

CASES YOU HATE TO SEE COME THROUGH THE DOOR

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Aah, the ring of the emergency doorbell at midnight. The overhead page “Triage to the front, STAT!” Even better, “Triage to the front with a gurney!” If you are not an emergency clinician, those phrases usually are harbingers of dread and doom. For an emergency clinician, the hypothalamic-pituitary-adrenal axis kicks into overdrive, and the epinephrine release surges us into gear..... but not always. There are some types of cases that even the most seasoned emergency clinician can learn to dread. With experience, some thought, and sticking to the basics of “A,B, C”, even these types of cases can become more welcomed when they cross your doorstep.

The Multitrauma Patient

The multi-trauma patient. Hit by car, kicked by horse, or, in my neck of the woods, attacked by mountain lion or vicious large big giant dog. Skin wounds, tissue trauma, broken limbs, and penetrating wounds into various body cavities. The patient is exhibiting signs of respiratory distress, with an open sucking chest wound, a flail segment, cyanotic mucous membranes, orthopnea, and is laterally recumbent. Definitely not a good thing, but is this patient treatable? In some cases, YES! In some cases, no, but we can certainly try! Think about the ABCs. First, does the dog have a patent airway? Yes, although it's BREATHING is seriously impaired due to the flail chest and the open sucking chest wound. At some point in time, that wound likely will need to have exploratory surgery, but not at this time.

To alleviate the respiratory distress associated with the chest wound, place sterile lubricant around the entire wound, then place a sterile surgical glove over the lubricant. This will create a seal in between the external environment and the chest cavity. Next, place the side of the chest with the flail segment down, to prevent its motion from impairing breathing. Simultaneously while you are starting treatment for the thoracic wounds, administer both antibiotics and analgesics to this dog. Initially, start with a first-generation cephalosporin such as Cefazolin (22 mg/kg Q6 – 8 hours). If the patient develops signs of infection, you can change antibiotic coverage based on culture and susceptibility testing. A pure mu agonist opioid such as morphine, oxymorphone, fentanyl, or hydromorphone is the best choice of analgesia in any multi-trauma patient. Partial agonists, such as Buprenorphine, or agonist-antagonists such as butorphanol, do not ever achieve the same amount of analgesia, and thus are not good choices for this patient. Do not be afraid of using an opioid in any patient that is in respiratory distress or hypovolemic shock. The pure mu agonists can readily be reversed with naloxone should adverse side effects occur.

So, you've covered the chest wound, and have placed the patient's flail segment down, to decrease the inefficient paradoxical chest wall motion. You now have to evacuate the free air from within the thorax. To do this while you are setting up to place a thoracostomy tube, clip the lateral chest wall. In this case, the entire chest wall should be clipped and aseptically scrubbed. When visualizing the chest wall, think of it as being a box. Ideally you should perform thoracocentesis by inserting a needle or an over-the-needle catheter in between the 7th – 9th intercostal space. For the dogs that actually read the anatomy texts, air should be dorsal and fluid should be ventral. Guess what? Most dogs don't know how to read, even the most astute pug. So, another choice is to envision a box within the big box (the thoracic wall). Insert your needle in the middle of the box. Make sure that the open part of the bevel is directed into the pleural space, and direct the needle so that it sits parallel with the body wall. You can then rotate the needle in a clockwise or counterclockwise direction, similar to the hands of a clock, taking care to make sure that the sharp point of the needle stays against the chest wall. While someone is performing the therapeutic thoracocentesis, you can be setting up for thoracostomy tube placement. As long as the all of the air can

be drained from the thorax, you can proceed with the rest of your assessment prior to placing the thoracostomy tube.

