

The Acute Abdomen – An Overview

Jennifer J. Devey, DVM, Diplomate ACVECC
Saanichton, British Columbia, Canada
jenniferdevey@gmail.com

Acute abdominal conditions are not uncommon in veterinary medicine. The history may be very non-specific and can include signs of lethargy or depression, anorexia, retching, vomiting, diarrhea and abdominal distention. The definition of an acute abdomen is a sudden onset of a painful abdomen; however, although these patients are usually painful on abdominal palpation, pain may not be clinically evident if the patient is in severe shock or is severely depressed. As they are being resuscitated these patients can often become excruciatingly painful. The clinician should have a very high index of suspicion that these patients may require surgery and serial abdominal exams (physical, ultrasonographic and cytological) should be performed with this in mind. Some of these patients can, and should be managed medically, and some require emergency surgery (within minutes to hours of presentation); therefore, it is important to be able to determine rapidly whether or not surgery is indicated. If there is any doubt it may be better to perform an exploratory laparotomy rather than wait and have the patient deteriorate.

Physical Examination

Patients with an acute abdomen may be unstable from a respiratory and cardiovascular standpoint. On presentation a primary survey examination (evaluation of level of consciousness, airway, breathing, and circulation) should be completed within 30 to 60 seconds. Abnormalities should be treated as indicated. For instance the patient that presents obtunded with shallow respiration should be intubated and positive pressure ventilation should be instituted. Not only will this help respiration but it will also protect the airway against aspiration. Depending on the severity of the patient's condition resuscitation may need to be instituted prior to completing a physical exam. A very brief history is obtained at this time if possible; however, resuscitation should not be delayed in the critical patient while a complete history is obtained. Instead permission should be rapidly obtained from the owner to allow treatment to be started.

A secondary survey, or complete physical examination, is completed once the primary survey is completed and resuscitation is instituted as indicated. Vital signs are taken at this time. Rectal thermometers may induce a vagally-mediated arrest in the severely bradycardic or hypotensive patient and should be avoided in these patients. Toe web temperatures can be taken and compared with rectal temperatures. If the patient is perfusing normally the ΔT (or the difference between the two temperatures) should be less than 7 degrees Fahrenheit. The jugular vein should be clipped and evaluated for distention since this will provide a crude estimate of central venous pressure. Patients with abdominal diseases may have concurrent pneumothorax, secondary aspiration pneumonia, metastatic disease, etc., and close attention should be paid to the ventilatory pattern, presence of cough, and bilateral auscultation of the thorax. The abdomen should be palpated, ausculted, and percussed with the goal of localizing pain, and detecting the presence of fluid waves, gas-filled organs, or solid masses. Auscultation should precede palpation since palpation can cause gut sounds to diminish. A rectal exam should be performed and the following should be evaluated: consistency of stool, evidence of blood, presence of foreign material or masses, dilation or contraction of the rectum, etc. (Rectal dilation in puppies with hemorrhagic diarrhea is almost always parvovirus enteritis.) The ventral abdomen should be clipped. Petechiation or ecchymoses may indicate thrombocytopenia, a coagulopathy or disseminated intravascular coagulation. Periumbilical hemorrhage may be seen with a hemoabdomen and periumbilical masses may be seen with pancreatic carcinoma. Distended superficial abdominal veins are consistent with increased intraabdominal pressure, almost always secondary to ascites or abdominal masses, which can be associated with decreased preload and decreased cardiac output.

Blood pressure should be considered one of the 4 vital signs and should be assessed as part of the initial exam since fluid resuscitation will depend to a large extent on the patient's blood pressure. A Doppler ultrasonic blood flow detector or an oscillometric device can be used; however, the Doppler is preferred since it allows the clinician to evaluate perfusion or flow as well as blood pressure. In addition arrhythmias can be detected with a Doppler.

