Diagnosis of the Acute Abdomen

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What does “acute abdomen” mean?

• Sudden onset of intense abdominal pain arising from sites within or outside the abdominal cavity
Pain

• Three possible types of abdominal pain
  • Visceral
  • Somatic
  • Referred
Pain

• In the abdomen, nociceptive fibers are only found:
  • In the wall and/or capsule of organs
    • Majority of organ tissue is not innervated
    • In the connective tissue of the parietal peritoneum

• “Visceral pain”
  • Organs
    • Predominantly C fibers
      • Low conduction velocity
      • Highly sensitive to distension (stretch), ischemia and inflammation
      • Relatively insensitive to other stimuli that normally evoke pain such as cutting or burning
      • Slow, dull, difficult to localize pain

• “Somatic pain”
  • Peritoneum, skin, musculature
    • A and C fibers
      • Faster conduction
      • Respond to lower levels of stimulation
      • A fibers respond to mechanical and thermal stimuli and trigger rapid, sharp, localizable pain
Referred pain

- Pain may also be referred from other areas
  - IVDD dogs
  - Soft tissue injury to thoracic musculature may have referred abdominal pain
Signs

- Signs of abdominal pain include
  - Restlessness
  - Stiff gait
  - Hunched back
  - Prayer position
  - Abdominal distention
  - Tachypnea
  - Tachycardia
  - Anorexia
  - Hypersalivation
  - Vomiting
  - Lethargy
Acute abdomen syndrome

• Patients with acute abdominal pain can have multi-organ signs
• Other associated signs include:
  • Dyspnea
  • Arrhythmia
  • Altered mentation
  • Hypotension
  • Shock
  • Cardiorespiratory arrest
Acute abdomen syndrome

• Many patients have severe vomiting and/or diarrhea which lead to hypovolemia
• Many causes of abdominal pain have significant cardiovascular and respiratory effects leading to rapid patient decompensation
• Painful stimuli cause tachycardia and vasoconstriction which exacerbates an already shocky patient condition
Diagnostic challenge

• Critical patient
• Requires immediate life saving stabilization
• Requires quick diagnosis

• Does the patient need surgery?
Typical order of evaluation

1. Signalment
2. Comprehensive history
3. Comprehensive PE
4. Clin path
5. Imaging
6. Treatments
   a) Analgesics
   b) fluids

1. Triage
2. Fluid resuscitation
3. Signalment
4. Comprehensive PE
5. Analgesics
6. Comprehensive history
7. Clin path
8. Imaging
Step 1: triage

• Closely evaluate the cardiovascular systems for evidence of hypovolemia and shock
• Evaluate dehydration parameters
  • Skin tenting
  • Mm tachyness
  • Sunken appearance of the eyes
• Evaluate cardiovascular perfusion parameters
  • Core body temperature
  • Mucous membrane color
  • CRT
  • HR
  • Rhythm
  • Pulse quality and character
  • BP*
Hypovolemic shock

- Hypovolemic shock is caused by loss of body fluid volume
  - Vomiting, diarrhea, hemorrhage
- Decrease in circulating volume decreases tissue perfusion
- Metabolic needs of tissues and cells not met and cells die
- Cellular death progresses to tissue death
Hypovolemic shock

• Hypovolemic shock is beginning of shock cascade

• Early Shock/compensatory phase:
  • Body compensates for fluid loss through increase in HR and vasoconstriction
    • HEART RATE x STROKE VOLUME = CARDIAC OUTPUT
  • Blood shunted to vital organs (brain, lungs, heart)
  • Metabolism changes from aerobic to anaerobic
  • C/Ss include:
    • BP decreased by 10 -15 mmHg
    • Tachycardia and/or tachypnea
    • Peripheral vasoconstriction
    • Cold extremities, increased capillary refill time

• Initiating volume resuscitation and preventing further loss crucial
Triage diagnostics

