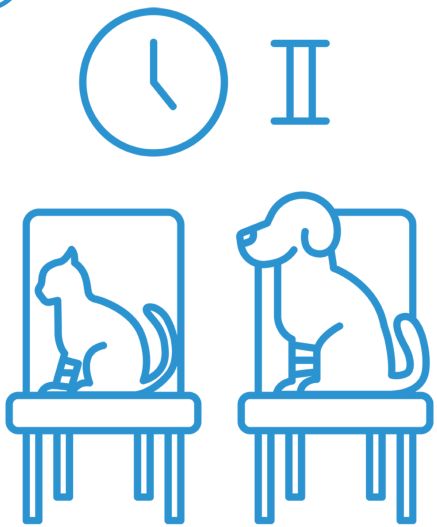
drip.vet



Triage, Stabilization and Endpoints of Resuscitation Part 2

DRIP 2

February 24, 2022

Instructor: Dr. Adam Lancaster, DVM, DACVECC

Be advised this document is here to enhance your learning experience and is a cumulative of the slides and transcript & area for your notes. You are welcome to take your notes electronically or print then use it to supplement your learning while watching the drip

Poll Question #1

- Which of the following fluids has been shown to be superior for resuscitation?
  1. LRS
  2. Norm-R
  3. Hypertonic saline
  4. Hetastarch
  5. All are equal

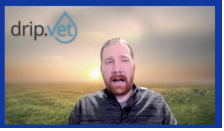
So maybe it was a poor wording on my part. But what I was trying to kind of get at here is that actually no fluid has shown to be superior to another fluid for resuscitation purposes in our patients. And actually that goes for human patients as well. So isotonic crystalloids, hypertonic saline, hetastarch-- when you're just talking about will this treat the shock and is this an appropriate resuscitative fluid, the answer is always yes.

So the reason that I want to point this out is that I don't want you to get hung up on, oh, I don't have this. I only have lactated Ringer's. And I don't have Norm-R. Or I only have hypertonic saline available because the other stuff's back ordered.

Just give them fluids. Any fluid that you choose to give is going to be better than not giving them fluids. So the correct answer is actually that they're all equal. But truthfully, any of those answers are technically correct because whatever you have on hand, I want you to basically give.

Colloids

- Artificial colloids
  - Hydroxyethyl starches
    - Hetastarch
      - Hextend
    - Tetrastarch
      - Voluven
    - Pentastarch
- Natural colloids
  - Human albumin
  - Canine Albumin
  - Fresh frozen plasma
  - Frozen plasma

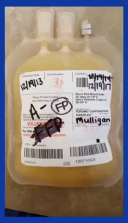


Colloids are the second big category of fluids that we have available. And we can actually break down colloids into artificial colloids and natural colloids. Natural colloids are things like human albumin, canine albumin, fresh frozen or frozen plasma.

And then artificial colloids are the hydroxyethyl starches. So the big ones that people know are hetastarch, Voluven, VetStarch. Those are the ones that most people are aware of. Pentastarches are technically a kind of hydroxyethyl starch. But they're actually not commercially available in the US so it's not something that you need to worry about.

Natural Colloids

- Not used for resuscitation in veterinary medicine
- Used for replacement of albumin or clotting factors
- Types
  - Human albumin
  - Canine albumin
  - Fresh frozen plasma
  - Frozen plasma

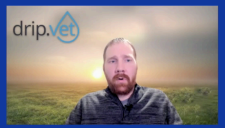


Natural colloids, again, things like albumin or plasma, these are really not used for resuscitation in veterinary medicine. So we use them more for replacement of albumin or clotting factors. They are available. Again, they will cause volume expansion.

But we typically don't use that for our patients I presume mostly due to cost and then again, because it's not really been proven to be superior to the administration of other types of fluids. So that doesn't really make sense to spend $300 on a blood product if you can spend $50 on some isotonic saline and get the same response.

Synthetic colloids

- Hydroxyethyl starches
  - Vetstarch, Hetastarch, Hextend and Voluven
  - Categorized based on their molecular weight, molar substitutions and C2:C6 ratios
- Dextrans
  - No longer commercially available

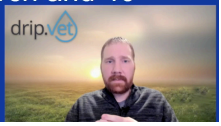


The types of synthetic colloids that are available are, again, VetStarch, hetastarch, Hextend and Voluven. They're categorized basically based on their molecular weight, their molar substitution, and their C2 to C6 ratios. That's just like the type of starch that it is, essentially.