Diagnostic Tests

Diagnostic tests are required frequently in order to determine the extent of the disease and to confirm the diagnosis. Resuscitation of the critical patient should not be delayed while tests are being performed unless those tests are required to guide resuscitation. Blood tests including packed cell volume, total solids, and glucose should be part of a STAT database. Many septic patients are hypoglycemic and require an immediate intravenous bolus of dextrose and dextrose supplementation in the intravenous fluids. An extended STAT database would include electrolytes, a blood gas (venous or arterial) and a creatinine. Ideally a complete blood count with microscopic evaluation of a blood smear for the differential and platelet estimate, prothrombin time, activated partial thromboplastin time, blood chemistries (especially albumin), fecal (if diarrhea is present), and urinalysis should be performed. The choice of tests may vary to some degree based on the presenting complaint. The advent of point-of-care devices has made it easy to assess many of these parameters within a matter of a couple of minutes.

Survey abdominal radiographs are always indicated. Chest radiographs should be evaluated preoperatively in every trauma patient, and in any patient in which aspiration pneumonia or metastases are a potential concern. Contrast studies including barium series, intravenous urography, cystography (single and double contrast), and angiography may be indicated. Water-soluble contrast material should be used instead of barium if there is any concern for gastrointestinal perforation or aspiration. Abdominal ultrasound can be very useful for diagnosing many causes of acute abdomen unless there is a significant amount of air within the peritoneal cavity and an AFAST is always indicated to assess for free fluid. Abdominal centesis or paracentesis should be performed in 4 quadrants. Ultrasound-guided centesis is preferred if available. Abdominocentesis may provide false negative results, and diagnostic peritoneal lavage should be performed if further assessment is indicated.

An electrocardiogram should be assessed for the presence of arrhythmias and tall T waves which are consistent with myocardial hypoxia/ischemia. Ventricular premature contractions and ventricular tachycardia are the most common malignant arrhythmias seen and are often associated with splenic disease in acute abdomen patients.

Diagnostic Peritoneal Lavage

Diagnostic peritoneal lavage allows for accurate evaluation of acute abdominal conditions. Four quadrant abdominocentesis can yield a high percentage of false negative results unless there is a large amount of fluid present whereas diagnostic peritoneal lavage has an extremely low incidence of false negative results. Results of lavage fluid examination are extremely useful in not only diagnosing a condition but also in determining the need to exploratory surgery in cases where the diagnosis is uncertain.

The animal is placed in left lateral recumbency with the goal of keeping the spleen away from the midline. Ideally the urinary bladder is emptied. A clip and surgical prep is performed of a 4 cm square area 2 cm distal to the umbilicus on the midline. A local block is placed in the skin and peritoneum 2 cm caudal to the umbilicus either on the midline or just lateral to the midline. Sedation is used if necessary. Surgical gloves are worn and ideally a drape is placed. A stab incision is made in the skin and a multi-holed catheter is inserted into the abdomen. In cats and small dogs an 18g 2 inch (5 cm) catheter is ideal. In medium and larger sized dogs a 16g or 14g 5.25 inch (13 cm) catheter is inserted. Side-holes should be added using a #15 scalpel blade. Alternatively a commercial diagnostic peritoneal lavage catheter can be used. The catheter is inserted in a caudal direction. If fluid is retrieved a sample is collected aseptically for analysis. To complete the lavage 20 ml/kg of warm (body temperature) isotonic crystalloid fluid is infused. Since this will increase pressure on the diaphragm, the respiratory rate and effort should be watched closely and fluid infusion stopped if the animal starts to show signs of respiratory distress. Once the fluid has been infused the animal is gently rotated to mix the fluid around and then fluid samples are collected for analysis. A packed cell volume, protein level, white blood cell count, and microscopic examination of the fluid should be performed. Cultures are indicated if bacteria are present. Blood chemistries such as amylase, lipase, alkaline phosphatase and bilirubin can be analyzed. Levels that are higher than serum suggest pancreatitis, intestinal disease, and biliary disease respectively. High potassium levels are consistent with urinary tract rupture. Urea nitrogen levels will equilibrate rapidly between the serum and peritoneum but in an acute bladder rupture the peritoneal level will be higher than serum. An abdominal glucose concentration that is greater than 20 mg/dL less than the serum

glucose is consistent with a septic peritonitis as is a blood to fluid lactate difference of less than 2 mmol/L. The catheter is removed and a dressing is placed over the incision. A suture or staple can be placed if desired.

