



Crisis
Management:

Anesthetic
Emergencies
&
Complications

Dr. Ralph Harvey

Anesthesia is Intended as a....

- ✦ Benign & reversible process, but...
- ✦ Potentially lethal drugs
- ✦ Injury & debilitating illness



Case Management to Avoid Complications

- ✦ Recognition of the patient at risk
- ✦ Regular inspection & maintenance of equipment
- ✦ Appropriate patient monitoring
- ✦ Attention to detail



Early Recognition of Problems & Potential Complications

✦ “Anesthesia is hours of boredom & moments of sheer panic.”

✦ Vigilance



Early Recognition of Problems & Potential Complications

- ✦ Try to prevent problems rather than treat them
- ✦ Direct therapy on changing patient status
- ✦ Stay calm and organized
- ✦ Think and act quickly



Human error is ultimately responsible for the majority of problems encountered in anesthetic management.

Safety in familiarity!

Anesthetic Emergencies & Complications

1. Absolute or relative overdose
2. Injection errors
3. Equipment problems
4. Ventilatory problems
5. Circulatory problems
6. Temperature regulation
7. Electrical problems
8. Delayed recovery

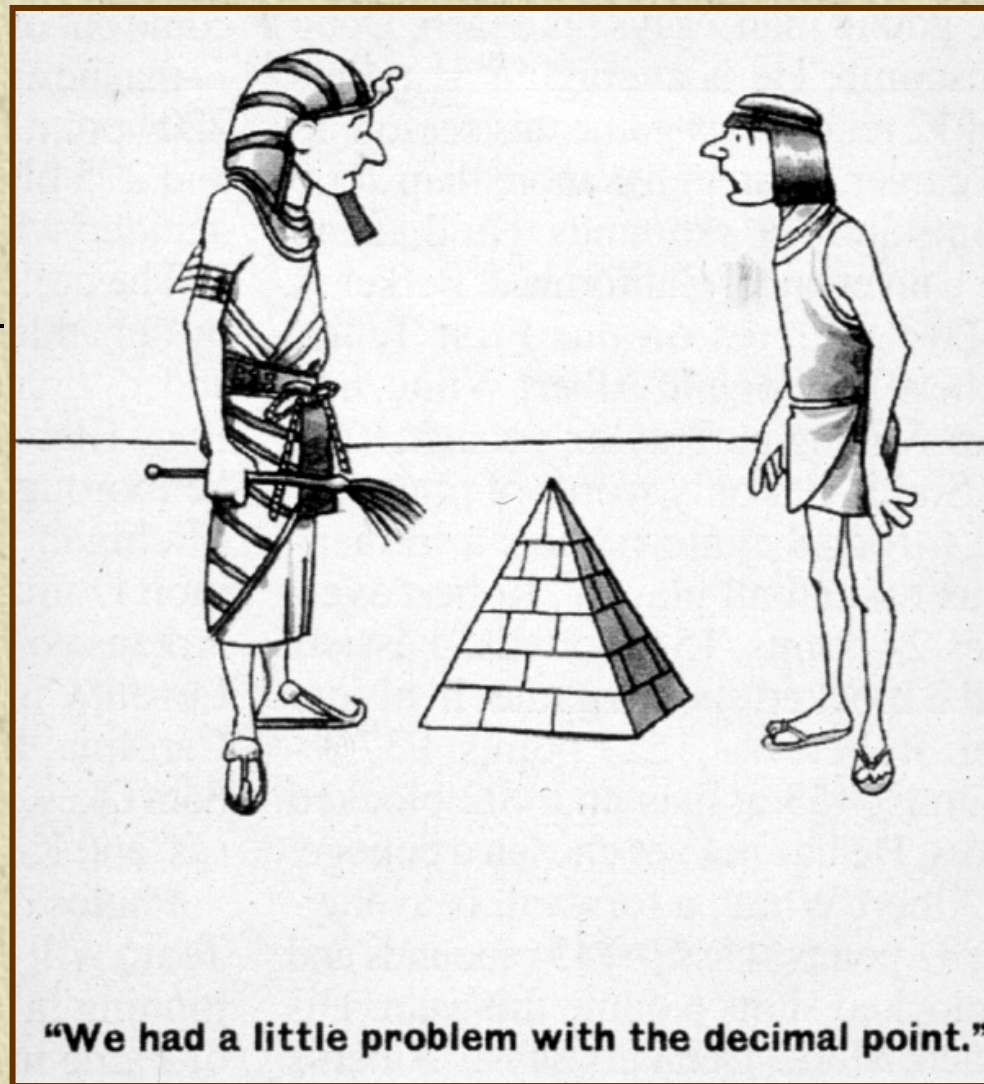
1. Overdose

✦ Relative or absolute

✦ Miscalculation

✦ Narrow therapeutic index

✦ Excessive depression-side effects=DEATH



Anticholinergic Overdoses:

-
- ✦ Anticholinergics should be used with caution in patients with heart disease
 - ✦ Tachycardia can be detrimental to this patient
 - ✦ Atropine prolongs barbiturate anesthesia
 - ✦ Severe or fatal cardiac dysrhythmias have been reported with IV administration



Tranquilizer/Sedative Overdoses

✦ Acepromazine

- ◆ cardiovascular support

✦ Xylazine or Domitor

- ◆ ventilatory & circulatory support
- ◆ specific antagonists
 - Yohimbine, Antisedan, etc.
- ◆ non-specific stimulants



