

Introduction to Traumatic Brain Injury

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version 1

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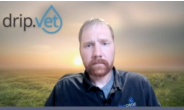


Head Trauma vs Traumatic Brain Injury?

- Head Trauma
 - Any injury to the head
 - May or may not result in injury to the brain
- Traumatic brain injury (TBI)
 - Injury to the brain following head trauma
 - Result of primary and secondary injury

When you talk about head trauma versus traumatic brain injury, there are differences. So think back to those pictures. So that dog with the knife in his head did have head trauma to an injury to the head. But it didn't result in injury to the brain, so it wasn't technically traumatic brain injury.

Traumatic brain injury typically follows head trauma, but it's an actual injury to the brain after head trauma. And again, it's a result of both primary and secondary injury. So this is just important when you're talking about it-- you're talking about head trauma versus traumatic brain injury-- just to be precise with that language. It's not just a question of semantics. There are some actual differences in those definitions.



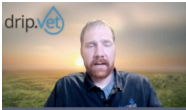
Patient Assessment

- Approximately 60% of human patients with TBI have concurrent injuries to other major organs
- Patients with concurrent injuries should be stabilized prior to neurologic assessment
- Once hemodynamically stable a full neurologic examination can be performed

So if you have a patient that presents to you that you think might have a traumatic brain injury, it's important to note that in human patients, about 60% of those patients that have traumatic brain injury also have concurrent injuries to other major organs. So these often are polytrauma cases, and you need to treat them as such. So you need to stabilize those patients prior to neurologic assessment.

I think I talked a little bit about this during one of my previous lectures when we talked about resuscitation. We needed to resuscitate patients fully before we said, well, this patient can't walk. He came in, and I think he has spinal trauma, let's say, or head trauma. And he can't walk. So clearly, the damage is too severe.

Well, it may just be that he's in shock, and that's why he can't walk. And if you fully resuscitate the patient, the mentation may improve. He may be ambulatory, all of those sorts of things. So it's really important before you perform a full neurologic examination that you make sure that they're hemodynamically stable.



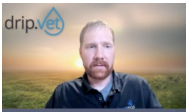
Neurologic Assessment

- State of consciousness
- Breathing pattern
- Pupil size and responsiveness
- Ocular position and movements
- Skeletal motor responses
- Neurologic score may be affected by shock state, ensure adequate resuscitation prior to neurologic assessment

The neurologic assessment is going to consist of looking at a few different things-- so the state of consciousness, the breathing pattern, pupil size and responsiveness, ocular position and movement, and skeletal motor responses. And then, you can assign them a score. This is essentially the modified Glasgow Coma Score.

So you can then assign them a neurologic score based off of all of these things. And then what you're supposed to be able to do is give them a prognosis based off of that. We'll talk about that a little bit more here in a couple of slides.

But again, just to reiterate, this neurologic score may be affected by the shock state. So it is going to be important that you ensure adequate resuscitation prior to neurologic assessment-- or at least, I guess, final neurologic assessment, where you're going to talk to the owner and try to paint a prognosis for them. It's fine to do a quick neurologic exam when they hit the door. But you're going to want to withhold judgment until you know they're fully resuscitated.



Pupil Interpretation

Best



Worst

Normal PLRs



Slow PLRs



Bilateral miosis



Pinpoint pupils



Unilateral unresponsive mydriasis



Bilateral unresponsive mydriasis



This is just a little quick blurb on pupil interpretation. So from the top, that's normal PLRs, all the way down to-- or wait. That's the best and then down to the worst, bilateral unresponsive mydriasis. So basically goes from normal to slow to then miosis bilaterally, pinpoint pupils, unilateral mydriasis, and then bilateral unresponsive mydriasis, which is the worst. So hopefully, you're going to see maybe normal to slow PLRs or, worst case scenario, maybe bilateral miosis. But beyond that pinpoint or to mydriasis, that indicates pretty significant damage.



