2.5.1

Edema

Edema is an abnormal accumulation of fluid in the interstitium. Imbalances of the forces of capillary exchange explains many of the cases of edema that health professionals see.

Hydrostatic Edema

Hydrostatic edema occurs when there is excess fluid moved into the interstitial spaces because of an increase in the hydrostatic pressure inside the capillary. Normally, arterioles regulate how much blood can enter the capillaries and so even under the influence of high blood pressure the hydrostatic pressure in the capillary remains relatively normal. However, if systolic pressure rises above 160 mmHg for a long time, it is possible to see more blood move into the capillaries than is normal. This often raises hydrostatic pressure in the capillary causing more fluid to accumulate in the interstitial space to cause edema.

Another cause of hydrostatic edema is the increased hydrostatic pressure on the venous side of the capillary beds. Normally blood pressure is very low on the venous side of a capillary bed. However, if there is a venous blockage or if the heart pump cannot pump the blood that returns to it adequately, then pressure can build up in the veins. When this pressure rises in the capillary bed, we can see less fluid reclaimed from the interstitial spaces and fluid accumulates causing edema.

Permeability Edema

Permeability edema occurs when macromolecules (proteins) that do not normally cross the capillary endothelial cell membrane cross, or more proteins than normal move out of the interstitial cells into the interstitial space. The extra proteins in the interstitial space basically increase the interstitial colloid osmotic pressure and create an imbalance in the capillary exchange physiology that results in edema as water follows the molecules to the interstitial spaces. Physical trauma or toxic chemicals are the primary causes of sudden increases in cell membrane permeability that leads to edema. For example, a burn can disrupt cell membranes in the skin and cause cells to allow more solutes (atoms and intracellular molecules) to leak out. Inflammation from our immune responses can also change the permeability characteristics of capillaries and tissue cells which can lead to accumulation of solutes and water (edema) in the interstitial spaces.

Lymph Edema

Lymph edema occurs when lymph vessels become damaged and the damage results in obstruction of lymph flow. If lymph flow cannot occur adequately, the interstitial fluid volume rises. As the fluid accumulates edema occurs.

Osmotic Edema

Normally, the osmolarity of plasma and extracellular fluids is very similar (around

300 mOsm). If plasma becomes diluted then plasma osmolarity will be lower than extracellular fluid (less than 300 mOsm). As a result water will leave the capillary (because the surrounding tissue is greater than 300 mOsm) at a rate higher than normal and extracellular fluid edema will result (remember that water likes to move to an area of higher

solute concentration). An example could be liver failure where albumin production is compromised which causes a significant decrease in blood colloid osmotic pressure (loss of solutes from the plasma) and this results in more water leaving the capillary on the arterial end of a capillary and less returning on the venous end. Excessive water intake could also dilute the plasma solutes and result in a similar movement of water from the capillary to the extracellular space