Traumatic brain injury in dogs and cats
OK State University Summer Seminar series- June 2024
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Traumatic brain injury (TBI), defined as a structural or physiologic disruption of the brain by an external force, is a relatively common emergency in small animals. It occurs in approximately 25% of patients with severe blunt trauma. Common causes include dog bite wounds, vehicular trauma, falling from height, and other accidents (hit by a golf club or baseball bat). TBI dogs and cats may present in critical, life-threatening condition but in some cases a good outcome is possible. Because the skull is a rigid structure, swelling or bleeding inside the brain will result in decreased cerebral blood flow in order to make room for the increased intracranial pressure.

TBI is divided into primary vs secondary injuries. The primary injury occurs immediately upon traumatic impact and cannot be reversed. The types of primary brain injury, from least severe to most severe, are concussions, contusions, and lacerations. The secondary injuries are the focus for treatment, as they occur in the minutes to days following the TBI. Secondary injuries may include hypotension, hyper/hypoglycemia, acidosis, hypo/hyperventilation, nutritional deficiency, hypoxia, electrolyte imbalances and acidosis, to name a few.

Initial goals include identifying and treating life-threatening cardiovascular (i.e. hemorrhage) or respiratory (i.e. pneumothorax) complications. The 6 perfusion parameters (mentation, heart rate, pulse quality, MM color, CRT, distal extremity temperature) should be assessed immediately- if there are abnormalities of perfusion, which are very likely, it should be treated with 1/8-1/4 shock bolus of IV crystalloids (keep in mind that animals with TBI are often in shock, so mentation abnormalities may be either from shock or from TBI). Hypertonic saline is a good choice for initial intervention as it will treat hypovolemic shock and also help decrease cerebral edema. The dose of hypertonic saline is 2-4 ml/kg IV over 10-15 minutes. Oxygen therapy via mask or flow-by (or intubation if necessary) as well as analgesics (ideally reversible pure mu opioid agonists such as fentanyl or methadone) should always be given to patients with TBI. NSAIDs and steroids should be avoided until the patient is stable, since NSAIDs can interfere with platelet function and renal blood flow and both NSAIDs and steroids can cause GI ulceration (especially if given while the patient is in shock). Steroids have been shown in large human studies to cause worsening outcome in patients with TBI.

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After initial assessment and treatment, typical management strategies include IV fluids for maintenance + dehydration deficit + ongoing losses, analgesics, seizure prophylaxis (usually with Keppra or phenobarbital), oxygen therapy for ~48 hours (with an FiO2 of approximately 0.4), and monitoring of coma score. The modified Glasgow coma scale is borrowed from human medicine and is used to provide a more objective measurement of neurologic severity and changes over time. Even with an initial low coma score, improvements in the score over the first 12-24 hours may be associated with a good outcome. Dogs and cats with TBI that survive the first 24-48 hours with improving coma scores can potentially make a full recovery within days to weeks. Some may have residual deficits such as blindness, ataxia, or behavioral changes (such as aggression).

Modified Glasgow Coma Scale	
	Score
Motor activity	
Normal gait, normal spinal reflexes	6
Hemiparesis, tetraparesis, or decerebrate rigidity	5
Recumbent, intermittent extensor rigidity	4
Recumbent, constant extensor rigidity	3
Recumbent, constant extensor rigidity with opisthotonus	2
Recumbent, hypotonia of muscles, depressed or absent spinal reflexes	1
Brainstem reflexes	
Normal PLR and oculocephalic reflexes	6
Slow PLR and normal to reduced oculocephalic reflexes	5
Bilateral unresponsive miosis with normal to reduced oculocephalic reflexes	4
Pinpoint pupils with reduced to absent oculocephalic reflexes	3
Unilateral, unresponsive mydriasis with reduced to absent oculocephalic reflexes	2
Bilateral, unresponsive mydriasis with reduced to absent oculocephalic reflexes	1
Level of consciousness	
Occasional periods of alertness and responsive to environment	6
Depression or delirium, capable of responding, but response may be inappropriate	5
Semicomatose, responsive to visual stimuli	4
Semicomatose, responsive to auditory stimuli	3
Semicomatose, responsive only to repeated noxious stimuli	2
Comatose, unresponsive to repeated noxious stimuli	1
MCGS Score	**Score**
3-8	**Grave**
9-14	**Guarded**
15-18	**Good**

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