Presents

Overview of Hypovolemic, Cardiogenic & Septic Shock

Exclusive Transcript Pulled From EMS Presentation On Shock.

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There's different types of shock

One is called hypovolemic shock then you've got cardiogenic shock and you've got septic shock We're going to go through these three different types of shock how they're different and why you need to know them

Its important to remember that the vascular compartment is where basically the blood is stored then it goes into the vasculature which it then goes into the heart

Once you understand these things I think it's going to be a lot easier to understand and then there's a decision that's made a choice where it can either go to the vital organs or the non vital organs. Okay so we got vital organs here and then we've got the non vital organs What is a non vital organ? Well something like skin would fit into that category it's kind of vital but not absolutely essential. The body's got to make a decision at some point about where blood is going to go if there's not enough of it to go around and then of course everything goes right back to where it's being held.

So we've got the vasculature and this is sort of the store house of blood, it's primarily in the venous system and so this is where you can have problems and so we'll call this "A"

Next is "B" which is the heart and then finally last is "C" which is the vasculature and so these are the three areas that really contribute to shock. So let's figure out what's happening in the normal system. So you've got blood, blood goes to the heart, the heart then pumps blood to the non-vital and the vital organs and why does this happen?

This happens because you need oxygen and oxygen needs to get to these organs Otherwise these organs will go into shock

So what is shock? Shock is a situation where the vital organs are not getting oxygen if vital organs don't get oxygen your body will go into shock because these organs will shut down and if they shut down more than three of these organs there's a very high mortality associated with this and so not only are we going to talk about the different types of shock but we're going to talk about the different ways of fixing shock in these specific organ systems But it's important for you to get a kind of a sense about what's going on You've got blood and blood goes to the heart the heart then pumps that blood and that's important because that blood the hemoglobin molecule specifically is binding to oxygen and taking an oxygen molecule to the target tissues.

Now why did those target tissues need oxygen? You may recall from biochemistry that oxygen is needed as the final electron acceptor so that the electron transport chain can continue to function and FADH2 NADH gets transported across and you get protons pumped into the intermembrane space which then come back into the matrix of the mitochondria to make ATP. If you don't make ATP you're dead. Basically so your target tissues need oxygen so there are three places where that can break down

A- if you don't have enough blood that can cause a problem and you'll eventually get into shock because there's not enough oxygen reaching the organs
B- if your heart is just not strong enough to pump that blood to your organs and you will see kind of a septic shock or distributive shock if there's a problem here in the way the body regulates how much blood goes to the vital and non vital organs.

So in other words if it starts messing up and things start going one way and less going the other way that can be a problem and that can cause less oxygen to go to your vital organs.

So three different possibilities. I want to break this down so you can see the differences first of all
The first type of shock is what we call hypovolemic shock
Hypovolemic you can follow along hair on your piece of paper now hypovolemic has to do with letter “A” that's where there's a problem at there's enough blood it's just not enough blood and so let's go ahead before we go through all of these and quickly go over what I want to talk about

CO- is the cardiac output
HR is the heart rate
SVR is systemic vascular resistance
R what is the resistance to flow in these blood vessels that's what SVR basically is
EF is the ejection fraction it's how much blood does the heart pump out

It's a surrogate for basically how strong is the heart beating Then we have something called the post capillary wedge pressure. This is measured by something called the right heart catheter, it's where you float a balloon into the pulmonary artery and there's a little tip distal to that balloon that can measure what the pressure is in the pulmonary artery when there's no more pulsation coming from the right ventricle this is a surrogate for the pressure in the pulmonary capillary which is a surrogate for the pressure in the pulmonary vein which is a surrogate for basically the pressure in the left atrium.

So when you see pulmonary capillary wedge pressure I really want you to think left atrium because that's really what it's measuring next one is JVP, that's the jugular venous pulse. When you see that I want you to think right atrium then we've got blood pressure and then finally skin the temperature. Let's go through these then and I think this will be very instructive to figure out what happens in hypovolemic shock. So in hypovolemic shock you've got a lot of bleeding you've bled out from an accident from a GI bleed, something's going on and so what's the first thing that you're going to see well the first thing you'll see is your jugular venous pressure is low and that makes sense, if you don't have a lot of blood obviously the pressure is going to be low. If the pressure going into your heart is low just from the Starlings force, if your preload is low your cardiac output is going to be low as a result your heart's going to try to compensate so your heart rate is going to go up then what's going to happen?