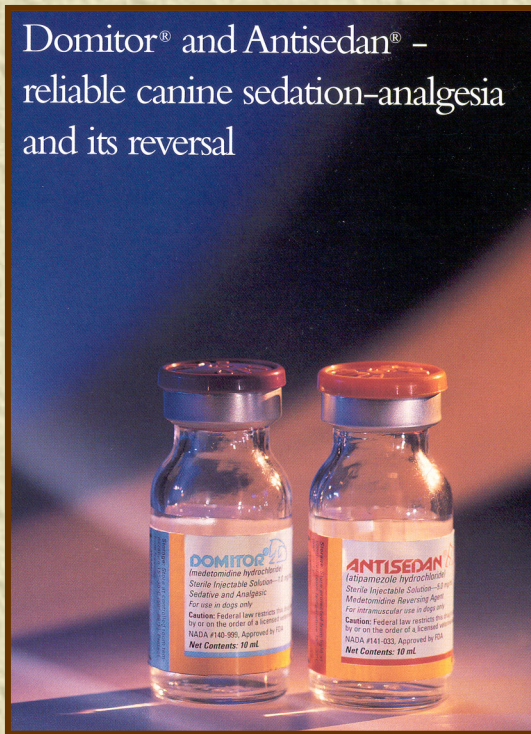
Antagonism vs. Stimulation

✦ Receptor specific process

✦ Not receptor specific



opioid receptors

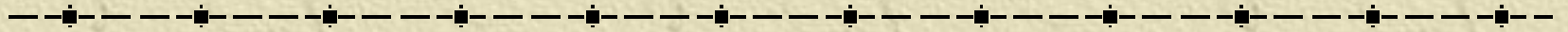


α -2 receptors



CNS stimulant

Antagonists:



- ✦ Naloxone (Narcan)
- ✦ Butorphanol (Torbugesic)
- ✦ Yohimbine (Yobine)
- ✦ Atipamezol (Antisedan)
- ✦ Flumazenil (Romazicon)

Opioid Overdose

(rarely a problem - great margin of safety)

✦ Support ventilation

✦ Naloxone

- specific antagonist action
- risk of later “renarcotization”
- great risk of pain or stress

✦ Butorphanol (Torbugesic)

- mixed agonist-antagonist drug
- reverses some sedation
- preserves some analgesia

Morphine

(rare adverse effects)

- ✦ Potent analgesia with moderate CNS depression
- ✦ Characteristic vomiting/diarrhea/constipation
- ✦ CNS side effects: excitement, dysphoria
 - ◆ species dependent
 - ◆ dose dependent
- ✦ Bradycardia in the dog
- ✦ Histamine release
 - ◆ avoid IV use
 - ◆ contraindicated with MCT
- ✦ Yet, a very high margin of safety!



Barbiturate Overdose

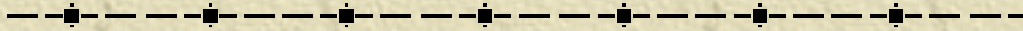
- ✦ Narrow margin of safety
- ✦ Support ventilation
- ✦ Monitor cardiopulmonary function
- ✦ IV fluid therapy
- ✦ Drug therapy possible
 - ◆ Doxapram (Dopram-V) (2.5-5.0 mg/kg)
 - ◆ Bicarbonate (0.5-1.0 mEq/kg)

2. Injection Errors

As an example, perivascular injection of ultrashort acting barbiturates

- ◆ Swelling at injection site
- ◆ Pain at injection site
- ◆ Failure to induce anesthesia or a reduced effect
- ◆ Risk of necrosis and slough





Therapy for Perivascular Injection of Ultrashort Acting Barbiturates

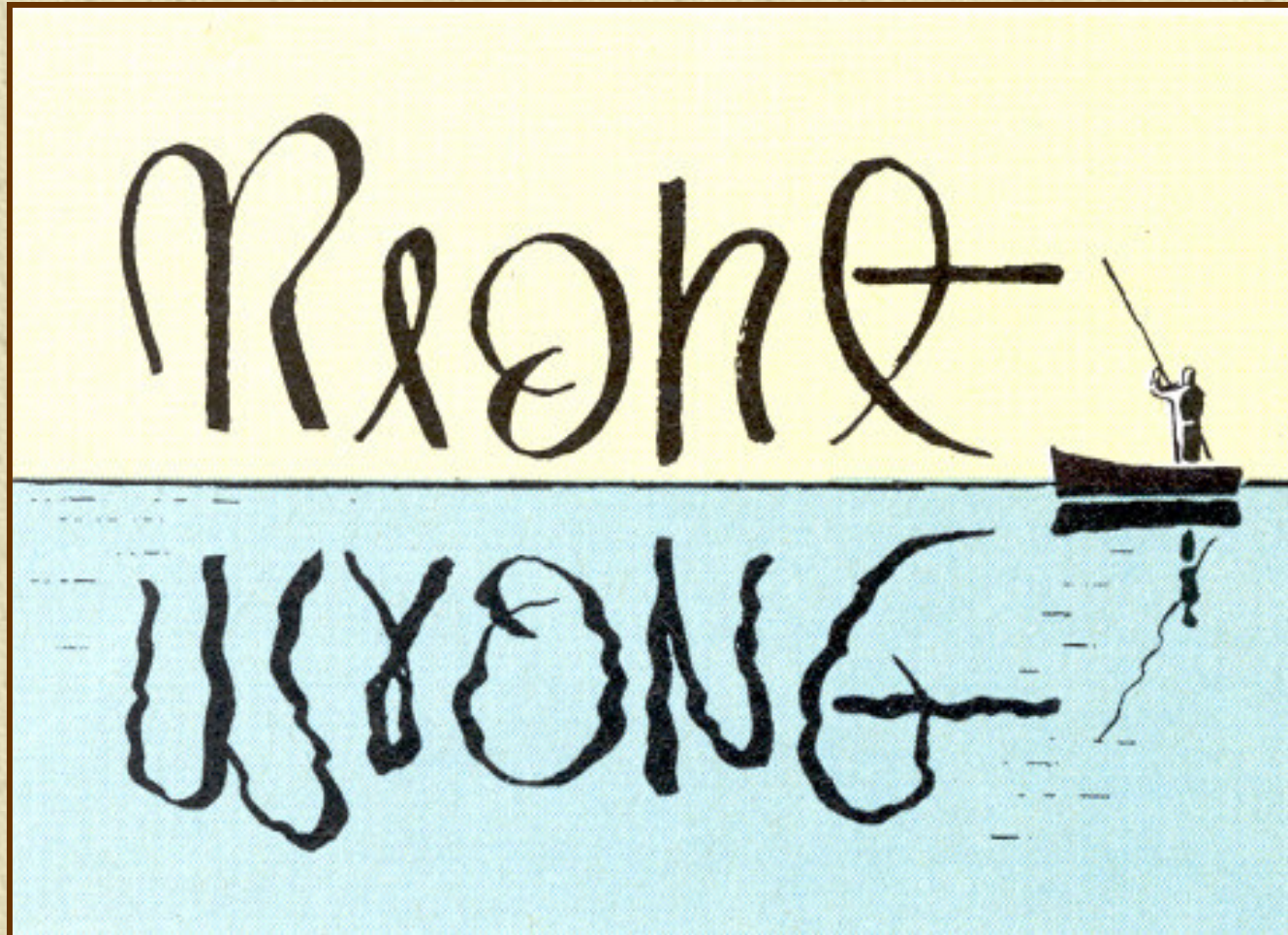
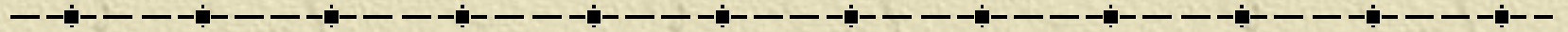
- ✦ Infiltrate generously with lidocaine (without epinephrine) mixed with saline
- ✦ Hot pack, hydrotherapy
- ✦ +/- steroids, DMSO