Products that have higher molecular weights, increased substitutions, and higher C2:C6 ratios have a longer half life. And because of that, may have risk of more side effects.

Synthetic colloids

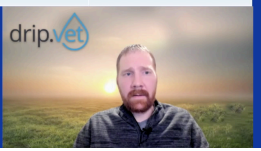
- Hetastarch has a higher molecular weight, increased substitutions and lower C2:C6 ratio when compared to tetrastrach (Voluven)
  - Voluven theoretically is “safer” and higher doses can be used
- Max dose is 20 mls/kg/day for hetastarch and 40-50 mls/kg/day for Voluven



So for instance, hetastarch has a higher molecular weight, has increased substitutions, and lower C2:C6 ratios when compared to a tetrastarch like Voluven.

So therefore, Voluven is theoretically safer. And higher doses can be used. That's why the max dose for hetastarch for a patient is 20 mls per kg day. for something like Voluven or VetStarch, it's 40 to 50 mils per kg per day.

Trade Name	Average Molecular Weight (kDa)	Molecular weight category	Degree of substitution	C2:C6 ratio	Labeled for Veterinary Use?	Max daily dose (ml/kg/day)
Hespan	450	High	0.7	4:1	No	20
Hextend	670	High	0.75	4:1	No	20
VetStarch	130	Medium	0.4	9:1	Yes	50
Voluven	130	Medium	0.4	9:1	No	50



This is just a nice chart to kind of show you. So Hespan and Hextend are types of hydroxy or types of hetastarches. So you can see that their average molecular weight is quite high, 450 and 670 respectively.

Their degree of substitution is high, so in the 0.7 to 0.75 range. Their C2:C6 ratio is lower, so it's 4 to 1. And therefore, that max daily dose is lower, 20 mils per kg per day.

The VetStarch and Voluven have a lower average molecular rate of around 130 so they're considered more medium weight. They have a lower degree of substitution, higher C2:C6 ratios. And therefore, they have the ability to give additional max daily doses.

So that's important because the amount of volume expansion is actually the same between these, which just means that you have the ability to administer more fluids before you reach the sort of, I guess, theoretical max daily dose for safety concerns. So it allows you to continue to resuscitate these patients if they need more fluids with that particular type of fluid.

Are synthetic colloids better than crystalloids? So we already kind of covered this. No, not necessarily. No benefit of colloids over crystalloids has ever been established for the resuscitation of shock. So that's important to note.

Again, I want you guys to take home from this, if nothing else. Just administer the fluid that you have available. So if you're like, oh, I really wish I had some hetastarch right now but you don't, and you have saline, just give them the saline. There is also the potential for significant adverse effects. Primarily, the ones that are of concern are acute kidney injury as well as coagulation disturbances. Interestingly, they actually are no longer on the market in Europe because of these safety concerns. This is, again, for I guess both people and veterinary patients.

And there's actually now a black box warning from the FDA on these colloids for people. So it basically states that there's a risk of kidney injury, excess bleeding, or death with these products. And the FDA recommends against the use of hetastarch unless there are no adequate alternative treatment options available.

So that's all for people, of course, because we don't have the same warnings for our veterinary products. But is there any evidence of these issues in our patients? It's actually a bit of contradictory evidence.

So there was a 2016 study that was published in JVECC that compared about 180 dogs that received hetastarch to a few more than that, say, 200 dogs that did not. And they did find a significant risk of death in the hetastarch group. But there's been other studies that have shown that really, there's not significant kidney issues or what I would call clinically relevant coagulation disturbances in patients who are administered colloids.

So I sort of use these as-- do I need to give something and I don't have another option basically. So like do I need to give colloid because I don't have another option? And if that is the case, then I feel comfortable with giving that.

If I feel like there's another option that I can give, then I will do that first. I used to use a lot more hetastarch than I do now because of these concerns. So I don't necessarily go to this right away.

But this is something that if I feel like I'm out of other options, I definitely will still administer to patients because, again, it's like what else are you going to do if you've already reached your max of your isotonic crystalloids and they're still hypotensive and you still think that they require more fluids, what are your other options here? So that's kind of how I look at that.