- Triage diagnostics
  - PCV/TS
  - BUN (azostick)
  - Lactate
    - Glucose

- USG
Lactate

- Change in metabolism from aerobic to anaerobic
- Lactate rises when the body’s attempts to compensate begin to fail or are not capable of keeping up
- Normal is <2.5mmol/L
  - Mild systemic hypoperfusion: 3-4 mmol/L
  - Moderate hypoperfusion: 4-6 mmol/L
  - Severe hypoperfusion: 6 mmol/L
**SIRS**

- **Progressive Stage:**
  - Body’s compensatory mechanisms not effective
  - Sustained decrease in perfusion of vital organs causes release of inflammatory mediators (SIRS)
  - End organ damage starting
  - c/s include:
    - Tachycardia, weak, thready pulses
    - Cold to touch
    - Decreased bowel sounds, irregular bowel movement
    - Decreased urinary output
    - Decreased consciousness or inappropriate response to stimuli
MODS

• **Refractory Stage:**
  • End organ damage has occurred along with multisystem organ failure (MODS)
  • IRREVERSIBLE
  • c/s include:
    • Hypoxia
    • Oliguria from renal shutdown
    • Disseminated intravascular coagulation (DIC)
    • Cardiorespiratory arrest

![Diagram showing MODS, SIRS, Hypovolemia, Hypovolemic shock, Sepsis, Septic Shock]
Hypovolemia is an essential factor behind alterations in metabolism and perfusion during SIRS, and the alterations can be significantly reduced by adequate volume substitution. Best results during initial compensatory and early SIRS.
Step 2: Fluid resuscitation

- Main goals are:
  - Prevent further loss
  - Control bleeding
  - Assist with vomiting
  - Restore previous losses
    - Initiate fluid volume resuscitation

- Intravascular volume replacement
  - Place large bore peripheral or central IV line
  - Isotonic crystalloids are treatment of choice
    - Shock rate:
      - 90ml/kg dogs
      - 60ml/kg cats
  - HTS can rapidly increase volume 3-5ml/kg over 5 minutes
    - Never use alone
  - End point parameters:
    - Improved pulses
    - Improved heart rate
    - Stable mean arterial pressure > 60 and 80 mmHg
Resuscitation

• If refractory to crystalloids
  • Synthetic colloids
    • Do not readily cross the intact vascular membrane
    • Help retain fluid within the intravascular space
    • 5ml/kg boluses
    • Followed by CRI if effective
      • Up to 20ml/kg in dog and 10-15ml/kg in cat
      • Vetstarch can be given up to 50ml/kg/day
  • Blood products if hemorrhage

• If still refractory
  • Pressor therapy
Pressor therapy

• Consider in patients that are refractory despite adequate intravascular volume

• Norepinephrine
  • Mixed alpha and beta adrenergic agonist effects with preference for alpha
  • Effect on heart rate and contractility is less potent than the vasoconstrictive effects
  • 0.1-0.2ug/kg/min IV

• Vasopressin
  • Not recommended as an initial vasopressor but can be added to norepinephrine
  • Synthetic ADH-water retention and vasoconstriction
  • At low doses the drug causes vasodilation in renal, pulmonary, mesenteric and cerebral vasculature
  • Test dose of 4 milliunits/kg IV
  • Dose is 0.1 mU/kg/min IV
Now back to why...
Step 3: Signalment

• Signalment can give clues to why

• Young animal-foreign body or infectious disease (parvo)
• Sex: intact or not
  • Older intact male-prostate
  • Cryptorchid male: testicular torsion
  • Intact female-pyometra
• Breed
  • GSD-intestinal or mesenteric volvulus
  • Cats: string foreign body
  • Schnauzer: pancreatitis
  • Dane, wolfhound, irish setter: GDV
  • Labrador/golden/GSD: hemoabdomen
  • Dalmation: urethral obstruction
  • Small breed dog: HGE
Step 4: Comprehensive PE

• Abdominal palpation should be the last thing performed

• Neurologic exam
  • Spinal palpation to rule out spinal referred pain

• Rectal examination
  • Pelvic urethra
  • Colon
  • Sublumbar lymph nodes
  • Prostate
  • Color and consistency of the feces
Abdominal palpation

