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Anatomy and Physiology II
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Congestive Heart Failure

Scenario

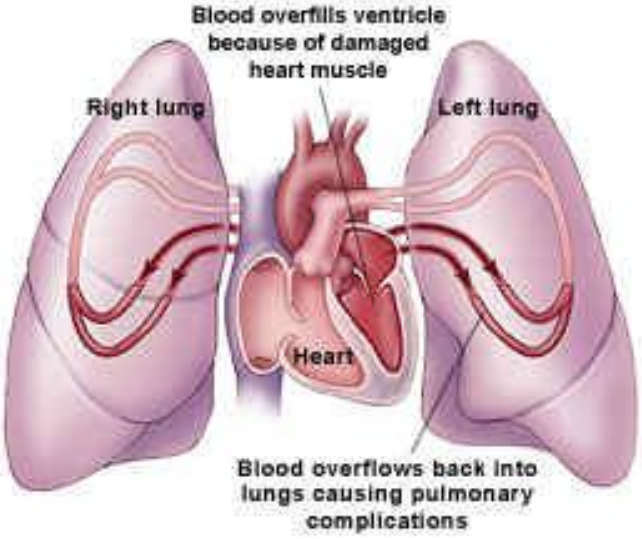
George is in congestive heart failure. Because of his condition, his ankles and feet appear to be swollen and he has trouble breathing.

1. What is congestive heart failure and what are some of its causes?
2. What is the relationship between congestive heart failure and the accumulation of fluid in the feet and ankles?
3. Why does he have trouble breathing?
4. How should he be treated?

Congestive Heart Failure and its Causes

When you hear the word failure you automatically assume that something has stopped working. Heart "failure" does not necessarily indicate that the heart has stopped working but rather that the heart is not working as efficiently as it should. Some may consider heart failure to be a disease, however heart failure is a traditionally considered to be a syndrome, meaning that heart failure is a collection of symptoms which arise from a number of other causes. The most common cause of heart failure is a weakening of the heart muscle, AKA cardiomyopathy. When the heart muscle weakens is can sometimes cause the body to build up fluids lending itself to be called "congestive" heart failure. Blood is essential in delivering the oxygen and nutrients our bodies need. With heart failure the blood being delivered tends to be delivered at a slower rate and cannot meet the demands of the body. To compensate for this deficiency the chamber of the heart, which there are four, stretch and tend to hold more blood to pump more blood through the body. This compensation mechanism may work but only for a short while; eventually the heart muscles will weaken and will not pump effectively. As blood flowing out of the

heart slows, blood in the veins returning to the heart backs up which cause the congestion in the body tissue defining the “congestive” in heart failure.



Congestive Heart Failure: Fluid Overflow
(Photo by http://www.heartcc.com/CHF.htm)

Heart failure is caused by many conditions that ultimately cause damage to the heart muscle. Some of these conditions include, but are not limited to:

- *Coronary artery disease* – arteries that become blocked or narrowed that cause decreased blood flow to the heart.
- *Heart attack* – this occurs when a coronary artery suddenly becomes blocked and cuts off the blood flow to the heart muscle. .
- *Cardiomyopathy* – damage to the heart muscle from things such as infection or alcohol and drug abuse.
- *Long term high blood pressure* – this causes the heart muscle to become too thick from prolonged over exertion.
- *Congenital heart disease* – the heart and its chambers or valves did not form correctly from birth.

There are two types of heart failure, systolic dysfunction and diastolic dysfunction. Systolic refers to contraction and diastolic refers to relaxation. Systolic dysfunction or

systolic heart failure occurs when the heart contracts with little force. This causes less oxygen enriched blood to pump through the body. Diastolic dysfunction or diastolic heart failure occurs when after the contraction the heart does not relax properly or are stiff. This causes less blood to enter the heart during the normal filling process. In order to determine which type of heart failure is present a calculation called an ejection factor is completed during an echocardiogram test. The ejection factor measures how well the heart pumps with each beat to determine systolic or diastolic related failure. The normal range for the EF is between 45 and 70%.

As previously stated there are two types of heart failure but according to the American Heart Association there are four stages of heart failure which are outlined below.

- Stage A – consists of people at high risk for developing heart failure. This is considered to be "pre-heart" failure.
- Stage B – consists of people diagnosed with systolic left ventricular dysfunction but who do not display any symptoms of heart failure.
- Stage C – consists of people with known systolic heart failure and current or prior symptoms.
- Stage D – consists of people with systolic heart failure and the presence of advanced symptoms even after receiving medical care.

Relationship between Congestive Heart Failure and the Accumulation of Fluid in the Feet and Ankles

One of the causes of CHF is a weakening of the heart muscle and the decreased out flow of blood to the body tissues. As stated above, blood flowing out of the heart slows, blood in the veins returning to the heart backs up which cause the congestion in the body tissue. The congestion in the body tissue is called "edema" and most frequently occurs in the legs and ankles.