Because it'll compensate at some point it's not going to compensate anymore it's going to go and get worse and worse and your blood pressure is going to start to go down as a result of that your ejection fraction may go up to compensate but as the blood pressure goes down your systemic vascular resistance is going to go up. Now this is important, if the cardiac output slow and your blood pressure is low then the arteries are going to try to squeeze together to bring the blood pressure up so there's enough pressure to reach the non-vital and the vital organs that's why the SVR or the systemic vascular resistance goes up.

You can imagine if there's not enough volume circulating both your right atrial pressure and your left atrial pressure are going to be low. No here's the important thing because the pressure is low and systemic vascular resistance is increasing which one do you think is going to increase more? Which is going to increase more? The blood going to the vital organs or more going to the non vital? Well it's going to actually shunt a lot of the blood towards the vital organs and it's going to close off the non-vital like the skin and so therefore your skin temperature is going to be cool. So that's what happens in hypovolemic shock.

Let's talk about cardiogenic shock that's B that's where we are here at B

So what's the primary problem with cardiogenic shock primary problem is the heart is not working and your cardiac output is going to be low so that's where it's starting.

Notice we're starting in a different place. Here the problem is not not enough volume, the problem is there's not enough cardiac output as a result of that the heart rate may speed up unless of course the thing that's causing your cardiogenic shock is something like beta blockers and therefore your heart rate would be low. So it just depends on what's causing your cardiogenic shock and that's going to be the thing that causes it to have problems.

So when that happens what do you think is going to happen to the pressure of fluid behind the heart? Well if the heart's not pumping, everything's going to back up and so both your left atrial pressure and your right atrial pressure are both going to go up because you're in cardiogenic shock. However your blood pressure is going to go down now what do you think is going to happen to your systemic vascular resistance? Well again because your heart is having a problem pumping blood, your blood vessels are going to do the same thing. Your blood vessels don't know the difference between whether it's the heart not pumping or just not having enough blood. They're going to do the same thing and so systemic vascular resistance is going to go up, your ejection fraction obviously because you're in cardiogenic shock is going to be low and what's going to be your skin temperature once again since you're having constriction and you're getting a shunting of blood from the non vital to the vital organs your skin temperature is going to be cold.

Let's talk about septic shock. Now septic shock is a lot different, septic shock is caused by an infection and when you have an infection you've got an immune response against that. Well something funny happens when you get that immune response that immune response or the antibodies or cells will release cytokines and chemokines and all of these sorts of things and

what do they do? They cause dysregulation of vasoconstriction that we've been talking about at the arterioles both going to the non vital and vital organs. Basically what happens is because there is dysregulation and specifically vasodilation.

So there is a shunting of blood to non vital organs away from the vital organs. Where's the problem? The problem starts off at the systemic vascular resistance. The systemic vascular resistance plummets, it drops and that's a big problem and as a result of that you have compensation.

In other words if the pressure just drops, which you'll see blood pressure drops in septic shock That causes a compensatory increase in heart rate and an increase in cardiac output at least early on in septic shock. The ejection fraction because of the infection actually is stunned and drops somewhat and as a result of the increased cardiac output the post capillary wedge pressure actually drops and so does your jugular venous pulse. It also drops now because there's regulation and blood is going to the skin believe it or not your skin temperature is actually up and these patients actually feel very warm.

Notice here that whereas in cardiogenic shock your post capillary wedge pressure and jugular venous pulse was high. In septic shock it's low so what I would recommend is studying these looking them over and over so you can see quickly the differences. Skin temperature is very important sometimes you can just walk into a room and touch the patient and look up on the monitor and see that they've got a fast heart rate and see that their blood pressure is low and just by simply touching the skin and a feeling if it's very warm you can tell if this patients in septic shock.

Although it's not a hundred percent of course and there's other things that you should look at but the key here is that there are certain readings that you'll see depending on the type of shock that you're in and knowing where everything starts off you'll be able to fill in the rest of the blanks

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