

Pulmonary edema case study examples

[Health & Medicine](#), [Stress](#)



RTE 1503

Abstract:

Hypertensive pulmonary edema is a frightening disease that occurs occasionally with acute hypertension. This case study analyzes a middle aged woman and her visit to the hospital emergency department when she collapses and has difficulty breathing. It is shown by the x-ray technician that she is suffering from hypertensive pulmonary edema and after proper medical management she quickly gets better. It is important to distinguish this disease from cardiogenic pulmonary edema, which is chronic in nature and has a very different clinical picture.

A 47-year-old woman with a history of hypertension recovering from a recent bout of the flu suddenly fell to the ground while cooking with her husband. On arrival to the emergency department, she was pale and clammy, with symmetric and reactive pupils. She was responsive but in clear respiratory distress and suffered from dyspnea. Her blood pressure was 189/101 mm Hg, pulse of 117 beats/min, respiratory rate of 22 breaths/min, and oxygen saturation by pulse oximetry measured 87% on ambient air. She received prompt oxygen therapy but was still having painful and short breaths. Her respiratory status continued to deteriorate. Pink frothy sputum was suctioned through the endotracheal tube. Blood oxygen saturation measurements were obtained and measured at 84%. CRP was shown to be 11. A decision to conduct a chest radiograph was made by the chief resident of the emergency department.

The X-Ray technician was called to the department and directed to the patient and was asked to conduct a decubitus anterior-posterior x-ray, as

well as left lateral imagery. The woman was particularly nervous and distressed and continually asked if the procedure was going to be painful and she was reassured it would not be. The patient stated that she had heard x-rays were radioactive and was scared of an injury. It was explained to her that the chest x-ray would expose her to about 0.1 mSv of radiation and that if she were to take a flight she'd be exposed to 1.5 mSv and that the benefits of the procedure far outweighed the risks of the radiation exposure. Finally, she asked if her husband could accompany her and she was told he could.

The woman was wheeled into the x-ray laboratory as she was having difficulty standing or even sitting up. She was asked to remove her necklace. She resisted, stating that it was a good luck charm given to her by her deceased grandmother. The technician dutifully explained to her that it would cause interference with the image and difficulty in ultimately reading it. The woman was also asked if she could be pregnant, to which she responded in the negative. The woman was positioned appropriately on the table and the technician stepped behind the partition and gave her husband a lead protection apron.

The woman was asked to take a deep breath and only release when instructed to, which she did marvelously. She held her breath for 3 seconds and heard the machine click. The technician went to the patient, repositioned the machine and the film, and returned behind the partition. She was asked to hold her breath again; she heard another click and then heard the technician say "all done." The patient expressed surprise that she was so nervous over such a quick and painless procedure while the

technician was poring over the images on his computer screen. The images show diffuse patchy alveolar infiltrates and air space filling, a normal heart size, no effusions, and no septal lines. She is diagnosed with non-cardiogenic pulmonary edema, likely secondary to hypertension. She is given anti-hypertensive medications, propped upright with tourniquets wrapped around the extremities and put on continuous positive airway pressure by the emergency department. Soon all her vital signs return to normal.

The purpose of the X-ray procedure was to discover the cause of the woman's dyspnea and terrible oxygen saturation. The causes of such conditions are manifold and can be quickly and accurately diagnosed with a simple chest X-ray. The differential diagnosis for her condition is: cardiogenic pulmonary edema, non-cardiogenic pulmonary edema, or an airway obstruction (why may also cause pulmonary edema.)

The images would look different for every one of the possible diagnoses. In the case of an airway obstruction, the obstructing object would likely be visualized. Furthermore, a characteristic breathing pattern would be evident in the case history. Finally, the patient is not of an age where she would not be aware of possibly swallowing an object that could cause an obstruction. A good anamnesis and a negative chest x-ray quickly rule out this possibility. Left heart failure is the most common cause of pulmonary edema, however there is no evidence of cardiac enlargement or plural effusions in the chest x-ray, which are hallmarks of diagnosis (Basic Radiology, 2011, pg. 90).

The X-ray findings are entirely characteristic of non-cardiogenic pulmonary edema insofar as there is no cardiomegaly present, the pattern of infiltrates is patchy, and there is no effusions or septal lines (Basic Radiology, 2011, pg.

91).

There are many causes of non-cardiogenic pulmonary edema, including direct injuries to the lung caused by toxins, hematogenous injuries caused by disease, and injuries caused by elevations in hydrostatic pressures (Harrison's, 2008, pg. 224). In this case the lung injury was caused by the patient's systolic hypertension of 189mmHg. Hypertensive pulmonary edema is often times considered a sign of the most severe forms of heart failure (Ford, 2010). It is believed that the syndrome is the result of the very increased sympathetic tones stimulated by increased pulmonary vascular pressures and a positive feedback loop that develops furthering fluid accumulation in the lungs (Ford, 2010). Hypertensive pulmonary edema can be a particularly disastrous occurrence during a pregnancy and can rapidly lead to death and it is believed that hypertensive disease affects up to 15% of pregnant women (Dennis, Solnordal, 2012).

Acute pulmonary edema ultimately relies on the cardiovascular function and fluid flowing from the pulmonary tissues. Hydrostatic and colloid osmotic pressures, and capillary permeability determine the amount of fluid within the lung tissues and are described by Starling's equation: $K_f [(P_{mv} - P_t) - (COP_{mv} - COP_t)]$ where: K_f is the ultrafiltration coefficient, capillary permeability; P_{mv} is microvasculature pressure, which approximates to arterial pressure-venous pressure; P_t is tissue hydrostatic pressure; COP_{mv} is microvasculature colloid osmotic pressure; and COP_t is tissue colloid osmotic pressure (Dennis, Solnordal, 2012).

Obviously, key to the diagnosis of hypertensive pulmonary edema is the absence of any physical findings associated with heart failure – which is most

commonly a depressed ejection fraction. In fact, recognition that the problem is related to sympathetic tones evolved from the treatments that were instituted to resolve crises, namely: anti-diuretics, positional arrangement as described above, CPAP, morphine, and nitroprusside – all the therapies favor a decrease in sympathetic tone and a shuttling of blood to the systemic side of the circulation (Ford, 2010). Ideally, in the treatment of pregnant women with a hypertensive crisis, mechanical methods will be tried first, in order to avoid toxic injuries to a developing baby (Dennis, Solnordal, 2012). If properly treated, just as suddenly as the hypertension and pulmonary edema appear, it disappears.

Ultimately, diagnosis of hypertensive pulmonary edema relies on a chest x-ray and a careful anamnesis. ECG and Echocardiograms are also effective tools.

In the case of our patient, the prognosis is very good. Her hypertensive crisis appears to be a one time occurrence as she has no cardiomegaly or other signs of heart failure. She should be constantly monitored for hypertension and her primary care physician must control her blood pressure. However, if it is properly controlled, she is unlikely to return to the emergency room for reasons related to the pulmonary edema secondary to a hypertensive crisis. In conclusion, hypertensive pulmonary edema can present a scary clinical picture. Dyspnea, chest pain, and sweats, may all be reminiscent of a cardiac crisis and patients may fear the worst. However, with proper x-ray readings, a cardiac crisis can be ruled out. Once appropriate therapy depending on the patients state is initiated, the disease quickly resolves and patients are able to go home.

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