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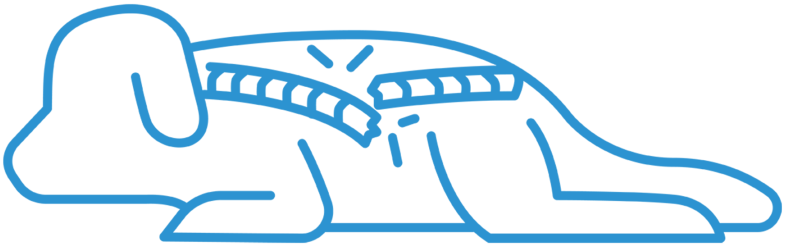

Traumatic Brain Injury and Spinal Fractures

drip 3

version 1

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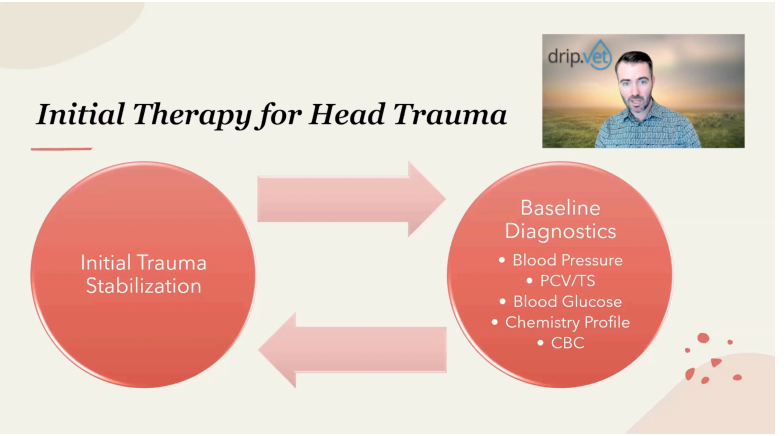
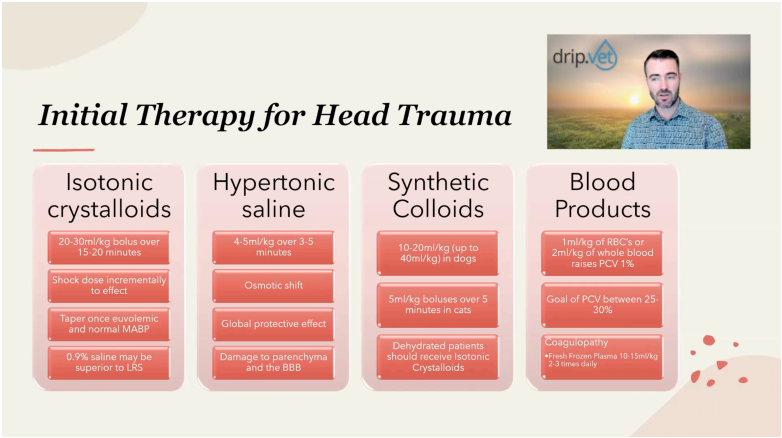


When we see these patients, we need to think about, well, what is our initial therapy for these patients going to be? Well, the main thing is that we want to take that initial trauma stabilization approach to get an idea of where the patient is injured, what is injured, what does it look like both systemically and neurologically, and what are our next steps from there, always starting with that initial trauma stabilization.

We also want to run baseline diagnostics. This is including blood pressures, PCV total solids, chemistry profile CBCs, and blood glucose. We want to do a lot of these things because a lot of patients without head trauma will appear to be neurologic simply due to hypovolemia or hypotension. We want to correct those before we automatically assume that the patient has suffered a TBI. Most of the time, yeah, you might look at it and say, yes, it looks like there's polytrauma here. But sometimes, these hypotensive or hypovolemic patients can make us think there's a TBI when there's not. And since that is a negative correlation with prognosis, we want to make sure that we're not overinterpreting those as well.



But obviously, we're here to talk about head trauma. When we see this, we say, OK, let's assume that the patient has head trauma. We want to make sure that we have them normovolemic, and normotensive, and we're monitoring and-- monitoring everything appropriately. We always have a few options from a fluid therapy standpoint. We always have isotonic crystalloids, we have our hypertonic saline, we have our synthetic colloids, and then we always have our blood products.

When we treat these patients, these isotonic crystalloids, you can pretty safely do a 20 to 30 milligram per kilogram bolus over about 15 or 20 minutes. This is a kind of partial shock dose, and we want to use that shock dose incrementally to effect. But once these patients seem to be euvolemic and have normal blood pressure, we want to start to back off on that. The reason being is that some of these fluids, especially LRS, have higher free water content in them. And if there's the higher free water content in the solution, if we are pushing them past that euvolemia, past the normal arterial blood pressure, we are now running the issue of having the patient over-hydrated, which will worsen brain edema in these patients.