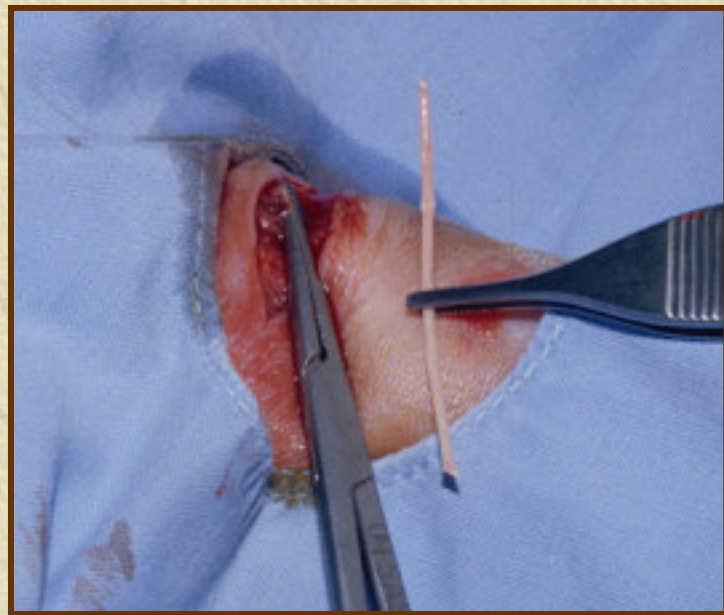
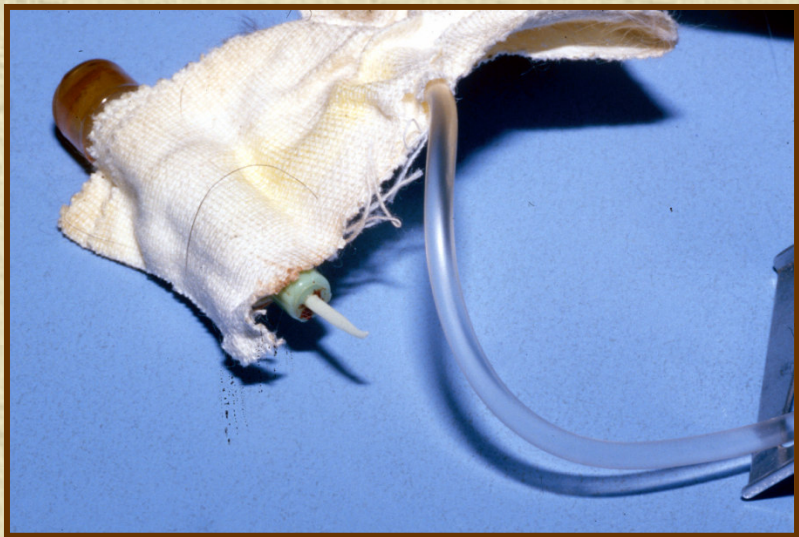


To avoid perivascular injection, use an IV catheter.



Principles of Medical Care





3. Problems with Anesthetic Equipment

✦ Trivial to deadly

✦ Easily remedied or obscure & difficult

✦ Regular inspection & maintenance

✦ Avoid substandard equipment

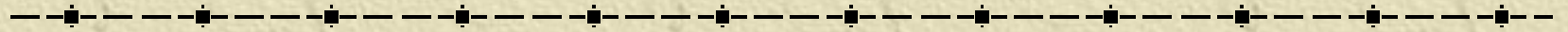
Anesthetic Gas Machines & Circuits

- ✦ Deliver oxygen & anesthetic
(in precisely controlled quantities)
- ✦ Provide positive
pressure ventilation
- ✦ Remove carbon dioxide



