A Clinical Approach to the Acute Abdomen
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The acute abdomen is a challenging clinical problem that requires an early and accurate diagnosis in order to minimize patient morbidity and mortality. There are many definitions but key to most is that there is a sudden onset of severe abdominal pain that is less than 24 hours in duration. The challenge lies in determining if a patient is truly suffering from an acute abdomen and then in narrowing the list of differential diagnoses.

It is important to realize that although many causes require surgical intervention this is not true for every case. Exploratory laparotomy, although an effective tool, is not a benign procedure and the benefits must be carefully weighed against the risks. The patient must also be adequately stabilized prior to the procedure. A sound understanding of normal anatomy is a key component to an accurate clinical assessment. A thorough history and physical examination are also necessary and the clinician must take care to avoid tunnel vision during this assessment.

The goal of this discussion is to cover the general approach to the acute surgical abdomen and to provide a discussion of important differential diagnoses and valuable clinical tools available in most general practice scenarios.

Etiology
There are many etiologies for the acute abdomen in the dog and cat. For a complete list the reader is directed to Beal’s Approach to the Acute Abdomen. (Beal 2005)

A systems approach to the underlying cause is helpful. The urologic system is a common source with bladder rupture, bladder obstruction and urethral obstruction being the most common. The gastrointestinal system is another common source with gastric dilatation-volvulus, gastric dilatation, foreign body (gastric or intestinal) and enteritis being the more common causes. Splenic torsion and neoplasia, pyometra, prostatic abscess and pancreatitis are less common but nonetheless require consideration.

Peritonitis can occur for a number of reasons and is most commonly secondary to a primary cause that must be identified. The clinician must not forget the extra-abdominal structures that may contribute. Body wall, skin and subcutaneous tissue injury/disease may cause clinical signs similar to those encountered with intra-abdominal disease. An excellent example of this is the dog with intervertebral disc disease (IVDD) associated back pain that is interpreted as abdominal pain.

Trauma cases present a unique set of issues and potential causes. Hemoperitoneum, uroperitoneum, bile peritonitis, septic peritonitis and penetrating injuries may be encountered in these cases.

Assessment/Triage
The initial assessment is important in any case but especially so in the emergent or trauma cases. If necessary the patient should be stabilized with appropriate therapy before any definitive diagnostics or therapeutics. Analgesia is also important and can often help facilitate a more complete examination.

Taking the time to obtain an accurate history is invaluable. What is the presenting complaint? When was the animal last normal? What, if any medications have been given? For this question do not forget to ask about common over the counter human medications as many owners do not think of these as “medications.” Be sure to distinguish between vomiting and regurgitation and ask for characterization of any diarrhea.

Although a comprehensive physical examination is important it can wait until the patient is stabilized. General body condition, attitude, ambulatory status, respiratory pattern and effort can provide useful information. Don’t forget an oral and rectal examination and to look for bruising along the abdominal wall, in the inguinal and perineal areas. Start with superficial palpation to determine areas of pain and then proceed with deeper palpation. If possible palpate organ size and consistency and for evidence of fluid. The distribution of pain is also valuable. Focal pain can be indicative of a foreign body, intussusception or mild pancreatitis. Regional pain can occur with moderate pancreatitis, cholecystitis or pyometra. Generalized pain can indicate peritonitis. Auscultation may be performed but the value is questionable. Serial auscultation can be used over time to assess intestinal motility. The present of borborygmi may suggest acute enteritis and similarly the absence of gut sounds may suggest ileus but both of these findings should be interpreted in light of the entire clinical picture.

Diagnostics
Radiographs
Orthogonal radiographs of the abdomen are easily obtained and can provide valuable information. Ventrodorsal and left lateral radiographs are often taken, but in cases where a GDV is suspected a right lateral view is needed. Whenever possible radiographs should be obtained prior to abdominocentesis to avoid introducing air artifacts. If free gas is present, it can be visualized between the stomach, liver and diaphragm on lateral radiograph. A horizontal beam with the animal in left lateral recumbency or a standing lateral
radiographic examination can also be helpful when looking for free air. Focal intestinal gaseous or fluid distension may indicate an obstruction whereas generalized distension may indicate ileus, a low obstruction or mesenteric torsion.

