (iv) Final and *third layer* consists of a single sheet with a slit; that completely covers the entire patient and operation table, leaving only the surgical wound exposed.

## F. Aseptic Technique

### 1. The sterile field

- (a) The *sterile field* includes the sterile instrument trolley, the draped patient, and the operating team wearing sterile gowns.
- (b) Front of the surgical gown from the chest to table level, and sleeves from above the elbow to the cuff, are considered to be sterile.
- (c) Back of the surgical gown, neckline, under the arms, and part of the gown below the table level are considered non-sterile.

### 2. Breaks in aseptic technique

#### (a) Operating team

- (i) Exposed hair, as a result of inappropriate head covering.
- (ii) Existing active respiratory tract infection.
- (iii) Existing skin infection (e.g. dermatitis).
- (iv) Putting on loose-fitting facemask.
- (v) Donning soiled scrub suit.

#### (b) Scrub procedure

- (i) Having rings and bracelets left on.
- (ii) Carrying long or dirty finger nails.
- (iii) Performing scrubbing in the improper sequence, duration and technique.
- (iv) Putting on gowns and gloves with wet hands.

#### (c) Touch contamination break

- (i) Sterile team member having front to back contact with another sterile member.

- (ii) Making any contact with non-sterile surface, usually during draping.
- (iii) Having hands held below table level.
- (iv) Putting on torn glove.

#### (d) Technique breaks

- (i) Retaining drapes soaked by blood or solutions.
- (ii) Opening of contaminated viscus at operation.
- (iii) Engaging in unnecessary conversation.
- (iv) Non-sterile person leaning over sterile field.

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