To place a thoracostomy tube, ideally the patient should be placed under anesthesia, and intubated so that you have a secure airway. This can be done with low dose diazepam mixed with propofol. Once the patient is intubated, you have the luxury of time and take care as you place the tube. Clip the entire lateral thorax, then perform an aseptic scrub. You can use one of two approaches to place the thoracostomy tube. If you have a trocarized thoracic drainage catheter, you can use this, or, you can make a small incision and dissect down through the subcutaneous tissue and intercostal muscles until you can puncture through the pleural cavity. The thoracostomy tube should not be placed through the open sucking chest wound. Make a small incision through the skin at the proximal aspect of the 11th intercostal space. You can burrow a tunnel with the tip of the trocarized tube, then pull the tube so that it is perpendicular to the chest wall, with the tip over the 7th – 9th intercostal space. Grasp the tube at the base, to prevent it from going too far into the thorax, and brace the palm of your hand against the top of the trocar. Push (DON'T SMACK IT!!!) the top of the trocar with the weight of your upper torso, until you feel the trocar pop through the chest wall. Once it is in the thorax, push the tube off of the trocar, so that the tip lies at approximately the 5th intercostal space. Be prepared to immediately hook up a Christmas tree adapter, three-way stopcock, length of IV extension tubing, and a 60 ml syringe to the tube, to evacuate air from the pleural space.

Alternately, you can have an assistant pull the skin on the lateral thoracic wall cranially and ventrally towards the point of the elbow. Make a small nick incision over the 9th intercostal space, and bluntly dissect through the subcutaneous tissue and intercostal muscles, until you are in the pleural space. You can place An Argyle trocarized catheter into that hole, or if you do not have an Argyle catheter, can place a large red rubber catheter through the hole. To make the red rubber catheter more rigid, to facilitate placement into the thorax, you can pass a rigid polypropylene catheter through the red rubber catheter. Once the red rubber is placed into the pleural space, remove the polypropylene catheter, and attach the end of the red rubber catheter to the rest of the suction apparatus as described above. Both types of tubes can be secured using a horizontal mattress suture around the tube, then a purse string-suture around the tube entrance site, combined with a finger-trap suture. The tube can be wrapped with bandage material, or simply a square of bio-occlusive clear bandage, so you can visualize the tube daily.

So, we've discussed and taken care of the patient's airway and breathing for now. Ideally, arterial blood pressure should be maintained with a mean arterial pressure above 60 mm Hg, and a diastolic pressure above 40 mm Hg. The coronary arteries are perfused during diastole, and need a diastolic pressure of 40 mm Hg or above to maintain coronary and thus myocardial perfusion. If the systolic blood pressure becomes too high, however, there is a risk of breaking clots that have formed off of blood vessels and damaged internal organs, and causing worsening hemorrhage. Intravenous fluid therapy, in the form of crystalloids and colloids, should be titrated in goal-directed therapy to a specific blood pressure and based on the patient's physiologic response to therapy. The "shock" volume of intravenous crystalloid fluids is 90 ml/kg for a dog, and 44 ml/kg for a cat. This does not necessarily mean that a patient needs or can tolerate administration of the entire calculated shock volume of crystalloid fluids. To be judicious, calculate $\frac{1}{4}$ of the recommended shock volume, and administer it as quickly as possible, then monitor the physiologic perfusion parameters of heart rate, blood pressure, capillary refill time, and urine output. If the patient's heart rate is decreasing and the blood pressure is normalized, then additional volumes of fluid may not be necessary. If the patient remains hypotensive, then additional boluses or a bolus of a colloid such as Hetastarch (5 – 10 ml/kg) can be administered quickly, then reassess the perfusion parameters. In cases of head trauma, pulmonary trauma, or internal bleeding, I personally use incremental boluses of hetastarch (5 ml/kg) to resuscitate to a systolic pressure of 100 mm Hg and a mean arterial pressure of 60 mm Hg. Sometimes, additional therapies such as blood products may become necessary in the case of extreme blood loss.