Resuscitation

The goal of resuscitation is to reverse the signs of shock and provide effective oxygen delivery to the cells. Resuscitative efforts should be aimed at maximizing hemoglobin levels (oxygen-carrying capacity), blood volume and cardiac function. Patients presenting with signs of shock should have oxygen administered via flow-by. This can be followed with nasal oxygen supplementation if longer-term support is indicated. Temporary positive pressure ventilation may be indicated in patients presenting in severe shock who show an inadequate response to supplemental oxygen (improvement of respiratory rate and effort, mucous membrane colour, pulse oximetry, blood gas analysis).

If there is sufficient distention of the abdomen to interfere with ventilation, measures should be taken to remedy this. Trocarization or insertion of an orogastric or nasogastric tube should be placed if there is severe gastric distention secondary to air. In the gastric dilatation and volvulus patient, the stomach should be decompressed once fluid resuscitation has been instituted since rapidly relieving pressure on the vena cava may cause acute hemodynamic collapse; however, if the patient cannot ventilate, the stomach should be trocarized immediately. Severe abdominal distention from fluid accumulations may need to be addressed by drainage of the fluid. Dorsal recumbency should be avoided in these patients since the additional pressure on the abdominal vena cava can significantly decrease preload.

One or two large bore peripheral intravenous catheters should be placed. Resuscitation of these patients will often require a combination of both crystalloids and colloids. Buffered isotonic solutions such as Normosol-R, or Plasmalyte-A should be administered. These patients are often acidotic and administration of saline, which has a pH of 5.4, should be avoided. Saline must be administered to the patient with a metabolic alkalosis from a gastric outflow obstruction. Electrolyte abnormalities should be corrected based on blood test results.

Crystalloids rapidly redistribute to the interstitial space and only approximately 20% is left in the vascular space within 20 to 60 minutes. Crystalloids should be considered interstitial rehydrators and not intravascular volume expanders. Infusion of excessive volumes of crystalloids may lead to tissue edema which creates a barrier to oxygen diffusion. Synthetic colloids such as hydroxyethyl starch should be administered to any patient showing signs of significant hypovolemia. Colloids are large molecular weight compounds that are not capable of diffusing across intact membranes and are effective intravascular volume expanders.

Fluids should be infused to achieve or maintain a systolic blood pressure of 100-120 mm Hg, a diastolic blood pressure of 60-80 mm Hg and a positive central venous pressure. Although ideally an arterial line for direct arterial pressure monitoring should be placed in every critically ill patient, this is not realistic. If blood pressure is being monitored indirectly a Doppler is recommended. If patients do not respond to infusion of fluids (i.e., blood pressure remains low) and volume is assessed to be adequate then a vasopressor or positive inotrope may be indicated. Norepinephrine is the first choice in septic patients. Urine output should be monitored in patients in shock or with renal dysfunction. An indwelling urinary catheter may be indicated to be able to quantify urine production.

Whole blood or packed red blood cells should be administered to maintain a packed cell volume as close to 30% as possible. Autotransfusion may need to be considered if the patient has a significant hemoabdomen and large quantities of blood products are not available. Fresh frozen plasma should be administered to help maintain an albumin close to 20 g/L and to provide clotting factors to any patient with a coagulopathy. In large dogs albumin may be indicated. Patients with a prolonged prothrombin time, activated partial thromboplastin time (or activated clotting time), a prolonged buccal mucosal bleeding time, or significantly decreased platelets (<75,000 or 5/oil immersion field) may have a clinically significant coagulopathy. If in doubt it is always better to err on the side of providing coagulation factors and red cells. Preventing a problem from occurring is always better than trying to treat a problem once it has occurred.

