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After dealing with cats as emergency patients, it is very clear to me that they are really a home “introduced” species. Cats have independent, mysterious and unpredictable personalities, but this is not the only way that cats are unique. Their response to disease and medical therapy represents a challenge in the veterinary medicine practice, making clear the famous sentence: “cat is not a dog in emergency or critical care.”

Despite the fact that dogs and cats have the same clinical entities in emergency, they frequently do not show the same symptoms and clinical signs. Cats are very sensitive to hypotension and are very difficult to resuscitate from hypotensive shock. The response to hypotension in cats is very different because they have vagal fibers close to sympathetic fibers and hypotension can stimulate both, showing a normal or slow heart rate, instead of the tachycardia showed by other species like dogs. In a research with hypotensive cats (blood pressure less than 80 mmHg systolic), 100% of cats were found to have normal or slow heart rates. As cardiac output is the result of contractility and rate, the fact of have normal or slow cardiac rate, diminish the cat patient compensatory response to shock, aimed at the goal of maintaining oxygen delivery to the tissues and hemodynamic stability like blood pressure and capillary blood flow.

The hyperdynamic signs of shock, commonly seen in dogs are rarely seen in the cat. Shock in the cat is most commonly decompensatory, evidence by normal or slow heart rate, severe hypothermia, weak or non palpable peripheral pulses and profound mental depression. The mucous membranes are gray or white and capillary refill is not evident. The bradycardia and low cardiac output leads to hypothermia, and hypothermia accentuates the bradycardia. There are many aspects of critical care that are unique for the cat.

Organic response

The very unique physiology of the domestic cat patient, facing a trauma episode deserve special consideration. It is well known that the magnitude of the inflammatory response to trauma is directly proportional to the exchange of energy and the extent of injury. Cat suffering severe multiple trauma is at much higher risk for the development of a significant systemic inflammatory response, any trauma will incite the same series of events, including the release of many different inflammatory mediators.

In the dog, in cases of massive bleeding, sympathetic response leads to splenic contraction, releasing of up to 30% of their volume but in cats the spleen does not react in the same way.

Shock due to trauma results when organic response is no longer able to compensate, leading to maldistribution of blood and impairment of oxygen delivery. The response to a traumatic insult also involves the production of acute phase proteins by the liver like Protein C and many others cytokines who are involved in control the inflammatory response, inhibiting enzymes and modulating coagulation. Feline endothelium cells has a very important role in modifying and regulating the body's response to injury and is particularly susceptible to hypoxic injury.

The increased nutritional demands plus a a generalized catabolic state can quickly lead to negative balance of nitrogen, leading the patient to malnutrition, that is very important in cats, as they are at a higher risk for hepatic lipidosis and more likely to refuse to eat in a hospital environment.

Tissue hypoxia causes an increase in intracellular calcium that is cytotoxic, impairs immune cellular function, and begin the production and release of oxygen-free radicals. In severe case of trauma with a massive inflammatory response, endothelial disruption activates the coagulation
cascade resulting in a procoagulant status in the feline trauma patient. However, Disseminated Intravascular Coagulation is a very rare syndrome in cats compare with traumatized dogs.

**Approach to the feline trauma patient**
The goal of treatment in feline trauma patients is the same as any critically ill patient: Optimize perfusion and oxygen delivery to the tissues.

The initial approach should be focused on major body systems examination, with special attention to respiratory and cardiovascular systems. Stabilization should be begin with the classic ABC: Airway, Breathing, Circulation (or Cardiovascular). Extra attention should be paid to the neurologic and renal systems as damage are common in cats and both can result in life threatening injuries.

Treatment goal in the feline trauma patient is to maximize oxygen delivery. The oxygen content in the blood is a significant determinant of oxygen delivery. Many sequelae of trauma in the cat can lead to pulmonary complications that result in decreased hemoglobin saturation as well as decreased PaO2.

The initial assessment of the respiratory system should begin with observation of the cat avoiding any stress during handling. Evaluation of the rate, effort and pattern of breathing prior to any additional stress is important. Panting cat means the possibility of severe respiratory tract condition. Always supplemental oxygen should be provided in a traumatized cat.

Airway is commonly affected by traumatic injuries in cats. Jaw fractures, skull fractures are commonly seen in vehicle accidents, while tracheal avulsion, or direct injury to the laryngeal/pharyngeal area are common in dogs-cats or cat-cat fights. If the airway is not patent, tracheostomy should be considered.

Physical exam and auscultation may reveal clinical evidence of pulmonary contusions, pneumothorax or hemothorax. If pleural space conditions need to be rule out, do not lead the patient for radiographs, thoracocentesis should be performed. In the author experience complications are rare when is done correctly.

Assessment of pulmonary function by arterial blood gas analysis is not common in practice, but another methods like pulse oximetry is more doable. However, this test can lead to numerous mistakes and care must be taken in the interpretation of the results. Hypothermia, very common in the post trauma cats, poor capillary perfusion, anemia, movement and pigmented mucosa can lead to inaccurate results.

