Chapter 1
General Surgical Consideration

Preoperative Procedures

History
■ Obtain a detailed history of the patient, especially as it relates to prior disease and treatment.

Physical Examination and Clinical Tests
■ Under common field conditions, which are often emergencies, a physical examination may be all that time will allow.
■ If possible, perform quickly applied clinical tests (e.g., hemoglobin levels, fecal occult blood, or urine dipstick), which may provide pertinent information not obtained via physical examination. Detailed clinical pathologic and radiologic evaluation may not be feasible.
■ In cases of elective surgery, relevant diagnostic procedures are strongly recommended to complement the physical examination and history.

Monitoring and Assessment
Cattle
■ Obtain a detailed history.
■ Pulse and cardiac auscultation
■ Respiration: rate, depth, rhythm, and sounds
■ Mucous membranes
■ Temperature
■ General appearance:
  ● Hydration status
  ● Condition of hair coat
  ● Coordination and gait
  ● Body symmetry
  ● Evidence of abnormal discharges from body orifices
  ● Attitude (e.g., lethargy or excitement)
■ Rectal examination
■ Oral examination
■ Clinical tests (which may be relevant in elective surgery):
  ● Hemogram
  ● Blood gas analysis
  ● Serum chemistry assays
  ● Urinalysis
  ● Fecal examination for occult blood and parasites
  ● Peritoneal cytology (e.g., neoplasia or peritonitis)
  ● Biopsy (e.g., lymph node)

Note
Highly valued animals are commonly insured. Permission to operate from the insurance company is often essential, especially in cases of elective surgery.
Pigs
- Obtain a detailed history.
- Physical examination is commonly limited to:
  - Temperature
  - General appearance
  - Respiration: rate, depth, and rhythm
  - Coordination and gait
- Observation of discharges from body orifices

Sheep and Goats
- Obtain a detailed history.
- Physical examination is similar to that for cattle, except for limitations related to size of the species.
- Perform clinical tests, such as those recommended for cattle, if they are pertinent and economically feasible.

Surgical Facilities
- In a farm setting, a properly selected surgical location will improve the surgical outcome.
- The ideal surgical facility should take into account:
  - Accessibility of the patient and surgical personnel
  - Patient restraint
  - Footing for the standing patient
  - Lighting
  - Access to water and drainage
  - Protection from environmental conditions:
    - Rain
    - Temperature extremes
    - Wind
    - Dust
    - Flying insects

Restriction of Food and Water in Elective Surgery
- Ruminants placed in lateral or dorsal recumbency should have restricted intake:
  - Roughage for 48 hours
  - Concentrate for 24 hours
  - Water for 12 hours
- Neonates or animals fed exclusively a milk diet require no food or water restriction.
- Monogastric patients should have restricted intake:
  - Feed for 24 hours
  - Water for 12 hours

Preoperative Medications
- Antibiotics
  - Preoperative antibiotics are indicated for patients with likely surgical contamination (e.g., umbilical abscess and open wounds).
- Sedatives and tranquilizers
  - Be careful, over sedated livestock may lie down.
  - Acepromazine maleate (see dosage Chapter 5)
    - Effect depends on dose and route of administration
    - Effect is predictable
    - Not as effective in excited patients
    - May be administered using IV, IM, SC, or PO
  - Xylazine hydrochloride (see dosage Chapter 5)
    - Effect is dose dependent
    - Somewhat unpredictable in its effect

Note
Extremely muscular pigs may be prone to the stress syndrome and malignant hyperthermia.

Note
Bringing an animal to a state of quietness and complacency before surgery is valuable—it may produce a smoother recovery.

Drug Information
- Xylazine is marketed in two concentrations: 20 and 100 mg/ml. Precise dosages are more easily obtained with the 20-mg/ml product.
Ruminant species are more sensitive to xylazine than are horses, so use caution to ensure the proper dose, especially in sheep, goats, and calves.

- May cause uterine contractions in pregnant animals
- Mild analgesic effect
- May be used as an epidural agent when mixed with 2% lidocaine or sterile water (see Chapter 4)

**Anticholinergics**
- Atropine
  - Commonly used in monogastric animals
  - Of questionable value in ruminants, where it may reduce the flow of saliva but has the disadvantage of making secretions more viscid and thus more difficult to remove from the respiratory tract.