Ventricular premature contractions should be treated if they are multifocal, are affecting perfusion (significant pulse deficits or alteration in peripheral flow as assessed by Doppler), if the heart rate is elevated (greater than

160-180 beats per minute), or if there is evidence of R on T phenomenon. Treatment includes the use of supplemental oxygen, ensuring tissue perfusion is being maximized, analgesics, and a constant rate infusion of antiarrhythmic drugs (lidocaine, magnesium sulfate).

Patients with an acute abdomen may present with hypothermia. Or they may become hypothermic during resuscitation secondary to intravascular infusion of large volumes of room temperature fluids. Hypothermia interferes with normal metabolic functions leading to vasodilation, cardiac dysfunction, and interference with the coagulation cascade. Core rewarming should be instituted since peripheral rewarming may lead to worsening of the vasodilation and subsequent worsening of the hypothermia. Artificial warming devices should be insulated from the patient since they can cause burns. Means of rewarming patients includes the use of warm water bottles, warm water circulating blankets, oat bags, warm blankets, and hot air circulating devices. Fluids should be infused at 104F in the hypothermic patient.

If the patient is vomiting or regurgitating a nasogastric tube should be placed for gastric decompression and initiation of early enteral feeding. Antibiotics may not be indicated in all cases; however, in general the patient should be started on broad-spectrum antibiotics to cover both aerobic and anaerobic bacterial infections.

Analgesia is a key part of treatment for most patients presenting with an acute abdomen. Non-steroidal anti-inflammatory drugs should be avoided due to their negative effects on splanchnic organs, and in some cases coagulation. Opioids such as butorphanol, hydromorphone, methadone, morphine, and fentanyl are recommended. They should be given intravenously since absorption from subcutaneous or intramuscular sites may be unpredictable. In cases of severe pain constant rate infusions may be required. Alternatively epidural analgesia can be administered. This is a very effective means of controlling pain and if an epidural catheter is placed repeat doses can be given. In the critical patients doses of opioids may need to be reduced to 25-50% of normal since the patients often cannot tolerate usual doses. For those patients who are not responding as desired to systemic analgesics a peritoneal lavage with or without local anesthetic may provide significant pain relief, especially in patients with pancreatitis or serositis.

Overview of Surgical Treatment

Surgical treatment is indicated in many acute abdominal conditions. The sun should never rise or set on gastrointestinal obstructions, ischemic abdominal diseases (organ torsions, vascular accidents), or peritonitis. The patient should be closely monitored while it is being resuscitated and prepared for surgery. Vital signs, blood pressure, central venous pressure, and electrocardiography should be evaluated as frequently as continuously to as infrequently as every 30-60 minutes if the patient is stable. All numbers should be recorded since often the trend of change is more important than the absolute numbers.

A team of a minimum of 3 people - surgeon, assistant surgeon and anesthetist/circulating nurse - is very important in the management of these patients. Balanced anesthesia with close monitoring of blood pressure and ventilation is essential. Isoflurane has no analgesic properties and pain medication should be administered intraoperatively if the patient appears to be perceiving pain. A Doppler blood pressure monitor for indirect pressure monitoring is very useful for this purpose and is strongly recommended. Many of these patients do not ventilate well under anesthesia and may require hand ventilation or preferably the use of a mechanical ventilator.

Appropriate patient positioning is obviously key to getting good exposure to the surgical site; however, patient positioning can potentially adversely affect hemodynamics and ventilation. Patients with abdominal masses that are hemodynamically compromised may be even further compromised when placed in dorsal recumbency. Abdominal masses, a large spleen or a full uterus can effectively occlude the abdominal vena cava significantly decreasing preload. Patients placed in dorsal recumbency with limbs held in an extreme extended position cannot ventilate well. Patients placed in a tilted position with the head down may have difficulty moving their diaphragm normally.