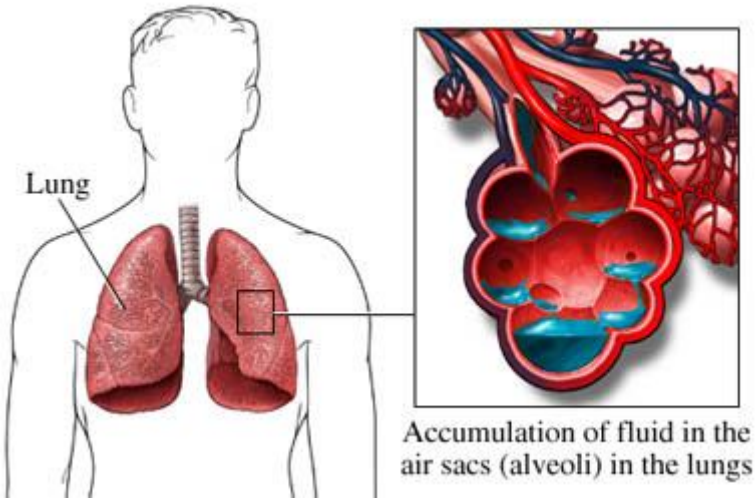
Fluid filled feet

(Photo by http://www.thegeminigeek.com/what-causes-swollen-feet)

Another cause of the accumulation of fluid in the feet and ankles is correlated to the kidneys and blood flow. The kidneys which function to filter the blood sense the decrease in blood flow that is caused by the weakened heart muscle. They in turn will release hormones which will cause the body to retain sodium and water. In the long run the retention of water will increase the volume of blood circulating and feed the kidneys the blood they need. However, this increase in fluid is more than the blood vessels can hold and will eventually leak into the body tissue creating the edema seen in the feet and ankles.

Congestive Heart Failure and Difficulty Breathing

As with the feet and the ankles, the lungs also collect fluid in much the same way. The excess fluid builds up in the fine tissue of the lungs and the air spaces. This build up of fluid increases the work of breathing while the oxygen getting to the lungs is decreased. One of the symptoms of heart failure that was discussed was the decreased blood flow to the body and the blood being essential for the delivery of nutrients and oxygen. The combination of decreased blood flow and fluid filled air spaces creates an oxygen deficiency in the body causing shortness of breath and over exerted breathing patterns. The most severe degree of heart disease is the presence of pulmonary edema.



Pulmonary Edema

(Photo by http://www.butler.org/body.cfm?id=125&chunkiid=19251)

How is Congestive Heart Failure Treated?

The first step in treating congestive heart failure is the proper diagnosis. Being that heart failure is a syndrome or a collection of other findings there is no single test that can diagnose it. Heart failure is first diagnosed by patient history and examination. Patients experiencing fluid retention, dizziness, fatigue, weakness, difficulty breathing or irregular heartbeats are considered for additional tests for heart failure. Blood tests are also used to determine heart failure. These are used to evaluate the kidneys and the presence of anemia. Anemia is a blood condition that results when there is not enough hemoglobin in a patient's blood. Another blood test commonly used the B-type Natriuretic Peptide blood tests. BNP is a substance that is secreted from the heart in response to changes in blood pressure. BNP levels will increase when heart failure worsens. Chest x-rays, electrocardiograms and echocardiograms are also used to assist in diagnosing heart failure but do not completely diagnose alone. The chest x-ray is useful in showing that the heart may be enlarged and is useful in determining pulmonary edema. The electrocardiogram provides clues that there are associated heart rhythm problems but will not tell the physician whether there is heart failure or not. The best test used as an indicator of heart failure is the echocardiogram or sonogram of the heart. This test indicates the strength of the heart muscle, the size of the chambers and valve problems. Once CHF has been diagnosed the treatment begins with treating the underlying cause of

the syndrome when possible. There are also several medications available that can slow, stop or reverse the heart failure. Some of these medications include diuretics, vasodilators, beta-blockers, inotropes, blood thinners, and antiarrhythmics. In addition to the medication it is the patient's responsibility to prevent the heart failure from worsening. The patient can monitor and maintain a low blood pressure, fluid intake and balance, salt intake and diet, body weight, and by committing to regular check ups. For those patients with severe heart failure the treatment options become heart transplantations and pacemakers. Currently new treatment options are being explored that include procedures called the cardiomyoplasty and the battista. The cardiomyoplasty consists of taking the large muscles of the back and shoulder and wrapping it along with a pacemaker around the heart to cause it to contract. The battista is the removal of the parts of the heart that have become enlarged along with the replacement of the mitral valve. The goals of treating heart failure are to decrease the progression of the disease. By following the prescribed medications and committing to a changed lifestyle, heart failure symptoms can lessen and the quality of life for those suffering with heart failure can be improved.

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