

# The Heart of the Problem: From Heart Attack to Kidney Failure



by

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## Part I – Emergency

Mrs. Helms came in through the front door of her house with an armful of groceries. She put the bag down on the kitchen counter and called to her husband. “Herb, I’m home! Are you ready for lunch?” She didn’t get an answer, so she walked to the living room and found Mr. Helms lying on the floor. “Herb! Are you okay?” she asked as she grabbed his shoulder. Mr. Helms responded weakly while clutching his chest. Mrs. Helms frantically called 911. It only took EMS a few minutes to arrive and the paramedics transported Mr. Helms to the hospital. Upon admission to the hospital, Mr. Helms’ vital signs were recorded as follows:

	<i>Mr. Helms</i>	<i>Normal</i>
Systolic blood pressure (mm Hg)	90	120
Diastolic blood pressure (mm Hg)	52	80
Oral temperature (°F)	98.9	97.8 to 99.1
Heart rate (beats per minute)	120, irregular	60–80
Respiratory rate (breaths per minute)	33, labored	12 to 20
Oxygen saturation	89%	95–100%

## Questions

1. Which of Mr. Helms’ vital signs and lab values were abnormal?
  
2. What additional medical tests would you order for Mr. Helms? In other words, what other information would be useful?

## Part II – Cardiac Involvement

Mr. Helms was admitted to the hospital with chest pains and shortness of breath. His wife was panicked since her 72 year-old husband had a history of heart disease. After examination and an echocardiogram, Dr. Collins spoke with Mrs. Helms. “I’m very sorry, but your husband has had another heart attack resulting in valve failure. A papillary muscle that controls a valve in his heart has been severely damaged and is no longer working.”

### *Questions*

1. What is the purpose of blood flow?
2. Describe blood flow through the heart starting with blood entering the right side of the heart and including all chambers and valves.
3. What is the function of heart valves?
4. What is the function of papillary muscles?
5. Which valve is affected with damage to the papillary muscle in the left ventricle?

### Part III – Cardiovascular Involvement

Dr. Collins called Nurse Nan from the patient's room and confided, "Mr. Helms is in bad shape. His left posteromedial papillary muscle was damaged from his heart attack. The papillary muscle is no longer able to maintain closure of the valve, and this has resulted in mitral valve prolapse. With decreasing cardiac output, this patient is in for a fight for his life." Nurse Nan knew that maintaining cardiac output was necessary for adequate blood flow through the body. As Dr. Collins walked away, Nurse Nan composed herself to tell Mrs. Helms the bad news and returned to the patient's room. Nurse Nan explained to Mrs. Helms that her husband had left-sided heart failure and that his blood pressure was slowly and steadily decreasing.

#### *Questions*

1. In general, how is the direction of blood flow disrupted because of mitral valve prolapse?
2. Does the mitral valve prolapse increase, decrease, or not change stroke volume (the amount of blood exiting the ventricle with each ventricular contraction)?
3. How does mitral valve prolapse decrease cardiac output (the amount of blood exiting the ventricle per minute)?
4. Explain how cardiac output determines blood pressure.
5. Why is Mr. Helms' heart rate higher than normal?

## Part IV – Pulmonary Involvement

Mrs. Helms was very upset with the news of her husband's condition. As the day progressed, she noticed that Mr. Helm's breathing was increasingly difficult. He could barely speak without losing his breath. Mrs. Helms called the nurse to her husband's room. "My husband can't breathe! What is wrong? I thought he had a heart attack not a respiratory condition!" Nurse Nan auscultated the patient's chest listening to Mr. Helms' respirations, which were rapid and wet, producing rales or crackling sounds. Nurse Nan calmly informed Mrs. Helms, "I'm sorry. Your husband's condition is worsening. The damage to his heart is causing his respiratory problems."

### Questions

1. The left side of the heart receives blood from which part of the body?
2. If the bicuspid (mitral) valve is not fully closing, does pulmonary circulation increase, decrease, or not change?
3. Does pulmonary blood pressure increase or decrease with left-sided heart failure? Explain.
4. Does this change in pulmonary blood pressure increase or decrease capillary filtration in the lungs? Explain.
5. How does change in pulmonary blood pressure and capillary filtration cause Mr. Helms' rales (wet breath sounds)?
6. Why is Mr. Helms breathing rapidly?



## Part VI – Resolution

Dr. Collins rushed Mr. Helms into surgery for valve replacement. Mrs. Helms waited anxiously in the waiting area for family for hours until she saw Nurse Nan coming toward her with a big smile. “Your husband is in the recovery room. He’s going to be just fine.” Mrs. Helms sighed with relief and gave Nurse Nan a big hug.

### Questions

1. How would you expect Mr. Helms’ vital signs and respiratory and kidney functions to change after valve replacement surgery? Explain.
2. Now that you are familiar with left-sided heart failure, describe blood flow with right-sided heart failure.
3. What are some possible causes of right-sided heart failure?
4. What symptoms could be expected with right-sided heart failure?



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