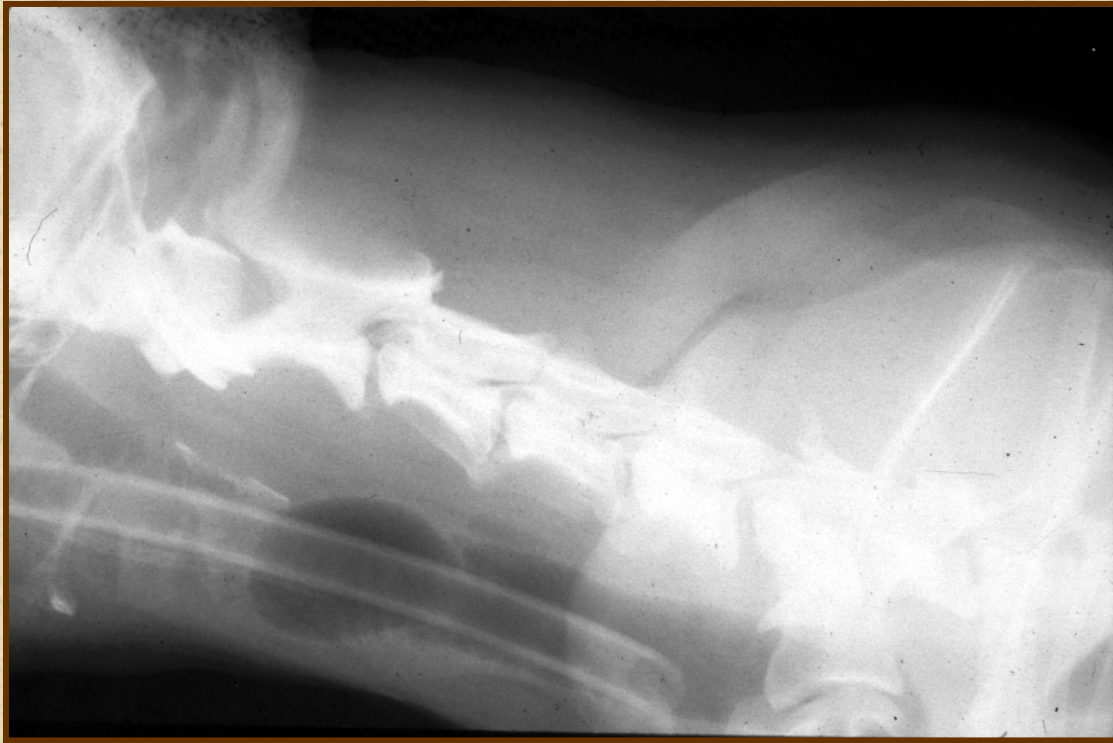
Common Problems with Equipment

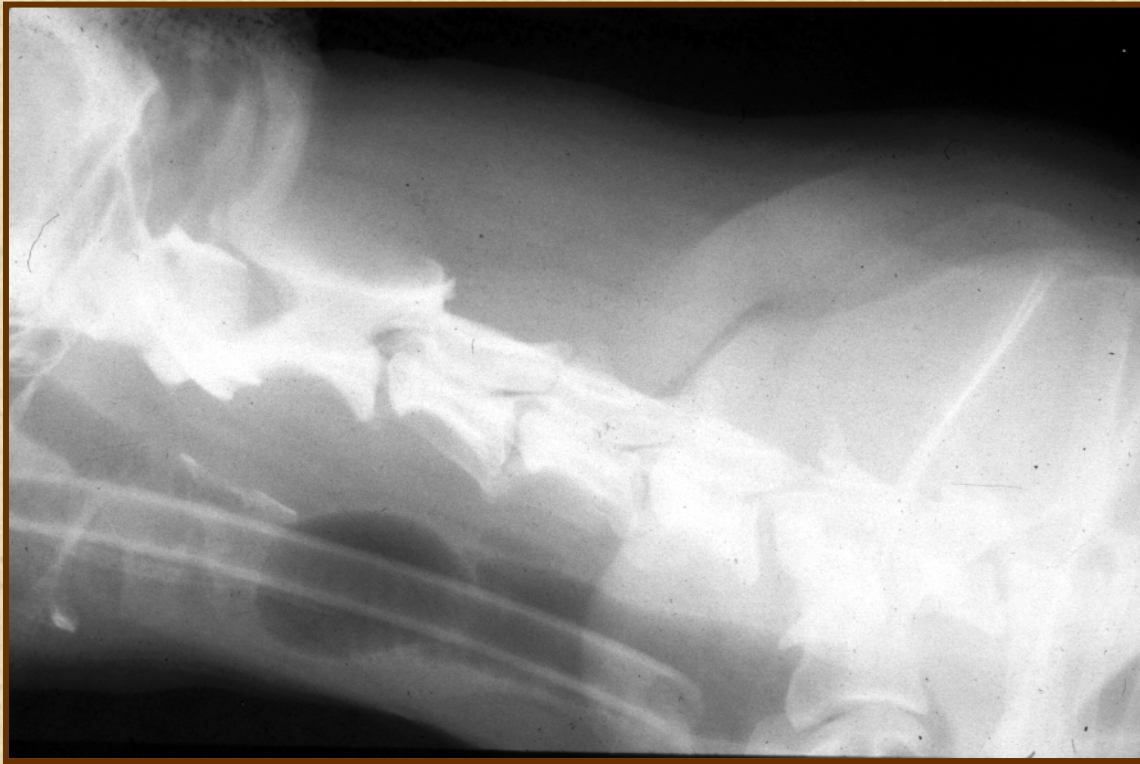
- ✦ Empty or disconnected tanks or delivery hoses
- ✦ Accidental disconnection of components
- ✦ Misconnected breathing circuits
- ✦ Leaky tubes, hoses, breathing bags
- ✦ Empty or overfilled anesthetic vaporizers
- ✦ Vaporizers out of calibration
- ✦ Exhausted carbon dioxide absorber
- ✦ Unidirectional valves stuck or missing
- ✦ Unsafe modification of equipment

