Emergency Approach & Treatment of Thoracic Trauma

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Pathogenesis

- Hit by car (HBC)
- High-rise syndrome
- Gunshot wounds
- Animal bite wounds
  - BDLD (big-dog, little-dog)
- Weapons
- Animal abuse
Primary survey

- Immediate assessment
- Stabilization of the ABCDs!
  - Airway
  - Breathing
  - Circulation
  - Dysfunction

Primary survey: Airway

Primary survey: Breathing

- Evaluate RR/RE
- Nasal discharge
- Tachypnea or dyspnea
- Orthopnea
- Auscult!
  - Increased BVS \(\rightarrow\) parenchymal
  - Dullness \(\rightarrow\) pleural
  - Crackles \(\rightarrow\) cardiac
  - Wheezes \(\rightarrow\) bronchial

Primary survey: Circulation

- Stabilize!
  - Assess HR, mm, CRT
  - Goal: HR < 160-170
- Volume resuscitate
  - 20 ml/kg crystalloid, repeat PRN
  - Re-assess
  - 5 ml/kg colloid, repeat PRN

Primary Survey: Disability

- Check key neurologic reflexes prior to analgesia
  - Deep pain
  - Motor
  - Anal tone

- Check:
  - PLR
  - Anisocoria
  - Scleral hemorrhage
  - Skull fractures
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**Analgesia is important, but...**

- ABCDs
  - Did you assess the patient’s cardiorespiratory first?
  - Did you assess the patient’s neuro status first?
- Picking the “right” analgesic in the ER
  - Reversible?
  - Titratable?
  - Cardiorespiratory sparing?
  - Pros vs. cons

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**In the ER: Some vets pick NSAIDS over opioids. Boo!!!**

- Fear of hypoventilation
  - Dose dependent
- Fear of making shock worse
  - Treat shock first!
- Fear of respiratory arrest
  - Treat underlying lung disease first!

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**Before reaching for an opioid:**

- Volume resuscitate first
- Treat underlying lung disease!
  - Thoracocentesis
  - Oxygen therapy
- Pick something reversible

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**Recuvyra: Highlights to Consider**

- Indicated for the control of postoperative pain associated with surgical procedures in dogs
- Transdermal fentanyl solution
- Approved by the FDA for use in dogs only; absorption characteristics of skin varies greatly between species

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**Recuvyra**

- A single dose to the skin on the dorsal scapular area → no need to clip hair
- Has a special syringe and applicator
  Wear gloves and face shield when handling
- Dries rapidly in 5 minutes
- It is absorbed through the skin -> does not undergo 1st pass through the liver
When considering NSAIDs:

- **Pros**
  - Good analgesic
  - Readily available
  - Inexpensive
  - Anti-inflammatory

- **Cons**
  - GI toxic
  - Nephrotoxic
  - As good as opioids?

**Clinical application:** When to reach for NSAIDS

- Wait until > 8-12 hours and stable, warm, normotensive
- When it's safe for oral, it's safe for injectable.

**Multimodal analgesic therapy**

- Multi-modal therapy: opioids + NSAIDs + lidocaine patch!
- Local anesthetics!
  - Lidocaine patches
  - Line blocks
Anatomical space

• Pleural space
• Pulmonary parenchyma
• Thoracic wall
• Mediastinal space
• Cardiac

Differentials for thoracic trauma

• Pneumothorax
• Hemothorax
• Diaphragmatic hernia (d. hernia)
• Pulmonary contusions
• Flail chest
• Fractured ribs

HBC: Rule out thoracic trauma!

Pleural space: Clinical signs

• Tachypnea
• ↑ RR/RE
• Dyspnea
• Muffled heart or lung sounds
• Cyanotic
• Empty abdominal palpation
• Sprung ribs
• Decreased chest compliance
• Borborygmi

Pleural space

• Gas
• Blood
• Inappropriate organs
47.1% of animals hit by car with fractures also had pneumothorax (Spackman et al., 1984)

Thoracic wall and pulmonary lesions in dogs sustaining fractures as a result of motor vehicle accidents. Spackman MA, Slag JF, Malangoni MA.

Abstract

The results of 327 dogs seen at the University of Minnesota Veterinary Teaching Hospital for fractures resulting from motor vehicle accidents were reviewed to determine the prevalence and types of thoracic wall and pulmonary lesions associated with such accidents. Results were analyzed for type of fractures, type of pulmonary lesions, and presence or absence of chest tubes. More than one type of fracture was present in 58% of the animals, with multifragmentary fractures of the thoracic wall and multiple rib fractures in 30%. The presence of a pneumothorax was associated with 55% of all pulmonary lesions. The most common type of pulmonary lesion was a pneumothorax (47.1%). Of dogs with pneumothorax, 75% required chest tubes for drainage. A significant decrease in survival occurred in animals in which the diagnosis was delayed or pneumothorax was missed.