When assessing intestinal distention there are a number of guidelines. In their paper Graham et al. described a ratio of the small intestine (SI) to the height of the 5th lumbar vertebrae at its narrowest point (L5). A ratio greater than 1.6 was significantly associated with obstruction. (Graham 1998) Others have discussed the ratio of the SI to rib width. (Beal 2005) Small bowel plication with “C” shaped small intestinal gas pockets can occur with a linear foreign body.

It is important to assess abdominal detail (keeping in mind that technique can influence this radiographic finding). A loss of abdominal detail can occur in the young animal where there is a lack of contrast, in the patient with a reduced abdominal fat and when free abdominal fluid is present. The retroperitoneal space must also be evaluated. A loss of kidney, a streaky appearance or distention of the retroperitoneal space can occur with retroperitoneal hemorrhage or leakage of urine.

Contrast can be used in cases where plain films are not definitive. If there is concern about intestinal wall integrity an iodinated contrast and NOT barium should be used. Positive contrast urethrocystogram is considered a definitive diagnostic procedure for suspect rupture of the bladder/urethra. Intravenous urography should be performed if there is concern for renal/ureteral injury/leakage as demonstrated by loss of retroperitoneal detail.

Thoracic radiographs are indicated in all trauma cases to evaluate the integrity of the diaphragm. Animals with hemoabdomen secondary to rupture of splenic or liver tumors, as well as older patients should always have three view thoracic radiographs to rule out primary or metastatic neoplasia.

Ultrasound

Ultrasound can be a very valuable tool but is extremely operator-dependent. Beal commented that when performed by individuals without extensive training the diagnostic utility is “severely limited and misdiagnosis is extremely common.” (Beal 2005)

This modality allows for evaluation of the liver, spleen, biliary tract, gastrointestinal tract, and urogenital system. Ultrasound guidance can be used to obtain fluid samples and organ aspirates. Processes that can often be diagnosed using ultrasound include pancreatitis, intra-abdominal abscess, intussusception, pyometra, abdominal masses, splenic mass/torsion and infarction/thromboses.

When used as part of the focused assessment with sonography for trauma (FAST) examination ultrasound can be helpful. In this technique transverse and longitudinal views are taken from four sites around the abdomen including the subxiphoid, ventral midline over the bladder and over the most gravity-dependent areas of the right and left flanks. Boysen et al. found that the FAST procedure was a simple and rapid method of detecting intra-abdominal free fluid in an emergent setting. They also found that veterinary clinicians with minimal previous training could perform it. (Boysen 2004)

Computed tomography (CT) and magnetic resonance imaging (MRI) are modalities used in human medicine and at veterinary referral practices but have limited availability in general veterinary practice.

Clinical pathology

Ideally samples should be collected prior to initiation of fluid therapy but this may not be possible in every case. A minimum database includes a PCV, TS, Glucose, BUN and urine specific gravity. When available lactate measurement can be beneficial in monitoring resuscitation and in predicting prognosis with some processes (i.e. GDV). A complete blood count (CBC), serum biochemical profile and urinalysis are ideal but can also be collected after partial resuscitation. A coagulation profile or an activated clotting time (ACT) can be helpful in cases of intra-peritoneal hemorrhage. The baseline results are invaluable in monitoring your resuscitative efforts and in serial evaluation of the patient.

Abdominocentesis vs. diagnostic peritoneal lavage (DPL)

Collection of fluid from the abdomen can provide significant information in determining the appropriate course of action and in prognosis. Procedures are indicated when there is a loss of serosal detail, penetrating abdominal injury without obvious peritoneal entry wound, shock, multiple injuries or signs of abdominal injury after blunt trauma, persistent abdominal pain of undetermined origin, or suspect dehiscence of an enterotomy or anastomosis site.

Various methods are described for both abdominocentesis and DPL and these can be found in the references provided and/or most veterinary emergency references.