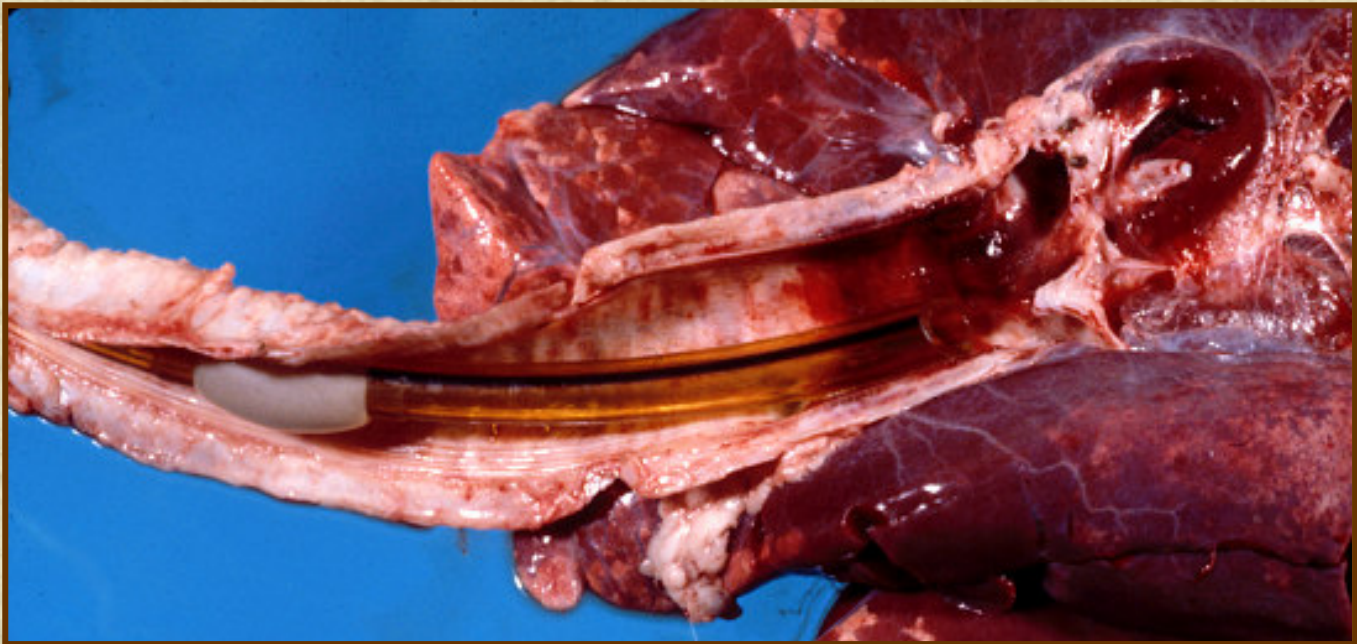
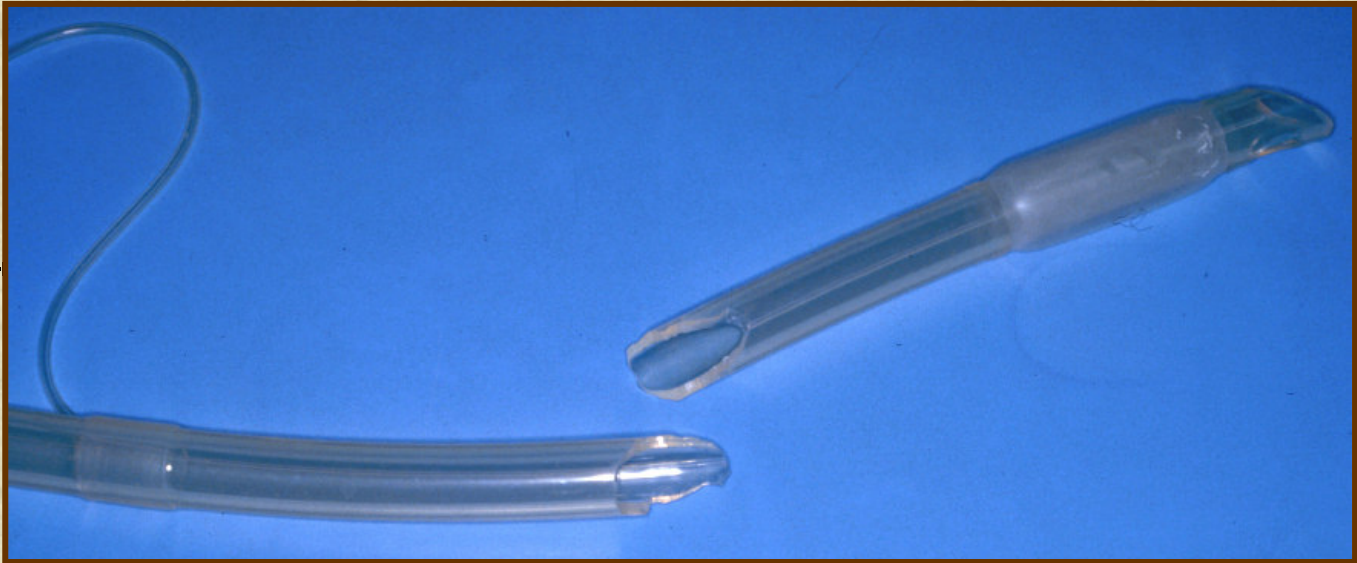


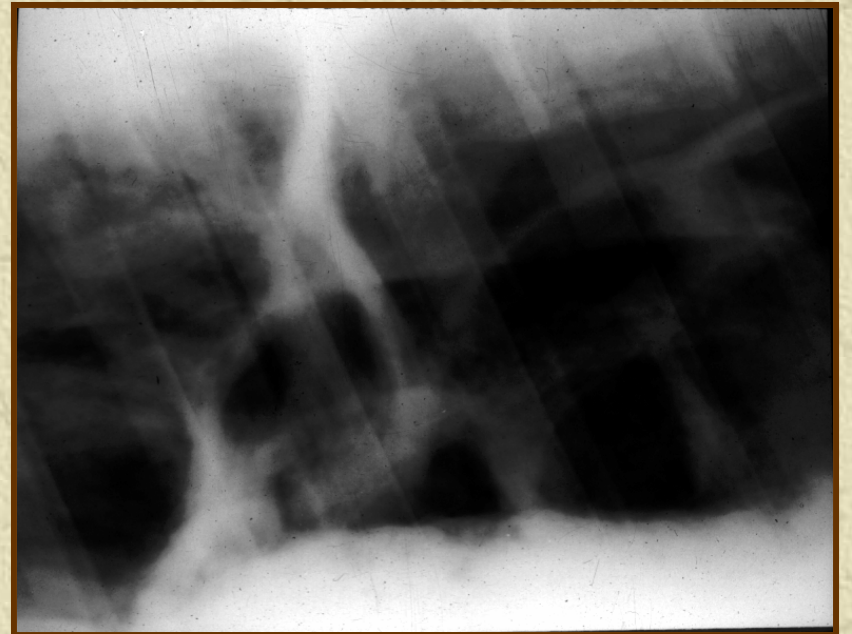
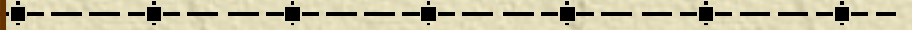
The responsibility for a system composed of different manufacturers' brands of components rests with the person composing the system. The fact that components can be connected does not guarantee their compatibility or a safe performance of the system.

