Canine Hemoabdomen: The Blood and Guts of the Matter
Rebecca Syring, DVM, DACVECC
Medical Director, Veterinary Specialty and Emergency Center/BluePearl

INTRODUCTION
Intra-abdominal blood loss often occurs percutaneously and, because there is sufficient space for significant blood loss to occur, often results in sudden life-threatening consequences. Hemorrhage into the peritoneal cavity can be divided into two major categories: traumatic and spontaneous. It is the author’s experience that treatment recommendations for abdominal hemorrhage will vary substantially depending upon the underlying cause for hemorrhage. Early recognition of abdominal hemorrhage, followed by appropriate resuscitative measures and definitive therapy to control hemorrhage are key to a successful outcome in these often-critical patients.

DIAGNOSIS
Abdominal hemorrhage is usually the result of splenic or hepatic lacerations following blunt trauma and less frequently occurs secondary to vascular avulsion/laceration or other organ injuries. Spontaneous abdominal hemorrhage can result from rupture of a mass structure within the abdomen, often on the spleen, but can involve other parenchymal organs or may occur as a result of coagulopathy.

Traumatic hemoabdomen may occur as a result of blunt or penetrating trauma. It is one of the more common sequel to vehicular trauma. Following blunt trauma, when a patient presents with signs of cardiovascular instability (tachycardia, pallor of mucous membranes, prolonged CRT and poor peripheral pulse quality) internal hemorrhage should be actively ruled out. Remember, the most common places for significant blood loss internally to result in cardiovascular instability include the abdominal cavity, retroperitoneal space and into muscle around long bone or pelvic fractures. Less commonly, pleural space hemorrhage may result in cardiovascular instability.

Spontaneous hemoabdomen may occur as the result of coagulopathy or rupture of a mass structure within the abdomen. Hemorrhage into the abdomen secondary to coagulopathy is usually due to alterations in secondary hemostasis resulting in prolonged PT/PTT bleeding times, such as anticoagulant rodenticide toxicity or hemophilia. It is rare for disorders of primary hemostasis (severe thrombocytopenia or thrombocytopathia) to result in body cavity bleeds. However, as a result of blood loss into the abdomen and consumption, it is not uncommon to see platelet counts as low as 20,000-100,000.

Examination findings
Abdominal distention or evidence of a fluid wave is often not detected in patients with significant abdominal hemorrhage; however, progressive distention may be noted as volume...
resuscitation occurs. A small percentage of animals with significant abdominal hemorrhage exhibit an ecchymotic ring encircling the umbilicus. Because the kidney is located in the retroperitoneal space in dogs and cats, laceration or avulsion of the kidneys may cause retroperitoneal effusion instead of abdominal hemorrhage. These patients may have pain on lumbar or rectal palpation and some may exhibit ecchymotic hemorrhage in the perineal region.

**Diagnostic findings**

Patients with acute abdominal hemorrhage frequently present with a normal packed cell volume but a disproportionately low total solids concentration (i.e. PCV 42%, TS 5.0). This occurs because of splenic contraction and an inadequate time for interstitial fluid to equilibrate with the intravascular space following loss of whole blood. Soon after initiation of stabilizing fluid therapy, decreased hematocrit will be unmasked.

Blind abdominocentesis should be performed in these patients—this test has been reported to be positive in more than half of patients with clinically significant abdominal hemorrhage. If blind abdominocentesis is negative, ultrasound-guided paracentesis can be performed. In acute hemorrhage, the hematocrit and total solids concentration of the effusion should be similar to the PCV/TS of the patient on arrival and the sample should not clot if placed in a red top tube containing no anticoagulant.

If abdominal effusion is suspected, abdominocentesis can be used as a fast, easy technique to retrieve a sample of free abdominal fluid. For this procedure, the area should be clipped free of hair and disinfected according to aseptic technique. A closed needle abdominocentesis is performed by attaching a 20 or 22 gauge hypodermic needle to a 3-5 ml syringe. Preferable, the patient should be placed in right lateral recumbency and the needle directed into the dependent zone just cranial and/or caudal to the umbilicus, avoiding the spleen; however, this can be done standing or in any position that the patient is most comfortable if needed. By performing a closed abdominocentesis, no free air is introduced into the abdomen and therefore the interpretation of future radiographs is not altered. Open needle abdominocentesis is performed by inserting an unattached needle into the abdominal cavity and allowing any fluid to wick out of the hub by capillary action. While this technique may introduce free air into the abdomen, it is considered more sensitive for obtaining smaller volumes of effusion. This is because the negative pressure applied to the syringe with the closed needle technique can cause omentum or viscera to occlude the needle lumen and therefore inhibit the ability to retrieve free fluid.