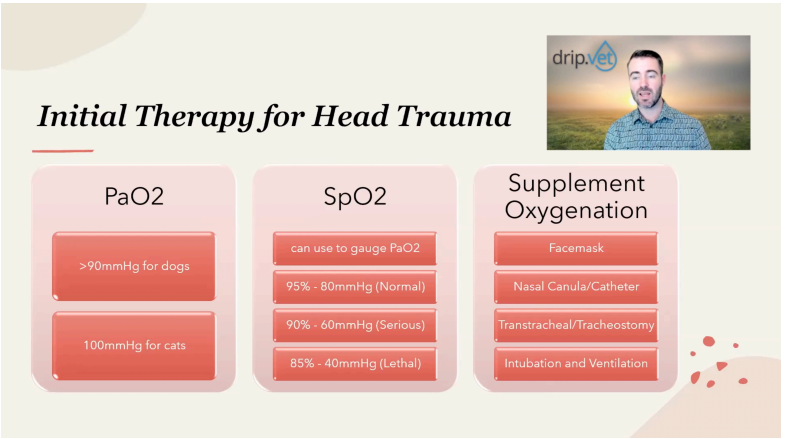
So once we get them euvolemic and they have a normal mean arterial blood pressure, we want to stabilize the fluid rates at those times. We don't want to continue to bolus those patients. And because of that increased free water in the LRS, sometimes 0.9% saline may be superior in some of these patients.

But then, if we focus on hypertonic saline, we want to use this in patients. But we need to get their-- we need to get them a euvolemic and some pretty good arterial blood pressures pretty quickly. For a lot of these patients, we want to do 4 to 5 milligrams per kilogram over about three to five minutes. You do need to watch out for a couple of things. You can encounter an osmotic shift where you might end up increasing cerebral edema in these patients. And if there's damage to the parenchyma and the blood-brain barrier, you still need to be cautious because that allows the sodium in the hypertonic saline to cross the blood-brain barrier, get into the brain, and could worsen cerebral edema. If there is damage to that blood-brain barrier penetrating intracranial traumas, things like that, you want to be a little bit careful.

You also want to continue to monitor these patients for a neurologic decline. If you see that, you might need to worry about the osmotic shift or damage to that parenchyma. But hypertonic saline may have a global protective effect. If we have the option to give it, it may be better than isotonic crystalloids. Synthetic colloids are something that we can give in 10 to 20 milligrams per kilogram in dogs, up to the 40 range, which means you can give about one to two-- or about two to four boluses, depending on how things are going for the patient. And then 5 milligrams per kilogram boluses over five minutes in cats seem effective. You do want to avoid this in dehydrated patients. Or, if the patient is dehydrated after getting a synthetic colloid, you always need to replace that with the isotonic crystalloids in those patients.

A lot of this information will probably be coming from the critical care side of it as well. I would refer you over there for some of the more fine tunings on how to treat these patients from a fluid therapy standpoint. We also want to consider blood products. If the patient is anemic due to a significant loss of blood in these patients, we want to have a goal of a PCV between 25% and 30%. How do we get there? If you take the patient's weight, 1 milligram per kilogram of red blood cells or 2 milligrams per kilogram of whole blood should raise the PCV by about 1%.

Usually, it's a pretty easy situation. If you're down by 10%, you give 10 mLs per kilogram of RBCs. It should, in theory, get you to that point. You can always retest the PCBs and total solids after giving the blood products. And that's why having these bedside tests available can be very helpful. If the patient has a coagulopathy, or you are worried about a coagulopathy, you may need to consider fresh frozen plasma that's given at 10 to 15 milligrams per kilogram about two to three times a day.



We also, as we talked about, want to make sure that these patients have appropriate oxygenation. We want to monitor PaO2 if we have the ability to do blood gas analysis in clinic. We want it over 90 millimeters of mercury for dogs, and we want it at 100 for cats. However, not every clinic has blood gas access. In those cases, we always want to try to monitor a SpO2 if we can. If we have a SpO2, we can always use it to gauge our PaO2.

Roughly, if you have a 95% SpO2, you should be about 80 millimeters of mercury. If you're higher than that, you should be OK. If your SpO2 is 90, then your PaO2 may only be 60. And that can be pretty serious in a lot of these patients. And of course, if your SpO2 is 85%, you're running lethal concerns for hypoxemia in these patients.

These patients are commonly going to require some type of oxygen therapy as well. And we can always consider things like face masks, nasal cannulas, and catheters, but you sometimes have to reach for transtracheal or tracheostomies or even consider intubation and ventilation for these patients.

Nasal catheters can sneeze out when the patient has a high flow rate of oxygen. And if that occurs, the patient's sneezing increases their intracranial pressure. We want to be careful with these nasal catheters, especially in some patients. Any semblance of irritation, especially at these high flow rates, we may need to back that flow down. Patients can use face masks, but most patients start to get irritated by them after a short period of time. And they don't deliver oxygen as well as some of these other options. If we're reaching for transtracheal or tracheostomies or intubation of ventilation, we're taking those next steps pretty quickly here.