**Analgesics**
- Butorphanol tartrate
  - May be used alone or in combination with sedatives and tranquilizers
  - Not approved by FDA for food animals
  - May cause excitement and a rough recovery from general anesthesia
- Flunixin meglumine
  - Nonsteroidal antiinflammatory drug (NSAID)
  - A good analgesic at the label dose
  - Also has antipyretic and antitoxemic effects
  - May be ulcerogenic at high doses or with prolonged use
  - Does not have FDA approval for all food animal species
  - Presently only labeled for IV use in cattle
- Aspirin
  - Dosage and short duration of effect may be problematic.
  - May be ulcerogenic at high doses or with prolonged use
  - Has not gone through the approval process, so some agencies have called for a ban on its use
- Phenylbutazone (bute)
  - NSAID
  - Prohibited from extra label usage in dairy cattle 20 months of age and older

**Preparing the Surgical Site**

**Cleaning**
- With a soft brush and comb, remove all loose debris from the animal.
- Remove the hair mass with a large animal clipper followed by a #10 or #40 head clipper.
- Remove hair at least 6 inches around the surgical incision site, with removal being neat and uniform.

**Preparation of the Proposed Surgical Site**
- Rough scrub with liberal amounts of surgical scrub solution\(^a\) and water. A minimum of three scrub and rinse cycles is recommended.
- Complete a final scrub with alternating scrub and alcohol solutions. Start at the proposed surgical site, and work in circles of increasing diameter to the edge of the clipped area.

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\(^a\)Surgical scrub solution may be iodophor scrub, chlorhexidine, or mild detergent.
Final preparation is completed with iodophor or other appropriate disinfectant placed on the proposed surgical site by using a method similar to that used for the final scrub or by means of a spray bottle.

Draping
- Because many surgical procedures in cattle involve local or regional anesthesia and standing restraint, complete draping may be difficult or impossible. Thus, regional draping—covering the field of surgery adequately—is recommended.
- Use moisture-resistant drapes: Abdominal fluid spillage followed by capillary contamination of cloth drapes is a common break in sterile technique.
- Draping (masking) of eyes may facilitate restraint techniques.

Tail Restraint
- Restrain the tail to prevent switching and surgical site contamination (Figures 1-1 and 1-2).

FIGURE 1-1. Tail rope used for restraint in obstetric procedures.

FIGURE 1-2. Tail-to-leg tie used for restraint in standing abdominal surgery.
Postoperative Care

Nutrition

- Palatable grass or alfalfa hay is a good first choice for cattle, sheep, and goats.
- Entice a patient to resume normal eating behaviors postoperatively.
  - This task can be very frustrating.
  - Changing the character of food by moistening it with water or molasses may help.
  - Feeding a variety of feedstuffs in a smorgasbord fashion may be beneficial.
  - Make certain the feed is fresh and is changed on a regular basis.
  - Small portions are generally better than large portions.
- For cattle, using a stomach tube with a slurry of alfalfa meal or pellets in water with electrolytes added increases the fill of the gastrointestinal (GI) tract and stimulates animals to resume eating.
  - Use 0.5 to 1 kg (1 to 2 lb) of alfalfa meal in 12 to 15 L (3 to 4 gallons) of water pumped into the rumen.
  - Keep stirring the slurry or it may clog the stomach pump.
  - Do not add dextrose, rumen bacteria will utilize added dextrose.
  - Many practitioners have a favorite mixture for oral nutritional supplementation for cows.
- Electrolytes may need to be provided as a supplement.
  - Sodium, potassium, and chloride are the most commonly supplemented electrolytes.
  - 30 g of KCl + 50 g of NaCl in 20 liters (5 gallons) of water will often be consumed voluntarily by cows with low serum chloride levels commonly seen in LDA, RDA, and volvulus of the abomasum.
  - Cows commonly refuse feed that is top dressed with salt.
  - Consider placing a small salt block in the manger for the patient to lick.
- Water
  - Maintain a clean, fresh water supply
  - Consider providing water orally via a stomach tube and pump; 20 to 40 liters (5 to 10 gallons) is generally sufficient for adult dairy animals.
  - Hypertonic saline (7%), 1 L IV, will stimulate cows to drink.
- Transfaunaition
  - Postoperative appetite of ruminants may be improved by inoculating the rumen with fresh flora obtained from a healthy cow.
    - Rumen flora is collected from a herd mate, an animal from a slaughter facility, or a cow fitted with a rumen cannula.
    - Fresh undiluted rumen liquid, 2 to 4 L (0.5 to 1 gallon), pumped into the patient will repopulate the rumen with normal bacteria and protozoa.
    - Maintain the temperature of the rumen fauna as the bacteria and protozoa are heat/cold sensitive.
- Patients will eat more if they feel good.
  - Treat all concurrent disorders, including ketosis, dehydration, and infection
  - Manage pain
  - Control fever
  - House in a clean, dry environment preferably in sight of herd mates.