Now that we've taken care of the ABCs, we can assess the rest of the patient. Are there any fractures in addition to the flail chest? If so, stabilization of the fracture with splint material is recommended, both for patient comfort and to prevent further damage. Are there other wounds that need to be addressed? Only address them once the patient's cardiovascular status has stabilized. Is there any evidence of abdominal trauma? In cases of animal bite wounds, there can be significant internal damage in the absence of external wounds due to the shearing forces applied by the crushing teeth as the smaller animal is picked up and shaken. If there are obvious penetrating injuries into the abdomen, an exploratory laparotomy is absolutely necessary. If there is question whether there is a ruptured viscous, perform lateral and VD abdominal radiographs, if the patient can tolerate them. Free gas may be visible in between the lobes of the liver, and between the liver and the diaphragm. Always perform abdominal radiographs before performing a diagnostic abdominocentesis. An abdominocentesis can introduce air into the abdominal cavity, and can cause an iatrogenic pneumoperitoneum, which makes decision whether to go to surgery for internal trauma difficult, to say the least.

To perform an abdominocentesis, clip the ventral abdomen and look at the umbilicus. Sometimes, with severe intraabdominal hemorrhage, the umbilicus can appear red or mulberry in color. After an aseptic scrub, gently but briskly push a 22 or 20 gauge needle into the abdomen, twisting as you push, to push hollow organs away from the tip of the needle. In some cases, you will need to place an additional needle in another quadrant before fluid will flow. Save any fluid obtained for evaluation of PCV, creatinine, and cytology. In order for a blind abdominocentesis to be positive, there needs to be more than 5 ml/kg of free fluid within the peritoneal cavity. Sometimes, the trauma and hemorrhage is retroperitoneal and may be difficult to identify. If retroperitoneal hemorrhage is present, the retroperitoneal space will look larger and sometimes have a swirling appearance on a lateral abdominal radiograph due to hemorrhage. If the PCV of the abdominal fluid is less than that of peripheral blood, perform a creatinine and compare it with peripheral blood. If the creatinine in the abdominal fluid is greater than that of the peripheral blood, a uroabdomen is present. In the case of blunt trauma, such as an animal that has been hit by a car, the patient should be stabilized before taking to surgery to fix the bladder. You can place an abdominal drainage catheter into the abdominal cavity, and connect it to a closed collection system, to drain the urine from the abdomen until the patient is stable enough to tolerate surgery.

To place an abdominal drainage catheter, you can infiltrate a small area just caudal to the umbilicus with 25 lidocaine (1 mg/kg), then make a small nick incision through the skin. Gently bluntly dissect through the underlying subcutaneous tissues and pick up the external abdominal oblique muscle with a thumb forceps. Make a small nick incision through the external abdominal oblique or rectus abdominus with the tips of a hemostat, then push a fenestrated tube (such as an Argyle thoracic catheter or a red rubber catheter) into the abdominal cavity, directing it towards the bladder. The abdominal drainage catheter can be secured to the body wall with a purse-string and finger-trap sutures. Catheterize the urinary bladder, too, to keep it drained and small, until the time of surgery.

Once the ABCs have been taken care of, the multi-trauma patient benefits from Rule of Twenty monitoring. Rule of Twenty Monitoring consists of (1) Oxygenation/ventilation, (2) Cardiac function/rhythm (3) Mentation/intracranial pressure (4) Blood pressure/perfusion (5) RBC/Hb (6) Fluid balance (7) Oncotic pull (8) Albumin (9) Acid-base balance (10) Na, K, Cl, Ca (11) renal function and urine output (12) Nutrition (13) Immune status, WBC selection and dosage (14) Coagulation (15) GI function, motility, integrity (16) Drug metabolism and dosages (17) Pain control (18) Bandage and wound care (19) Nursing care and patient mobility (20) Tender loving care.

One of the most important things to remember is that any patient, particularly those with respiratory abnormalities, cardiovascular abnormalities, and severe wounds, are constantly changing. Never take the word "stable" for granted, as clinical status can change very rapidly. Be prepared by being pre-emptive and aggressive with your monitoring and therapy, and you can do the best that you can for your patient.