To control the airway use an endotracheal tube









4. Ventilatory Complications

✦ Inadequate Delivery of Oxygen

✦ Hypoventilation

- Inadequate Ventilation

- Apnea

✦ Hyperventilation: Tachypnea or panting

✦ Irregular patterns of ventilation

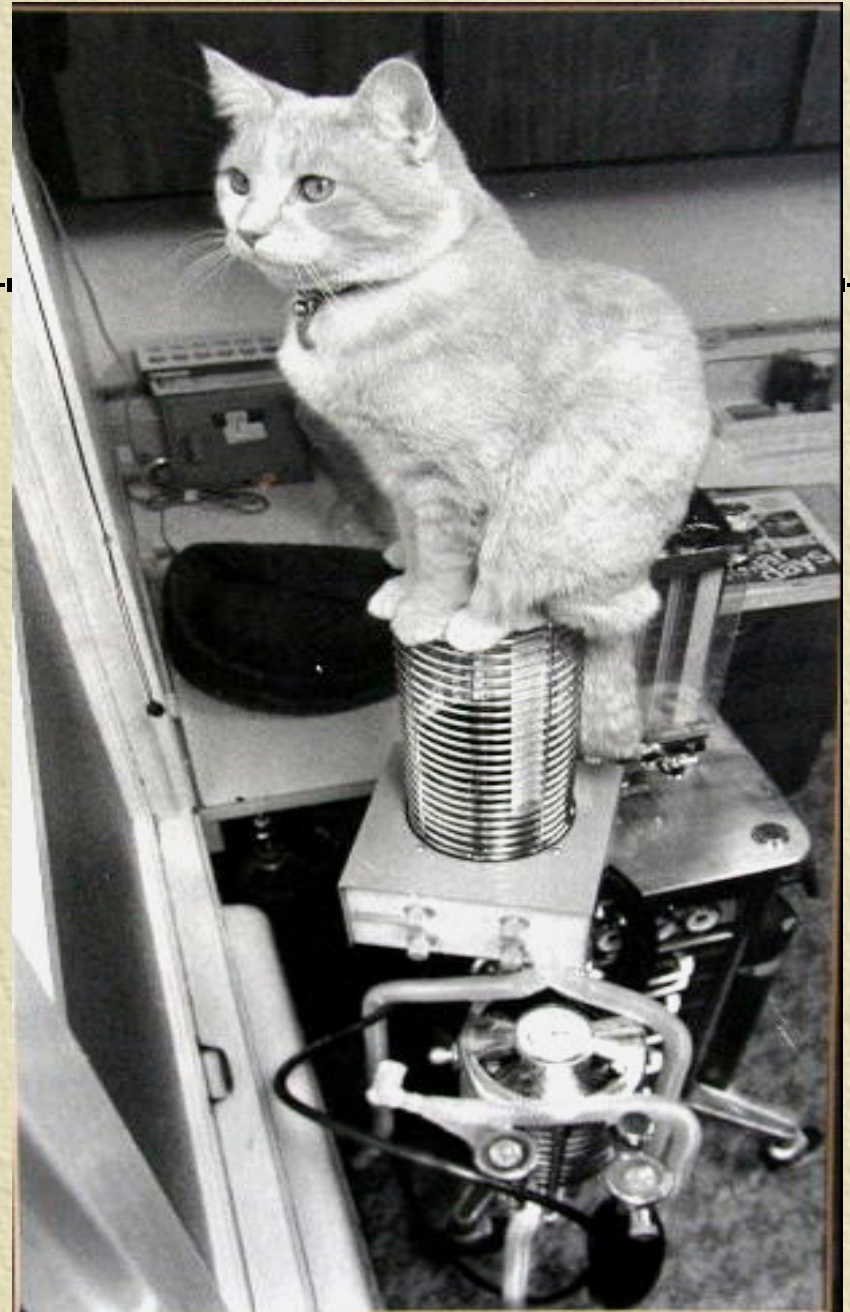
All Anesthetics are Respiratory Depressants

- ✦ Anesthetic overdose: Relative or Absolute
- ✦ Direct depression of central respiratory centers
- ✦ Secondary to circulatory depression
- ✦ Specific drug actions

Hypoventilation

- ✦ A consistent problem with anesthesia
- ✦ Hypercarbia
- ✦ Hypoxia
- ✦ Monitor best by capnometry
- ✦ Support ventilation

Quick!...Put that cat
on a ventilator!



Management of Hypoventilation

✦ Endotracheal Intubation

✦ Positive pressure ventilation with oxygen

✦ Identification & correction of cause(s)

- excessive anesthetic
- airway obstruction

✦ Avoid use of doxapram (Dopram) for anesthetic hypoventilation



Hyperventilation & Panting

✦ Inadequate anesthesia

- ◆ titrate to effect

✦ Carbon dioxide accumulation

- ◆ excess dead space
- ◆ machine or breathing circuit problems

✦ Opioid induced panting

- ◆ drug specific (oxymorphone, hydromorphone)

✦ Hyperthermia

- ◆ less common than hypothermia

5. Circulatory Problems

- ✦ Changes in heart rate
- ✦ Cardiac arrhythmias
- ✦ Changes in blood pressure
- ✦ Changes in tissue perfusion