- External visual inspection first
- Auscult
- Percuss and ballot
  - Percussion
    - Hyperresonant areas may indicate intra-abdominal air
    - Hyporesonance may indicate fluid
  - Ballottement
- Palpate
Plz. Plz remoov ur hand.
Step 5: Analgesics

- Diagnostic dilemma
- Pure opioid agonists preferred
  - Hydromorphone
  - Morphine
  - Fentanyl**

<table>
<thead>
<tr>
<th>Table 1: Analgesic drugs and doses for treating moderate to severe pain in the critically ill dog &amp; cat</th>
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<tr>
<td><strong>ANALGESIC</strong></td>
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<tr>
<td><strong>Opioids</strong></td>
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<tr>
<td>Buprenorphine</td>
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<td>Morphine or Methadone</td>
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<td>preservative-free Morphine</td>
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| **Sedatives** | | |
| Disopyramide | 0.2-0.6 mg/kg IV | 0.5-1.0 mg/kg IV | |
| Midazolam | 0.25-0.5 mg/kg IV | 0.25-0.5 mg/kg IV | q2-4 hr |
| | 0.25-0.5 mg/kg/hr CRI | 0.25-0.5 mg/kg/hr CRI | q2-4 hr |

| **Local Anesthetics** | | |
| Bupivacaine (0.5%) | 2 ml/kg ID* | 2 ml/kg ID* | Mix with opioid EPI |
| | 1.5-2.5 mg/kg (6ml total) EPI | 1.5-2.5 mg/kg (1.5ml total) EPI | Mix with opioid EPI |
| Lidocaine (2%) | 2-4 mg/kg ID* | 2 mg/kg ID* | Mix with opioid EPI |
| | 3-6 mg/kg (6ml total) EPI | 3-6 mg/kg (1.5ml total) EPI | Mix with opioid EPI |

| **Combination** | | |
| Morphine | 20 mg/L | Rapidly infuse 2 ml/kg, then set rate at 2 ml/kg/hr |
| Lidocaine | 300 mg/L | | |
| Ketamine | 60 mg/L | | |
| Fentanyl | 1.5 mg/L | | |
| Lidocaine | 300 mg/L | | |
| Ketamine | 60 mg/L | | |
| Bupivacaine (0.5%) | 1 mg/kg | | |
| Sodium bicarbonate | 0.01 mEq/kg III Diluted with 0.9% saline to 3, 5, 12 ml | Administered intrapleural or intraperitoneal |

SC: Subcutaneous, IM: Intramuscular, IV: Intravenous, SL: Sublingual, EPI: Epidural, ID: Intradermal, CRI: Constant rate infusion (a bolus infusion of drug is required prior to initiating therapy) *can be diluted by 50% with warm saline to reduce the pain of injection and promote dispersal
Step 6: History

- Vomiting vs regurgitation
  - Vomiting: retching and repeated contraction of the abdominal muscles and diaphragm
  - Regurgitation: passive
History

• Describe vomitus

• Describe feces (purina fecal chart)
Step 7: Clin path

• Stabilized diagnostics
  • CBC
  • Full chemistry with electrolytes
  • UA

• Fecal exam
• Parvoviral fecal antigen
• Amylase/lipase
• PLI
• Ionized calcium
• Blood gas
Abdominal fluid analysis

- Always get fluid if it is there
How to obtain fluid

• Single needle
  • Recommended when using US assistance or with large amounts of fluid
  • Single needle with attached syringe
  • 20 gauge
Fluid

- 2 or 4 quadrant
  - Recommended for smaller amounts of fluid and no US
  - 2 or 4 open 20 gauge needles
  - Dependent cranial, dependent caudal (2)
  - Left cranial, left caudal, right cranial, right caudal (4)
  - Leave open needle in position for 1 to 2 minutes
  - Capillary flow through needle maximizes retrieval of small amounts of fluid