While abdominocentesis is a simple and specific tool for the determination of abdominal effusion, it is not a very sensitive technique and may miss small or pocketed effusions, with false negative results as often 50% of the time when blind abdominocentesis is performed. The volume of abdominal effusion required for a positive blind abdominocentesis has been estimated to range anywhere from 5 to 25 ml/kg. Ultrasound guided abdominocentesis of abdominal fluid may help to increase the sensitivity of this technique. The FAST (Focused Assessment with Sonography for Trauma) ultrasound technique has been documented to be an effective way to detect significant hemorrhage—it requires minimal training in ultrasonography, does not need a high powered machine, and can be performed in less than one minute. Four regions should be scanned: on midline near the bladder, in the subxiphoid region (detects fluid around the liver lobes, in the pleural space and pericardium), and in both flanks near the kidneys.

Hemorrhagic fluid should be assessed for the ability to clot, as free blood within the abdominal cavity rapidly defibrinates and should not clot. The presence of a clot indicates inadvertent sampling of a solid organ, such as spleen, or intact vessel.
When spontaneous hemoabdomen occurs, testing of PT/PTT clotting times to rule out coagulopathy is imperative to rule out a bleeding disorder as the cause of blood loss. Therapy for this type of hemoabdomen would require replacement of clotting factors in the form of fresh whole blood or fresh/fresh frozen plasma rather in order to cease blood loss. Surgical intervention in the face of severe coagulopathy could result in fatal hemorrhage and would likely not be needed at all.

**RESUSCITATION METHODS**

When a patient with abdominal hemorrhage shows signs of cardiovascular instability and shock, a decision needs to be made quickly regarding intravascular volume replacement therapies. Initial treatment strategies focus upon two primary goals: replacement of intravascular volume losses such that circulation is restored (thus organ function maintained) along with minimizing and ultimately stopping additional blood loss. With this in mind, the two schools of fluid resuscitation, traditional versus hypotensive resuscitation, prioritize each of the two goals differently.

**Traditional Resuscitation**

Traditionally, resuscitation of the patient with hemorrhagic shock focused upon rapid volume resuscitation with isotonic crystalloids at three times the shed blood volume and provision of blood products to maintain hemoglobin concentrations and coagulation within optimal ranges. The implied advantage for traditional resuscitation schemes is prompt and optimal restoration of intravascular volume, systemic blood pressure and oxygen delivery to the tissues, thus decreasing the duration of hypoxic or ischemic injury to end-organs. While this is highly desirable goal, traditional resuscitation schemes may promote blood loss in patients with uncontrolled hemorrhage. Hemostasis may be impaired because of clot disruption caused by increased local blood flow, pressure and decreased blood viscosity. In addition, a dilution coagulopathy can result following large volume infusion of crystalloid and artificial colloids. Delay of surgical correction of hemorrhage until the patient is fully resuscitated may also contribute to increased blood loss and therefore requirements for transfusions.

Intravascular volume restoration can be achieved with a variety of different types of intravenous fluids in patients with internal hemorrhage—no one fluid type is appropriate for every situation. The goal of fluid resuscitation is to expand intravascular volume in order to preserve tissue perfusion. Isotonic crystalloids (i.e. Normosol-R) are often selected for initial resuscitation at shock rates of 60-90 ml/kg in the dog and 45-60 ml/kg in the cat. The limitation to isotonic crystalloid resuscitation is the limited time that this fluid will remain in the intravascular space, given its propensity to freely distribute to other fluid compartments in the body. Hypertonic saline has been used for rapid volume resuscitation (3-5 ml/kg of 7.5% NaCl over 10-15 minutes); however, concerns exist for this type of fluid exacerbating ongoing hemorrhage. Artificial colloids (i.e. Hetastarch, Vetstarch) can be used to prolong the duration of volume expansion and to maintain oncotic pressure in patients with low protein concentrations. Certainly, blood products (whole blood or packed red blood cells) are the most physiologic resuscitation fluid in a patient that has bled; however, not all patients will require transfusion therapy, and shed blood in the abdomen cavity will eventually be reabsorbed into the circulation.