Tachycardia

✦ Dog > 180bpm

✦ Cats > 200bpm

✦ Horse > 60bpm

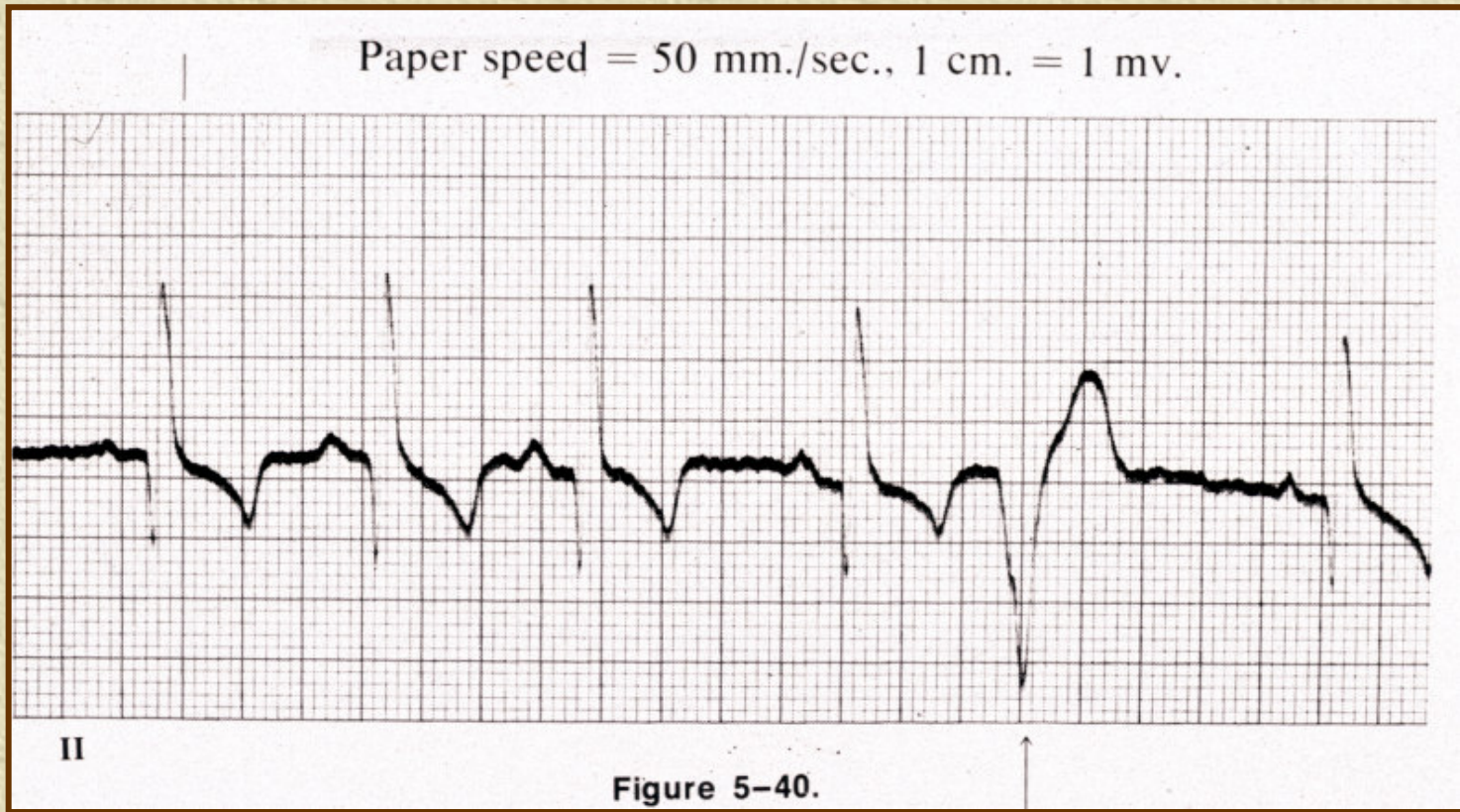
✦ Decreased efficiency increased work load

✦ Due to pain, fear, inadequate anesthesia, preanesthetic excitement, hypotension, specific anesthetic drugs

Compensatory Tachycardia

- ✦ Response to hypovolemia & hypotension
- ✦ Reduces coronary blood flow
- ✦ Increases work load, oxygen demand
- ✦ This reflex is usually absent during anesthesia

Ventricular Premature Contraction



Ventricular Tachycardia

- ✦ Occasional VPC cause for concern
- ✦ Multi VPC's emergency
- ✦ Runs of V-Tach emergency
- ✦ Ventricular arrhythmias indicate an irritated, hypoxic, or diseased myocardium



Management of Ventricular Tachycardia

- ✦ Adjust anesthetic dose
- ✦ Insure adequate ventilation with oxygen
- ✦ Lidocaine 1-2 mg/kg (0.5-1.0 mg/lb) IV
 - ◆ Other antiarrhythmics
 - ◆ Correct acid-base or electrolyte imbalances
 - ◆ Change anesthetics

Bradycardia

-
- ✦ Dogs < 65bpm
 - ✦ Cats < 80bpm
 - ✦ Horses < 35bpm
 - ✦ Vagal parasympathetic stimulation
 - ◆ difficult endotracheal intubation
 - ◆ deep abdominal procedures
 - ◆ intraocular Surgeries
 - ◆ direct vagal stimulation or traction
 - ◆ vagotonic anesthetic drugs



Management of Vagal Bradycardia

- ✦ Discontinue vagal stimulation
- ✦ Atropine 0.04mg/kg (0.02mg/lb) IM
- ✦ Atropine 0.02mg/kg (0.01mg/lb) IV
 - ◆ carefully titrated to effect
 - ◆ give slowly to avoid tachycardia

Prevention of Vagal Bradycardia

- ✦ Atropine 0.04 mg/kg (0.02 mg/lb) IM
- ✦ Glycopyrrolate 0.01 mg/kg (0.005 mg/lb) IM
- ✦ Usually unnecessary in horses!
- ✦ Significant contraindications and adverse effects in some situations!