25% of dogs that fell from high rises had pneumothorax (Gordon et al., 1993)

Highrise syndrome in dogs: 91 cases (1986-1991)

Robert J. Gordon, DVM

Department of Surgery, Animal Medical Center, New York, NY 10021

Abstract

It's unknown whether dogs with highrise syndrome. Dogs fall from to 6 stories, and at 12 dogs for which the fall was witnessed. Of 10 dogs (33%) packages, 8 dogs had a thoracic injury to the face, thorax and abdomen, similar to injuries seen in cats with highrise syndrome. With highrise syndrome, it's possible that both injuries occurred. A study of 6 cases of highrise syndrome in cats and dogs found no thoracic injuries. Thoracic injuries in dogs fall from high rises should be considered if the patient has been outside for at least 30 hours.

63% of cats that fell from high rises had pneumothorax (Whitney et al., 1987)

Highrise syndrome in cats.

Robert J. Whitney, DVM

Department of Surgery, Animal Medical Center, New York, NY 10021

Abstract

Highrise syndrome was diagnosed in 132 cats over a 9-month period. The mean age of the cats was 3.7 years. Most cats had some form of severe trauma. Of these, 30% had associated fractures, and 5% had pneumothorax. Twenty percent of the cats were under 6 months of age. Of the cats with pneumonia, 5.5% had rib fractures (63.3%), 19% had a thoracic injury, 15% had a thoracic injury, and 15% had a thoracic injury. Of the cats with pneumothorax, 6.5% needed chest tubes.

Pneumothorax

- 1 out of 2 trauma patients
- Stabilize first, chest rads second!
- Types:
  - Open
  - Closed
  - Tension

Tap, tap, tap
- 7th to 9th ICS
- Cranial to the rib
- If >2-3 chest taps in <6-12 hours:
Thoracocentesis

• Supplies:
  – 20 cc syringe
  – 3 way stopcock
  – 16-22 ga. needle or butterfly catheter
  – Extension setting
  – Empty bowl
  – +/- sedation
    • Butorphanol: 0.2-0.8 mg/kg IM or IV
    • Diazepam: 0.1-0.25 mg/kg IV

Chest Tubes

• 3-strikes-and-you’re-out rule
• Sedate or anesthetize, if possible
• Don’t clamp the tube, if anesthetized
• Continuous vs. intermittent suction

Thoracostomy Tube

• Blunt dissection vs Trocar (i.e. cat ca-bob)
  – Surgical preparation
  – Skin incision over 8th-10th intercostal space
  – Pull skin cranially 2 intercostal spaces

Hemothorax

• Thoracic trauma

• 8.7% of dogs that were HBC and had fractures also had hemothorax (Spackman et al., 1987)
• Catastrophic bleeding prior to arrival
• Major vessel laceration
Hemothorax

- Stabilize
- Fluid resuscitate
- Blood transfusion
- Autotransfusion
- Supportive care
- O₂ therapy

Hemothorax: Autotransfusion

- Autotransfusion → save the blood in the pleural space!
  - Sterile technique! Scrub!
  - Sterile syringes or catheter
  - Three-way stopcock
  - Sterile 60 ml syringes
  - Grey top or red top (check to see if clots)
  - +/- CPDA 1 ml: 7 ml blood: Don’t really need!
  - Blood filter

Hemothorax: To cut or not to cut?

- To cut or not to cut?
- Surgical explore
  - Excessive bleeding
  - Hemodynamic instability despite aggressive resuscitation!
  - Penetrating chest injury (intra-thoracic)

Diaphragmatic Hernia

- 2-5% of thoracic injuries (Cockshutt, 1995)
- Causes:
  - Blunt thoracic trauma
  - Penetrating thoracic or abdominal trauma
- Pathophysiology:
  - Sudden increase in abdominal pressure forces diaphragm forward
  - Muscular portion of diaphragm most commonly ruptures

Diagnosis of Diaphragmatic Hernia

- Physical examination:
  - Ranges from normal to severely dyspneic and tachypneic
  - Dull lung sounds
  - Borborygms ausculted in thorax
  - Abnormal percussion (dull vs. tympanic)
  - Tucked abdomen
  - Empty abdominal palpation
  - Cranial shifting of heart sounds

Treatment of Diaphragmatic Hernia

- Immediate vs Delayed Surgical Correction?
- Prognosis?