Wound Care

- The speed of wound healing is rarely increased, but factors that slow wound healing can be controlled.
- Principles of wound healing include:
  - Controlling contamination and infection

Note

Animals require good postoperative nutrition for optimal recovery and return to normal function.

Caution!

Using rumen content from a cow in a different herd may breach biosecurity protocols.
Controlling inflammation
- Avoiding desiccation
- Avoiding disruption of normal cellular function
- Minimizing tension and movement of the wound

Wound dressings and skin antiseptics, especially powder preparations, can act as foreign materials and thereby delay healing.

In case of mass contamination during surgery, sterile isotonic solutions with or without antiseptics are recommended for flushing the wound.
- Solutions should be warmed but not to temperatures exceeding 40°C.
- Use large volume plus low pressure (≤15 psi).

Bandage types:
- Wet-to-dry
- Adherent
- Semiocclusive nonadherent

Bandage materials:
- Gauze
  - Soft, nonirritating, and very absorbent
  - Permits rapid evaporation
  - May adhere to the wound unless coated with some type of ointment (e.g., triple antibiotic ointment, or povidone iodine)
- Absorbent cotton
  - Available as sterile or nonsterile cotton and in various grades
  - Should be sterile and of a high-quality grade
  - Commonly used on the outside of gauze as a protective absorbent dressing for wounds
  - Should be used with caution when applied directly to wounds
  - Absorbs moisture rapidly, but evaporation is very slow, which results in a wet bandage that supports bacterial growth.
- Nonadherent wound dressing
  - Many options are available.
  - Packaged sterile
  - Somewhat expensive
  - Poorly absorbent
- Muslin (heavier than gauze)
  - Should be considered when additional tension or pressure is desirable
- Adhesive tape
- Elastic bandage (Ace)
- Stockinette
- Elastic adhesive (Elastikon)
- Nonadhesive (Vetwrap)
- Spray-on bandage

Use of bandages and proper application:
- Use bandages to keep a dressing in position and to exert the desired amount of pressure on the wound.
- Apply the bandage to maintain its placement but without excessive pressure (Figure 1-3).
- Elastic bandages are often used when pressure is required temporarily.
- Esmarch’s bandage is a rubberized bandage.
  - Begin bandaging at the distal end of a limb. Blood is forced up and away from the extremity.
  - May facilitate relatively bloodless surgery when applied preoperatively to an extremity
  - Commonly used as a temporary bandage but may be used for an extended period (e.g., 72 hours on a prolapsed prepuce)

Caution!
Do not create excessive pressure on the blood vessels of the pastern.

FIGURE 1-3. Bandaging the bovine foot in a figure-eight pattern.
General Surgical Consideration

- Many-tailed bandages may be used to support the abdomen in food animals with abdominal wounds.
  - Made from heavy burlap or canvas
- Bandage the bovine foot in a figure-eight pattern. Include an interdigital dressing.

Postoperative Medication

Antibiotics
- Antibiotics are generally indicated in food animals.
- Use FDA-approved antibiotics.
- Use appropriate drug, dose, duration, route, and withdrawal time.
- Should not be used as a crutch for poor sterile technique.
- The IP use of antibiotics, although controversial, can be effective when used during abdominal surgery of food animals.
  - Use an antibiotic with minimal inflammatory response.
  - Dilute the drug with 500 to 1,000 ml of sterile isotonic solution, and pour directly into the abdominal cavity.