Non-Vagal Bradycardia

✦ Anesthetic depression

✦ Hypoxia

✦ Hypothermia

✦ Identify causative factors & correct immediately

6. Temperature Regulation

✦ Hypothermia

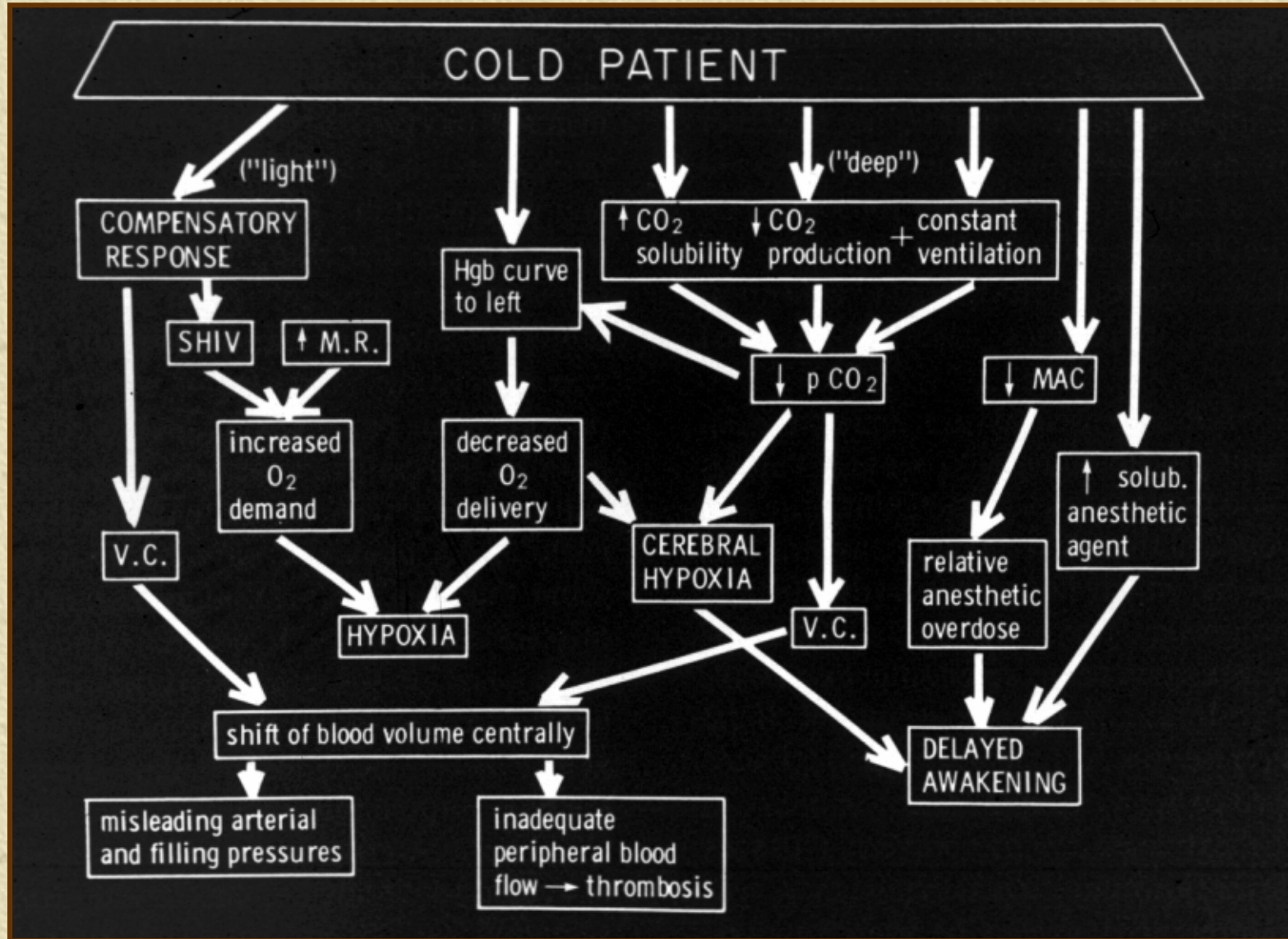
A very common and clinically significant problem

✦ Hyperthermia

It does occur



Significance of Hypothermia



Hyperthermia as a Clinical Problem

(Not the same as “Fever”)

Potential causes:

- ✦ Exercise/environment
- ✦ Stress/excitement
- ✦ Anesthetic hyperthermia in cats - some opioids, potentially stress, etc.
- ✦ Insulation
- ✦ Iatrogenic
- ✦ “Malignant”
 - MH-like syndromes
 - reported for many species!

Hot Dogs

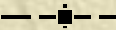


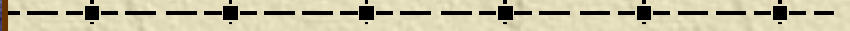
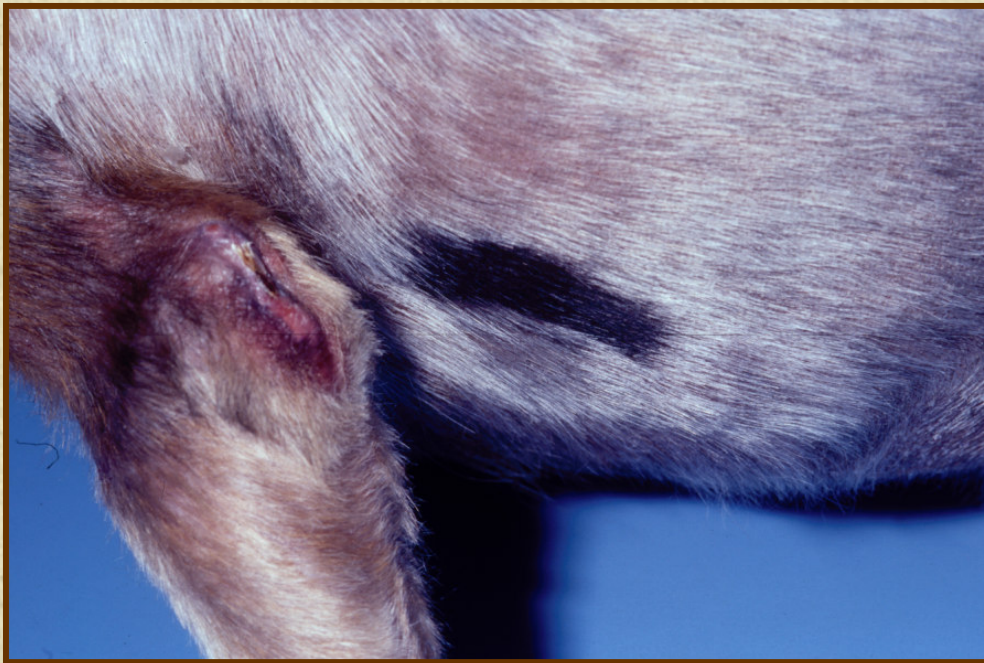
“Why dogs bite their owners.”

7. Electrical Problems

- ✦ Supportive & monitoring equipment
- ✦ Risk of electric shock, burn, fire







8. Delayed Recovery from Anesthesia

- ✦ Anesthetic overdose
- ✦ Inadequate elimination or metabolism
- ✦ Hypothermia
- ✦ Debilitation
- ✦ Neurological deterioration
 - hypoxic episode
 - physiologic imbalance
 - neurological accident
 - ischemia, increased ICP, embolus, stroke

Management of Delayed Recovery

- ✦ Physiological support
- ✦ “SOP” - monitor, evaluate, diagnose, treat
- ✦ Facilitate elimination or metabolism
- ✦ Reversal of anesthetics
 - Antagonists
 - Naloxone
 - Yohimbine
 - Antisedan
 - Stimulant (very rarely indicated)
 - Doxapram