- Always perform after radiographs as free air can be introduced
DPL

- Diagnostic peritoneal lavage
- Indicated in
  - Trauma
  - Penetrating injuries
  - Possible abdominal perforation
  - Post operative leakage with small amounts or no free fluid
- Use a large 16 or 18 gauge angiocath with additional holes made
- 20ml/kg warm saline placed into abdomen
- Abdomen agitated and fluid removed
Abdominal effusions

**Transudate**
- TP: <2.5g/dl
- Cells: <1500 cells/ul

**Modified transudate**
- TP: 2.5-7.5g/dl
- Cells: 1000-7000 cells/ul

**Exudate**
- TP: >3.0g/dl
- Cells: >7000 cells/ul

**Serosanguineous or hemorrhagic**

**Chyle**
Abdominal fluid analysis

• EDTA tube for cytology and cell counts
• Clear or red top for biochemical testing

• Centrifuge fluid samples **
  • Use supernatant to evaluate TP and chemistries
  • Use sediment to prepare cytology slides
  • **Opaque fluids (exudates) often do not require centrifugation to prepare slides
Abdominal fluid analysis

• Clin path to perform on fluid:
  • PCV/TP
    • If fluid PCV > peripheral = active hemorrhage
  • Creatinine
    • If fluid creatinine > blood = urine
  • Glucose
    • If glucose in abd fluid is >20 less than blood = septic peritonitis
  • Lactate
    • If fluid has lactate 2.0 > than fluid = septic peritonitis

• Cytology/cell count
  • Always look at fluid in house, don’t just send out

Modified transudate

TP: 2.5-7.5 g/dl
Cells: 1000-7000 cells/ul
Exudate

TP: >3.0g/dl
Cells: >7000cells/ul

Surgical emergency!!
Bile peritonitis
Step 8: Definitive diagnostics

• Ultrasonography has changed current minimum database
  • Bloodwork, UA, 3 view thorax and abdominal ultrasound are standard
  • Radiographs are frequently bypassed for US
  • For acute abdomen, rads are critical
  • Rads allow for overall evaluation of entire abdomen and skeleton and assesses patterns of intestine gas
Benefits of rads over US

• Better at identifying:
  • Free gas
  • GDV
  • Radiopaque foreign bodies
  • Organ displacement and herniation of bowel
  • Skeletal structure and pelvic region
• *Don’t require a specialist to perform
Abdominal rads

• Lateral and VD
  • DV or both laterals alone are acceptable if unable to position patient

• Which lateral?
  • Gas and fluid displacement different
  • Different positions take advantage of this
    • Left lateral: gas in antrum and duodenum, fluid moves to fundus
    • Right lateral: gas in pylorus-can resemble a “ball” in the stomach
  • Ideally take both

• Pull legs caudally to allow more clear visualization of the pelvic inlet
Routine radiograph

• Liver should be sharp and contained within the costal arch
• Kidneys are bean shaped and symmetrical
  • 2.5 x L2 ish
• Stomach axis parallel to ribs
• GI tract
  • May or may not contain solid material
  • Should not exceed 12mm or 1.5 the height of L5 (L2)
Intestinal measurement

Should not exceed 12mm or 1.5 X the height of L5 (L2)
Radiographic ?s to answer in acute abdomen

• Is there:
  • Any abnormal density
  • An effusion
  • An abdominal mass
  • Evidence of bowel obstruction
  • Any free air
  • Organ malposition
Abnormal densities

• Are there abnormal densities?
  • Metal (rocks, bullets)
  • Bone
Abdominal mass

• Is there an abdominal mass?
  • Try to determine organ of origin
  • Displacement of other organs key
Effusion

• Is there an effusion?
  • Peritonitis
  • Hemorrhage
  • Leakage (urine, alimentary tract contents, other)
• **Beware** of young and emaciated animals!
Evidence of bowel obstruction

- Is there evidence for bowel obstruction?
  - Fluid/air accumulation
    - S.I. > 1.5x L5 vertebral body height
Linear foreign bodies