Perioperative survival rates after surgery for diaphragmatic hernias in dogs and cats: 92 cases (1990-2002)

Thomas G. Gibson, DVM, Brighton A. Beasley, DVM, MS, DACVECC; William Sears, DVM, MS.
• Pulmonary contusions
  – Most common finding
  – Clinical signs:
    • Tachypnea
    • Coughing
    • Cyanosis
    • Dyspnea
    • Hemoptysis

• Concurrent pleural space disease

• Difficult auscultation
  – ↑ BVS dorsally, dull ventral

• Prognosis:
  – 82% SURVIVAL
  – If positive pressure ventilation: 30% survival if > 25 kg

• Treatment
  – O₂
  – Volume resuscitate... but not too much
  – Supportive
  – Hydration but not
  – No!!!
    • Steroids
    • Antibiotics
    • Furosemide
**Thoracic Wall**
- Broken ribs
- Flail chest
- Open chest wound

**Rib Fractures**
- **Diagnosis/Exam Findings**
- **Causes of rib fractures:**
  - Blunt thoracic trauma
  - Penetrating trauma (bite wounds)
- **Treatment**
- Rib fractures should be a warning that additional injury has occurred

**Thoracic Wall**
- **Clinical signs:**
  - Tachypnea
  - Chest wounds
  - Asynchronous rib movement
  - Severe pain
  - Auscultation varies

**Thoracic Wall**
- **Treatment**
  - O₂
  - Cover wound!
  - Bad side down
  - Measure oxygenation
  - Pain management
  - Wound management
  - Antibiotic therapy
  - Surgery

**Flail chest**
- Fracture of 2 or more consecutive ribs (usually both dorsally and ventrally) causing paradoxical movement of the flail segment
- Asynchronous or paradoxical movement of floating rib segments
- Flail segment moves inwards during inspiration
- If penetrates chest from outside (open wound), refer for thoracotomy

**Flail chest**
- **Clinical signs:**
  - Dyspnea
  - Hypoventilation
- **Treatment:**
  - Shave whole body
  - Look for lesions/puncture
  - Local anesthesia
  - Opioids
  - NSAIDS
  - Surgery
  - Positive pressure ventilation
**Pneumomediastinum**

- **Etiology:**
  - Associated with large airway rupture
  - Tracheal tear
  - Esophageal rupture
  - Cervical wounds
  - Alveolar rupture

- **Beware of intubation**
  - Positive-pressure ventilation

- **Tracheal rupture**
  - Hyperflexed neck rapidly
  - Cats > dogs
  - Surgical correction

**Traumatic myocarditis**

- **Etiology:** heart hitting chest

- **Clinical signs:**
  - Pulse deficits
  - VPCs
  - Arrhythmias

- **Delayed development**

- **Signs resolve 24-72 hours**

- **Life-threatening**
Traumatic myocarditis

- Treatment:
  - O₂
  - ECG
  - Anti-arrhythmics

Further diagnostics

- Physical examination (PE)
- Chest radiographs
- ECG
- FAST or T-FAST ultrasound
- Arterial blood gas
- Pulse oximeter

Ultrasound and Thoracic Radiographs

- Brief ultrasound first!
  - Fluid vs. pericardial effusion
- Minimize stress when taking rads
- TAP FIRST if possible
- Use O₂ concurrently
- Just one view?
  - Lateral
  - DV if VD too stressful if possible

FAST exam

- Focused Abdominal Sonogram for Trauma
- New standard of care, human ER
- Helps pay off your ultrasound machine
- Evidence of free abdominal fluid: look in 4 areas
  - Caudal to xiphoid process
  - On midline over bladder
  - Over most gravity dependent area
  - right and left flank

FAST: Focused Abdominal Sonography for Trauma

- Use the FAST exam for the chest
- The "Glide" sign
- Etch-a-sketch™
**Treatment**

- Focus on ABCDs!
- Oxygen therapy
- Tap, tap, tap!
- Rule out abdominal trauma!
- Do radiographs post-tap or post-chest tube!

**Treatment**

- Treat underlying anatomical location of thoracic trauma
- Analgesics once stable
- Volume resuscitate until stable!
  - Do not flood with extra fluids → worsen contusions!
- Goals of O₂ therapy:
  - SpO₂ > 93% or a PaO₂ of > 80 mm Hg

**Treatment**

- Monitoring and supportive care
- No PPV unless rule out pneumothorax
- Good prognosis with supportive care!

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