**Hypotensive Resuscitation**

Hypotensive resuscitation (HTR) refers to a method of fluid resuscitation that has been suggested for stabilization of the pre-surgical patient with uncontrolled hemorrhage. The main premise of HTR focuses upon early and definitive control of blood loss. Two broad categories of HTR have been described: limited-volume resuscitation and delayed resuscitation. Limited-volume resuscitation (LVR), also referred to as permissive hypotension, refers to a scenario
where intravenous fluids are administered prior to definitive control of hemorrhage in order to improve tissue perfusion, but they are given in conservative volumes such that systemic blood pressure is not normalized. In studies investigating limited volume resuscitation, the target blood pressure attained prior to surgical intervention is quite low, with many studies using a mean arterial pressure of 40-60 mmHg as a pre-surgical target. Delayed resuscitation (DR), on the other hand, refers to a strategy where the patient receives no volume resuscitation until definitive control of hemorrhage has been attained or is imminent (i.e. that patient is under anesthesia in the operating room). Once hemorrhage has been controlled, with either of these strategies, aggressive volume expansion ensues, to set endpoints such as a normal blood pressure, heart rate, cardiac output, serum lactate, base deficit, urine output, etc.

The reported benefits of hypotensive resuscitation include decreased hemodilution, decreased requirements for transfusion, less blood loss into the abdominal cavity, and improved mortality rates. Hypotensive resuscitation can only be employed if immediate surgical intervention is planned, as prolonged hypotension predisposes the patient to a myriad of secondary problems ultimately culminating in refractory hypotension, the systemic inflammatory response syndrome or multiple organ failure.

Applying Resuscitation Concepts to the Patient

Results from human clinical studies and experimental studies should be applied with caution to the veterinary patient with traumatic or non-traumatic hemorrhage. The only clinical study that demonstrated improved outcome with delayed resuscitation investigated penetrating trauma. These studies employ early surgical intervention (within minutes to an hour of presentation to the emergency department). In the study by Dutton, et al, only 13.5% of patients enrolled experienced spontaneous hemostasis, with the remainder receiving surgical intervention or angiographic embolization to control blood loss.

This brings up an important point--how many animals with hemorrhage secondary to trauma require surgical intervention in veterinary hospitals? In the author’s practice, few patients require invasive means of hemorrhage control following traumatic injury. Many patients with traumatic hemoabdomen can be managed successfully with conservative medical management. This consists of fluid resuscitation, +/- abdominal counterpressure, and frequent reassessment of the patient. Those patients who do not stabilize appropriately with medical therapy require emergency surgery to control hemorrhage. In patients with non-traumatic hemorrhage (i.e. ruptured hemangiosarcoma), the time to surgery is often delayed longer than the time frames investigated in these studies. In these settings, hypotensive or delayed resuscitation would result in prolonged periods of hypotension, which may be more likely to promote multiple organ dysfunction.

While hypotensive resuscitation is potentially applicable, it is difficult to translate results from human clinical or laboratory studies to veterinary practice, as the type of injury, degree of hemorrhage, and ultimate interventions for stabilization used in veterinary medicine may differ from those routinely employed for the human trauma patient. Clinical studies in veterinary patients are required to ascertain the benefit of hypotensive or delayed resuscitation in our patients.

Alternative therapies

The application of counterpressure over the abdomen (referred to as a “belly wrap”), which may extend to incorporate the pelvic limbs, has been recommended for stabilization of patients with abdominal hemorrhage but has fallen out of favor in recent years. The use of abdominal counterpressure can help to both increase mean arterial pressure (MAP) and limit further bleeding into the abdominal cavity. The resulting increase in MAP is the result of increased systemic vascular resistance caused by constriction of venous capacitance vessels
following placement of the wrap. The wrap may tamponade further bleeding by opposing hydrostatic pressure of the bleeding focus. Abdominal counterpressure is more likely to be useful in limiting hemorrhage from venous or parenchymal bleeds, as the hydrostatic pressure in the arterial circuit is difficult to exceed without causing other harmful effects. Following patient stabilization, the wrap can be removed in a graded fashion (i.e. cut 1 inch every hour), watching physical examination parameters (heart rate, mucous membrane color, capillary refill time and pulse quality) for signs of rebleeding.

Abdominal counterpressure should be used with caution in patients with respiratory distress and should be avoided in patients with diaphragmatic hernias, as this may lead to decompensation. Another potential complication of abdominal hemorrhage and/or abdominal counterpressure is intra-abdominal hypertension, also known as abdominal compartment syndrome. Marked elevations in intra-abdominal pressure (>30 cm H2O) can result in oliguric renal failure, splanchnic hypoperfusion leading to bacterial translocation, impaired cardiovascular and respiratory function, elevations in intracranial pressure, and dysfunction of other abdominal organs. The duration and degree of abdominal counterpressure should be limited to minimize these potential adverse consequences.

References