Thoracic radiographs should be delayed until cat is stable. Pulmonary contusions, rib fractures, diaphragmatic hernia, as well as pleural space disease can be diagnosed by X-ray examination, but also stress of restraint can be life threatening in an unstable cat. Many thoracic injuries are commonly seen in the trauma cat: penetrating chest wounds, hemothorax, pneumothorax, pulmonary contusions and tension pneumothorax.

Cat lungs are very sensitive to hypoxemia due to poor perfusion, leading to increased capillary leak and inflammatory lung disease secondary to severe trauma, so much attention should be paid to the respiratory status of any cat after any significant trauma, even in cases where there was no direct thoracic trauma.

Cardiac output is another important determinant of oxygen delivery, and is commonly diminished in the trauma patient. Hemorrhage, arrhythmias, direct cardiac injury and myocardial dysfunction can all lead to impairment of adequate cardiac output. Initial evaluation includes assessment of heart rate and rhythm, mucous membrane color, capillary refill time, pulse rate and pulse quality.

Assessment of blood pressure can be difficult in cats. Direct blood pressure is not common in practice: excessive handling, pain, need to anesthesia or sedation, and side effects are the main
reason. Indirect determination of arterial blood pressure can be done by doppler measurement, but studies done in healthy cats have shown that these measurements underestimate the systolic blood pressure. However there are no studies about the accuracy of doppler measurements in sick cats.

The cardiovascular response to poor tissue perfusion and impaired oxygen delivery in the dog is tachycardia, but this is not the case in cats patients, where low heart rates are common in critical care cats.

This response seems to be unique to the feline species, and still there is no explanation about the mechanism. Theory goes to cytokine-associated myocardial depression it may play a role. Hypothermia is very common finding in critically ill cats have been suggested as responsible for the bradycardia, but no research has proves a real correlation.

Cardiac arrhythmias should be investigate in any trauma injured cat with evidence of poor tissue perfusion (tachycardia or bradycardia, pale mucous membranes, prolonged capillary refill time, weak pulses) by regular ECG assessment.

Treatment begins with fluid administration, always starting with isotonic cristalloids. In cats, the recommendation is to use a bolus of 30-50 ml/kg of crystalloids plus 5-10 ml/kg of colloids. Care should be taken when administering fluids to injured cats as fluid overload is common: pulmonary edema and pleural effusion are common in this patient population. Cats on inflammatory conditions has increased vascular permeability, myocardial dysfunction and decreased colloid oncotic pressure due to hypoalbuminemia.

It is recommended start with small boluses of 10 – 20 ml/kg and monitor the effect of this volume like blood pressure normalization. No matter is teh cat patient is hypothermic, always warm fluids before the administration. Therefore external warming should be used with air heating, circulating water blankets, or incubator. Always monitor temperature.

Consider that may be possible that cats have a previous anemia (FeLv - FIV infections) leading to low hemoglobin, decrease oxygen delivery and add the consideration of decreased ability of the feline spleen to contract, if so, blood transfusion should be administered. But remember that cats can have naturally occurring antibodies, leading to transfusion reactions, even in those cats that never previously received a blood transfusion.

Neurologic damage in the trauma patient can occur through direct trauma to the brain tissue or secondary to hypoxic tissue damage from poor perfusion to the CNS. A complete neurologic evaluation should be done after initial resuscitation to determine any necessary therapeutics and establish a baseline for further monitoring. Additional details on therapy for patients with head trauma will be discussed below.

In general, maintenance of adequate perfusion to the CNS is imperative in both treating and preventing neurologic damage. Renal Signs of damage to the renal system are often not evident on initial presentation of the trauma patient. These manifestations may not be detected for several hours and require close monitoring after the traumatic incident. Abnormalities such as a uroabdomen, uroretroperitoneum, direct renal trauma or urethral damage can be life threatening. Close monitoring of the urine output, BUN, creatinine and potassium should be done in any cat in which renal system damage is suspected. Additional diagnostics such as abdominal radiographs, abdominal ultrasound or intravenous contrast studies may be necessary in some cats.

**Neurologic trauma considerations**
Head trauma is commonly seen in cats vehicle accident or cats falling due to high rise syndrome. The primary goal in the treatment of head trauma is optimizing tissue perfusion and maintaining
cerebral perfusion pressure (CPP). Supplemental oxygen, elevation of the head 30º, avoidance of any neck twist position or occlusion of the jugular veins should be instaured.

The goal of maintain CPP is made by strict control on mean arterial blood pressure and intracranial pressure. Keep an eye on mean arterial pressure is imperative in these cats, and aggressive treatment for any intracranial hypertension is necessary. A well discussed issue in hypotensive head trauma cats is using hypertonic saline at a dose of 3 – 5 ml/kg. Still there is no clear information about it, but some evidence show that hypertonic fluids improves intravascular volume and helps decrease intracranial pressure. If there is clinical evidence suggesting cerebral edema and increased ICP, Mannitol at 0.5 – 1 g/kg iv should be given over 30 – 60 minutes.

Nursery
After first aid and stabilization and assessment of the major body systems, additional considerations include clipping, flushing and cleaning of any wounds as well as stabilization of any fractures prior to definitive surgery. Evaluation of the oral cavity for any fractures, dislocations or pain is important in the cat, as any trauma that may lead to anorexia must be addressed.