- Intestine convoluted and gathered or clumped together at one site
- Usually in the mid-right abdomen and intraluminal gas bubbles appear asymmetrical and irregular shaped
11yr DSH

4 day history of vomiting

painful abdomen, vomited with abdominal palpation
Pneumoperitoneum

• Is there free air?
  • Alimentary tract rupture
  • External wound
  • seen most easily with left lateral view
  • right abdominal wall and lateral to duodenum

• **Free air not related to surgery or a procedure is a surgical emergency**
4yr FS DSH
History of chronic, intermittent vomiting, acutely worse over past 2 days
PE: lethargic, minimally responsive, painful on abdominal palpation

Surgical emergency!!
Organ malposition

- Is there organ malposition?
  - Torsion/volvulus - stomach
  - Torsion - spleen
  - Volvulus - mesentery (often looks like distal high-grade small bowel obstruction)
  - Hernia - diaphragmatic, inguinal, nonspecific abdominal, scrotal
GDV or volvulus

- Right lateral view is the exam of choice
- Large dilated gas filled gastric shadow divided into two compartments by soft tissue
- Splenic enlargement and malposition may be evident
- Gas within the gastric wall may indicate gastric wall compromise is fastric rupture has occurred

Surgical emergency!!
4yr old GSD with acute onset of vomiting and abdominal distention
PE: laterally recumbent, hypotensive, shocky
4yr old GSD with acute onset of abdominal pain, lethargy, vomiting
PE: shocky, pale mucous membranes, PCV 23% with hemolyzed serum. Firm mass in cranial abdomen

Surgical emergency!!
Ultrasound

• If the diagnosis is not evident by radiograph ultrasound is recommended
  • Barium studies have been largely replaced by ultrasonography

• Ultrasound is
  • Able to assess intestinal wall infiltration and regional lymphadenopathy
  • Better for detecting small volume effusions
  • Able to assist with guided tissue sampling
  • Able to identify non-radiopaque foreign bodies
  • Able to assess intestinal motility

• Be aware - Ultrasound can be very difficult in patients with:
  • Excessive gas
  • Post operative inflammation
  • Free air in the abdomen
Intestinal wall infiltration and regional lymphadenopathy
Detecting small volume effusions
Identify non-radiopaque foreign bodies

• Appears as a hyperechoic interface with dense acoustic shadowing
Identify non-radiopaque foreign bodies
Linear FB
Intussusception
Assess intestinal motility

- Normal is 5 contractions per minute for the stomach
- 1-3 per minute for the SI
- Ileus with obstruction
  - Lack of peristalsis with generalized dilation
Mucocoele
Is a FB a surgical emergency?

- Not all FB are immediate surgical emergencies
- Depends primarily on patient clinical status
Summary

- Abdominal pain may be feature of numerous medical and surgical conditions
- Many causes of pain are conditions that require urgent medical attention and/or surgery
- Animals with acute abdominal pain should always be treated as emergency
- Animals with acute abdominal pain are a challenge because of multi-organ effects and occult nature
- Rapid assessment and treatment are vital
- Can be stressful because a decision about whether the patient requires surgery must be made quickly
- Signalment and history give important clues to diagnosis
Summary

• Consider obtaining a lactate meter
• Obtaining abdominal fluid is required if present
  • Finding on abdominocentesis that requires surgery
    • Exudate
    • Hemorrhage with a high PCV
    • Bile peritonitis
• Radiographs are often the most useful diagnostic
• Findings on rads that require surgery
  • Obstructive pattern with or without obvious FB
  • Pneumoperitoneum**
  • Torsion/GDV**
• Ultrasound is a good back up tool to rads
  • Findings on ultrasound that require surgery
    • Radiolucent foreign body
    • Intestinal plication
    • Bleeding abdominal mass
    • Mucocele
    • Intussusception
Words of wisdom

• “If you haven’t done a negative explore, you aren’t doing enough surgery”

• “You never go to Disneyland without taking home souvenirs”