Fluids
- Five to 10 gallons of sterile isotonic fluids administered IV during a period of 24 hours is effective for eliminating dehydration and beginning convalescence in adult cattle.
- If sterile fluids are not available, distilled water or clean filtered tap water with added electrolytes can be effective. The risk of complications increases with the use of non-sterile fluids.
- Scours, toxemia, shock → metabolic acidosis → hyperkalemia
- Abomasal volvulus, vomiting → metabolic alkalosis → hypokalemia
- The amount of NaHCO$_3$ required to replace a deficit is determined by the following equations for all livestock species:
  - 0.3 × Adult body weight (kg) × Base deficit = Deficiency (mEq)
  - 0.5 × Neonatal body weight (kg) × Base deficit = Deficiency (mEq)
- Hypertonic saline 7%.
  - One liter contains 70 g of NaCl.
  - One liter contains nearly 1,200 mEq of sodium and 1,200 mEq of chloride.
  - Hypertonic saline will stimulate the patient to drink water.
  - Do not give hypertonic saline without access to water.

Pain control
- Pain in ruminants is difficult to evaluate.
- Flunixin meglumine
  - Given at the label dose, it effectively controls visceral pain.
  - Not as effective for musculoskeletal pain.
  - Do not use continuously for more than 5 days because of possible abomasal ulcers.

First-Aid

Conversion to mEq.
- 1 g NaCl = 17 mEq
- 1 g KCl = 14 mEq
- 1 g NaHCO$_3$ = 12 mEq

TABLE 1-1

<table>
<thead>
<tr>
<th>Isotonic Solutions</th>
<th>Amount to be added to each Liter</th>
<th>Amount to be added to each Gallon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dextrose 5%</td>
<td>50 g</td>
<td>200 g</td>
</tr>
<tr>
<td>NaCl 0.9%</td>
<td>9 g</td>
<td>36 g</td>
</tr>
<tr>
<td>KCl 1.1%</td>
<td>11 g</td>
<td>44 g</td>
</tr>
<tr>
<td>NaHCO$_3$ 1.2%</td>
<td>12 g</td>
<td>48 g</td>
</tr>
</tbody>
</table>
Follow ELDU (Extra Label Drug Use) guidelines
Currently only approved for IV use in cattle

Meloxicam
Approved food animal drug in other countries but not in the United States.
Typical dose 0.5 mg/kg of BW
Follow ELDU guidelines

Aspirin
An NSAID
Has not gone through the approval process, so FDA discourages its use for food animals
Use and precautions are similar to those for flunixin meglumine.

Phenylbutazone
Prohibited from extra label usage in dairy cattle 20 months of age and older.
Oral dosage requires a large loading dose (10mg/Kg) followed by 5 mg per kg of body weight every 48 hours.

Butorphanol
An effective analgesic
May require concurrent tranquilization for optimal effect
Follow ELDU guidelines

Morphine
A powerful analgesic
Controlled drug with the potential for abuse
Follow ELDU guidelines

Drugs to increase GI motility

Neostigmine
Has a questionable effect in ruminants
Stimulation of smooth muscle may not be well organized, with GI spasms rather than organized propulsive movement being the result.

Bethanechol
Preliminary studies indicate that bethanechol may increase contractility of the small intestine.
Indications exist that a synergistic response occurs when given in combination with metoclopramide.

Metoclopramide
Has been used (at 0.1 mg/kg) to treat abomasal empting defect in sheep
Its greatest effect appears to be in forestomachs and abomasums.
Has been used in selected cases of vagal indigestion

Erythromycin
An antibiotic with GI stimulation as a side effect (1.0 mg/kg in 1 L of saline infused for 60 minutes every 6 hours has been used to treat postoperative ileus in horses).
Pain is a possible negative side effect.

Suggested Reading


Chapter 1 Study Questions
1. Should alleviation of pain be a major priority in food animal practice?
2. Is it practical to do “field surgery” on food animals?