Excerpt from ***The Science Behind the Skill of Vein Access***

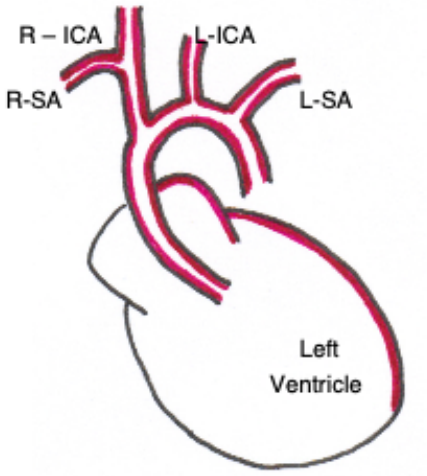
By M. Gail Stotler, Vein Access Technologist, BS Biology, BSN, RN

Provisional Title: How Blood Moves Around The Body

Venous Blood Return

How does blood move around the body? The answer most often given by lay people and health care professionals alike is that the **heart** contracts and moves the blood around the body.

But the physiological truth is that the heart just pumps blood **UP** and **out of the heart**.



Left ventricle contracts.

Forcing blood **UP** and out of the left ventricle at a blood pressure of 120/80 mm Hg (just enough pressure to travel the distance from your LV to your brain).

UP and out the aortic arch.
UP to the brain - thru the R-ICA and L-ICA.
UP to the right and left shoulders to the right subclavian artery (off the R-ICA) and the left subclavian artery.

And then, two other mechanisms take over from there to move blood around the body.

GRAVITY and **MOVEMENT**

As you know, GRAVITY takes everything **DOWN**. This includes blood in the body as well.

Let's follow a drop of blood as it leaves the left ventricle of the heart –

> The left ventricle contracted with a pressure of 120/80 mm Hg and propelled blood **UP** and out of the heart – UP to the head and shoulders. From there, everything else went **DOWN** the aortic arch to the rest of the body. How? By GRAVITY (mostly).

Think about this for a second. The only arterial blood going **up** is the blood that goes **up** to the brain. That's a short distance to go, and the pressure of the blood as it leaves the left ventricle is forceful enough to take the arterial blood in an upward direction to the head (**against gravity**). But the rest of the body is "south of the heart" (so to speak), and the arterial blood travels through these narrow lumen arteries with the help of **gravity** to the rest of the body.

Now that drop of arterial blood is at its final destination – the big toe – where it becomes a drop of venous blood that needs to return to the heart.

What moves venous blood, and how does venous blood return to the heart? How does a drop of blood get from my big toe back to my heart? Remember, gravity takes blood **down**.

There are two ways that the drop of venous blood can get back to the heart -

1. **Hang upside down** and let **gravity** bring it back.

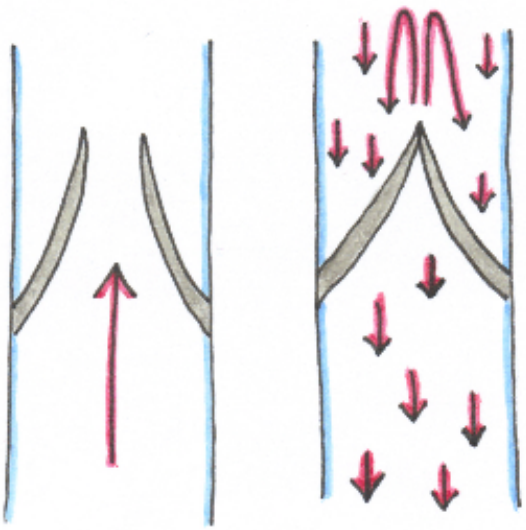
   (That's not practical – You can't "live" like that! But, it would work!)

2. **MOVE!** That's right. It is **MOVEMENT**, the contracting of skeletal muscles, that causes a squeezing of the veins. This "milks" the blood along, up the legs and back to the heart. It does the same for all the venous blood everywhere in the body. (Except in the brain. Since the brain is higher than the heart – when standing, anyway – **gravity** brings the brain's venous blood back to the heart.)

So, then what happens when you stop moving? Does that drop of blood in your thigh fall all the way back to your foot?

It would, except **veins have valves**. So when the blood starts to fall down, the little valves close (or open, depending on how you look at it) and hold the blood in place until you start moving again.

So, leg veins have oodles of valves because the legs are long, and they aren't always moving. But arm veins have very few valves because they are not as long, and we are constantly moving them, and therefore, the blood.

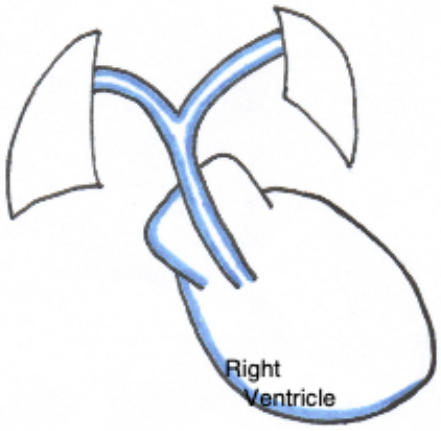


Note: Valves can become incompetent, failing to hold the blood in place, if you permanently injure the vein wall with over distention (varicosing the vein). The valves are attached to the wall of the vein, and if the wall is all stretched out, then the valve leaflets cannot touch each other and close appropriately. (And this will lead to more varicosing, more valve incompetence, more injury of the vein, and impaired venous blood return, and therefore, edema.) So, be careful with that tourniquet (SNUG, not tight).

So, the drop of venous blood in my big toe comes back to my heart by MOVEMENT – the contracting of skeletal muscles which squeeze the vein, milking the blood along, held in place with the help of valves – all the way back to my right ventricle.

The right ventricle then contracts at a pressure of 40 mm Hg (a fraction of the left ventricle pressure) to send the blood to the lungs.

(It requires less mm Hg pressure as compared to the left ventricle because the distance from the right ventricle to the lungs is much shorter than the distance from the left ventricle to the brain.)



Isn't that a neat story?!