	Score
Motor activity	
Normal gait, normal spinal reflexes	6
Hemiparesis, tetraparesis, or decerebrate activity	5
Recumbent, unresponsive 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
Brain stem reflexes	
Normal pupillary light reflexes and oculoccephalic reflexes	6
Slow pupillary light reflexes and normal to reduced oculoccephalic reflexes	5
Bilateral unresponsive myosis with normal to reduced oculoccephalic reflexes	4
Pupillary pupils with reduced to absent oculoccephalic reflexes	3
Unilateral, unresponsive mydriasis with reduced to absent oculoccephalic reflexes	2
Bilateral, unresponsive mydriasis with reduced to absent oculoccephalic 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

Modified Glasgow Coma Scale

Table 2. Modified Glasgow Coma Scale score category and suggested prognosis.

Score Category	Actual MGCS score	Suggested Prognosis
I	3-8	Grave
II	9-14	Guarded
III	15-18	Good

MGCS, Modified Glasgow Coma Scale.

So this is that modified Glasgow Coma Score that I was mentioning. So there are three different categories. There's motor activity, brainstem reflexes, and level of consciousness. And then you give them a score from 6 to 1, basically from best, which would be in a normal dog, to worst. So for motor activity, for instance, a score of 6 would be if the dog has a normal gait and normal spinal reflexes. A 3 would be like recumbent with constant extensor rigidity. And then a 1 is recumbent, hypotonia of muscles, and depressed or absent spinal reflexes. So that's really bad, right?

Brain stem reflexes. Again, 6 to 1. Normal PLRs, all the way down through that bilateral unresponsive mydriasis. And then the level of consciousness, which would be a normal level of consciousness through depression, the semicomatose to comatose. And then again, you assign them a 1, 2, 3, 4, 5, or 6 in each of these categories. And so you end up adding those up together, and you get anywhere between 3 and 18.

In the paper that was initially published with this modified Glasgow Coma Score, they assigned prognoses based upon the number that you got. So they said that if you had a 3 to an 8, that was considered a grave prognosis. A 9 through a 14 was a guarded prognosis. And a 15 through 18 was a good prognosis.

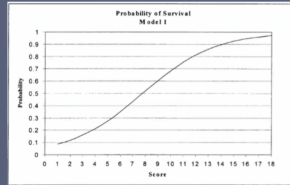


The Prognostic Value of the Modified Glasgow Coma Scale in Head Trauma in Dogs

Simon R. Platt, Simona T. Rasbelle, and John J. McDonnell

J. Vet. Intern. Med. 2007;11:183-184

- Authors conclusions:
 - MGCS predicted survival at 48 hrs in dogs with head trauma with a 50% survival with a score of 8



And this is a chart that was published in that paper as well. And if you look, so let's say, at a modified Glasgow Coma Score of 8-- so you go over on the x-axis to an 8 and go up on the y-axis. That goes to about a probability of about a 50% survival with a modified Glasgow Coma Score of 8.

And if you go down to-- I don't know. Let's say I'll pick a number 3. That looks like, to me, maybe about a 15% survival. If you go up to 18, all the way on the end here, interestingly, it's not even 100%. You don't quite get there. But you're in the 90s for survival.



Modified Glasgow Coma Scale

- Important points
 - Systemic shock will affect the MGSC so interpret cautiously in patients with shock and TBI
 - The use of coma scales for long term prognosis (functional outcome) has not been documented
 - Coma scales can be used as a guide of the immediate success of therapy or as an indicator for initiation of therapy
 - They should not be used solely to guide choices concerning euthanasia

So there is some correlation with that. But what's important to note is that these coma scales are not meant to guide euthanasia choices. So I would not use this to say, oh, you have a modified Glasgow Coma Score of 8. Therefore, tell the owner there's a 50/50 chance that your pet may make it. That's not really what it's meant to do.

What it's more useful for, though, is for you to be able to tell whether this patient is improving or not. So if your patient comes in and has a modified Glasgow Coma Score of 8, you treat it. You give it whatever the treatment might be that you administered.

And six hours later, it has a modified Glasgow Coma Score of 10 or 12. That's good, right? It's going in the right direction. I'd probably keep moving forward with that patient or keep going with my current therapy.

If it had an 8 and now it's a 6, well, that's the wrong direction. So something's going on there. And you need to either reconsider the treatment you're doing or maybe have a more heart-to-heart conversation with those owners. So that's really what it's more useful for.