The diagnostic accuracy of the DPL is said to be 93-98% in our veterinary patients. A major advantage of the DPL is the early detection of serious injuries before delayed signs such as progressive hypovolemia or chemical peritonitis ensues. (Rivera 2004) Disadvantages of the DPL are the inability to detect retroperitoneal injuries and that non-specific findings can be found when it is performed immediately after trauma. Complications that can occur include perforation of the abdominal viscera, subcutaneous hematoma formation and fluid accumulation and inadequate drainage of the lavage fluid. It is contra-indicated when there is dyspnea, a diaphragmatic hernia, organomegaly, ileus and previous abdominal surgery.

Fluid analysis

Fluid should be collected in EDTA for cytologic analysis, serum (red top) tube for biochemical analyses and a sterile tube for aerobic and anaerobic culture. When hemorrhagic fluid is obtained it should be observed for clotting. Intra-abdominal hemorrhage will not
clot. Smears can be made from direct samples or from centrifuged DPL samples and then stained with Romanowsky-type stain (Diff-quick) and Gram stain (especially when bacteria are noted).

Gross assessment of the fluid can provide some idea of the source. Turbid or flocculent fluid is suggestive of peritonitis. Green fluid may contain bile and can indicate biliary tract leakage. Pink fluid suggests mild hemorrhage whereas dark red fluid is indicative of major hemorrhage. A PCV of more than 2-5% indicates significant hemorrhage. Abdominal fluid has a WBC < 500 cells/μl. (Dye 2003) It is important to account for the dilutional effect when evaluating fluid form a DPL.

A pure transudate is often associated with systemic hypoalbuminemia or portal venous obstruction. It is characterized by fluid that is grossly clear with a total protein <2.5 g/dl and a low cell count (<500 cells/μl). The cells present are either nondegenerate neutrophils or reactive mesothelial cells.

A modified transudate can be serous to serosanguineous and is often associated with right- sided heart failure, dirofilariasis, neoplasia and liver disease. It is characterized by a total protein of 2.5-5.0 g/dl and a cell count of 300-5500 cells/μl. The cells present will depend on the cause but can be red blood cells, nondegenerate neutrophils, mesothelial cells, macrophages and lymphocytes.

An exudate is often cloudy with a total protein >3.0 g/dl and a cell count >5000-7000 cells/μl. The predominant cell type is the neutrophil although other cells may be present. This is the most common type of free fluid associated with an acute abdomen. It can be septic or non-septic and the septic exudates are characterized by the presence of intra- and extra-cellular bacteria.

The fluid obtained from a direct abdominocentesis can be evaluated biochemically:

- Glucose – a fluid glucose that was >20 mg/dl lower than that of the blood (peripheral) was 100% sensitive and 100% specific for the septic peritonitis in dogs. (Bonczynski 2003)
- Creatinine – an abdominal fluid creatinine to blood creatinine ratio > 2.0 – highly sensitive and specific indicator of uroabdomen
- Potassium – abdominal fluid potassium to peripheral blood potassium ratio of 1.4 in dogs and 1.9 in cats is supportive of a uroabdomen.
- Ideally, both creatinine and potassium should be performed. Not all analyzers are validated to measure these parameters on samples other than blood or serum so care must be taken when interpreting these results using in house analyzers.
- Lactate – in one study when the fluid lactate was >2.0 mmol/L than the peripheral lactate it was 100% sensitive and specific for a septic effusion. In another study a lactate of >2.5 mmol/L in the effusion was 95% accurate in predicting a septic effusion. (Culp 2010)

Microbial evaluation
Aerobic and anaerobic culture is important but one must consider sample handling (especially for anaerobic cultures) when interpreting the results. It is also important to consider if there were inflammatory cells present with/without the etiologic agents on cytology. The absence of bacteria on cytologic evaluation DOES NOT exclude a septic process.

Take home notes ...
1. A high suspicion of a surgical disease likely warrants exploration.
2. When and if to explore can be very challenging decision and is influenced by many factors.
3. Severe abdominal pain is the highest consideration for surgical intervention.
4. Hemodynamic stability prior to anesthesia maximizes longs term outcome (keep in mind this may or may not be possible).
5. Early surgical intervention (when indicated) minimizes anesthetic risk and maximizes post-operative outcome in the stable patient.
6. Don’t forget about the rest of the patient.

References