Due to the fact that a hollow viscus may be incised or the gastrointestinal tract may be compromised at the time of surgery, broad-spectrum antibiotics must be started prior to beginning surgery. A complete exploratory always should be performed. The skin incision should extend from the xiphoid to the pubis.

Incisions heal from side to side, not end to end, and morbidity is likely to be higher due to lack of visualization or poor surgical exposure than a long incision. A headlight is strongly advised. Time, trash, and trauma must be minimized. This means the surgeon must have a thorough knowledge of anatomy since surgery for the critically ill or injured can take you anywhere.

Since many of these patients have altered coagulation capability accurate hemostasis is important in order to minimize blood loss. Several factors will influence the body's natural ability to clot including blood pressure and tissue perfusion, the absence of coagulation factors, hypothermia and acidosis (respiratory or metabolic). The presence of clots or hematomas can lead to delayed healing as well as an increased likelihood of infection. Intraoperatively hemorrhage can be controlled using ligatures or vascular clips, electrosurgery, hemostatic agents, or by removing whatever is bleeding.

A conscious decision should be made in regard to placement of a feeding tube in each patient. Ideally a nasogastric tube should be placed in all dogs for postoperative decompression and early enteral feeding as well as with in cats with evidence of gastroparesis. Gastric decompression helps decrease the chance for bloat, decrease interference with diaphragmatic excursions, and has been proven to significantly decrease the time it take for normal gastric motility to return. A gastrojejunostomy or jejunostomy feeding tube should be considered in all patients with upper gastrointestinal surgery (including hepatobiliary and pancreatic surgery) if there are any concerns that enteral nutrition will not be able to be started within 24-36 hours.

"Dilution is the solution to pollution." The abdominal cavity always should be lavaged with warm isotonic fluids. The number of litres of saline used will depend to some extent on the degree of contamination. It has been recommended that approximately 200 to 300 mL/kg minimum – or until the lavage effluent is clear - be used to lavage a contaminated or infected abdomen. Gloves and instruments should be changed after lavage if there was any contamination during the surgery or if the gastrointestinal tract was entered. Cultures should be taken after lavage is performed.

Closure of the linea alba is performed using a simple continuous pattern of polypropylene or polybutester in the external rectus sheath. The peritoneum should not be closed.

Peritoneal drainage is indicated in cases of peritonitis if the source of the contamination has not been completely controlled, if an anaerobic infection is likely, if relaparotomy is planned or if significant peritonitis is present. The two most common options for peritoneal drainage include open peritoneal drainage and closed suction drainage.

Postoperative Care

Postoperatively the patient should be monitored in a similar fashion as it was preoperatively. The patient should be aggressively rewarmed. Vital signs should be returned to normal as soon as possible. The endotracheal tube should remain in place with the cuff inflated until the patient is awake and has a strong swallow reflex and is ventilating appropriately based on end-tidal CO₂ measurements. Regurgitation and aspiration can occur at any time and not infrequently occurs during recovery. For this reason the cuff should remain inflated until the patient is ready to be extubated. A nurse or doctor should remain with the patient until extubation. Lab tests should be run in the immediate postoperative period to ensure that parameters such as packed cell volume, albumin, electrolytes, creatinine and glucose are in the normal range.

Pain should be managed aggressively. Patients should receive pain medication on a schedule but also on an as needed basis since every animal's condition is different. Some opioids such as hydromorphone/methadone may last as long as 4 hours if the patient does not have an extremely painful condition but may last less than an hour if the patient is very painful. Good intraoperative pain control will help with postoperative pain control. Constant rate infusions are the most effective means of keeping patients comfortable.

References available on request.