June 2015 Critical Care Case of the Month: "Just ask the Nurse"

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History of Present Illness

A 61-year-old police officer had just finished delivering a speech at a law enforcement conference in Phoenix when he briefly complained of chest pain or chest tingling before lapsing into a mute state. He became diaphoretic cyanotic, and vomited. Emergency medical services was called. They noted a blood pressure of 80/50 mm Hg, a pulse of 45, temperature of 95º F, a respiratory rate of 12, and widely dilated pupils. He was transported to the emergency room.

PMH, SH, FH, Medications

Unknown.

Physical Examination

Vital signs: blood pressure 120/75 mm Hg by oscillometric thigh cuff, pulse 43 and irregular, temperature 96º F, respiratory rate 10, SpO2 96% on O2 @ 5L/min by nasal cannula
Neck: No JVD.
Lungs: Poor inspiratory effort
Heart: Irregular rhythm without a murmur
Neurological:

- Delirious – mute – won't obey commands or track with his eyes
- Pupils 3 mm reactive
- Withdrew 3 extremities to nail bed pressure –defended his left arm with his right arm

He suddenly became asystolic and cardiopulmonary resuscitation was begun. After about a minute of CPR a femoral pulse could be felt.

Which of the following are ***indicated at this time***?

1. Arterial blood gas
2. Chest x-ray
3. Electrocardiogram
4. Electrolytes
5. All of the above

Correct!
5. All of the above

Although the underlying pathology is not entirely clear, in a man this age myocardial infarction would certainly be high on the differential. His electrocardiogram shows atrial fibrillation with bradycardia and nonspecific ST segment and T wave changes.

Arterial blood gases

- PaO2 155 mm Hg
- pCO2 36 mm Hg
- pH 7.18
- $HCO3^-$ 13 mEq/L

Electrolytes

- Na^{++} 138 mEq/L
- K^+ 6.9 mEq/L
- Cl^- 103 mEq/L
- $HCO3^-$ 14 mEq/L

His chest x-ray is shown in Figure 1.

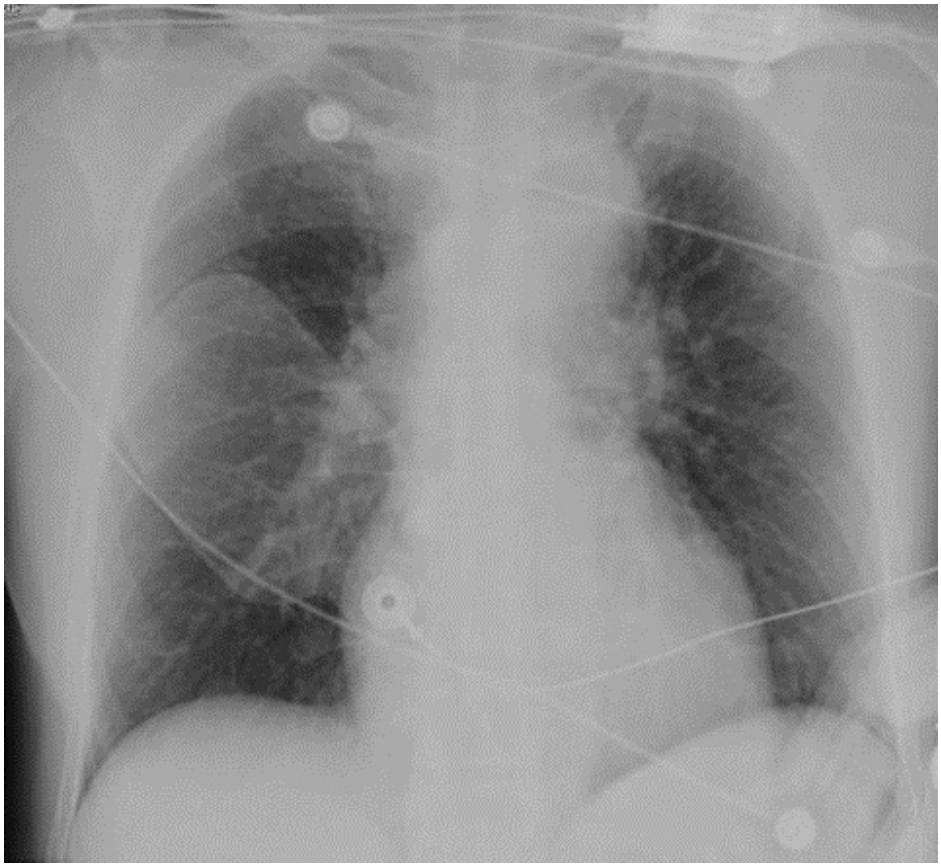

Figure 1. Admission portable chest radiograph.

The intensivist became frustrated climbing over the pressure tubing connecting the thigh blood pressure cuff to the manometer on the wall, and asked the nurses why they were using a thigh cuff. The nurses indicated they had done so because the patient had no detectable blood pressure in either arm.

The intensivist re-examined the patient (not having done a vascular examination the first time around), and found no radial pulse in either wrist. The correct diagnosis was finally suspected.

Which of the following ***should be done next***?

1. Computerized tomography of the brain
2. Carotid angiography
3. Spinal tap
4. Thoracic CT scan
5. All of the above

Correct!
4. Thoracic CT scan

Limb pulse deficit is a classical finding of ascending aortic dissection, but is not often noted. Blood pressure discrepancy > 20 mmHg is more likely to be present. The other key clinical findings of ascending aortic dissection are “ripping or tearing” chest pain and widened aorta on chest radiography. Although the left mediastinum width in this patient’s CXR (7cm) is technically widened (> 6cm), the clinicians did not notice this until later. The key finding was the pulse deficit, supported by the vague history of chest pain. When the intensivist mentioned to the ER nurse that he thought the patient might be dissecting his aorta, she said that was what she thought all along. She was invited to share her diagnostic musings more openly in the future. Rapidly confirming the diagnosis by thoracic CT scan or transesophageal echocardiography is the most important next step.

The thoracic CT scan is shown in Figure 2.

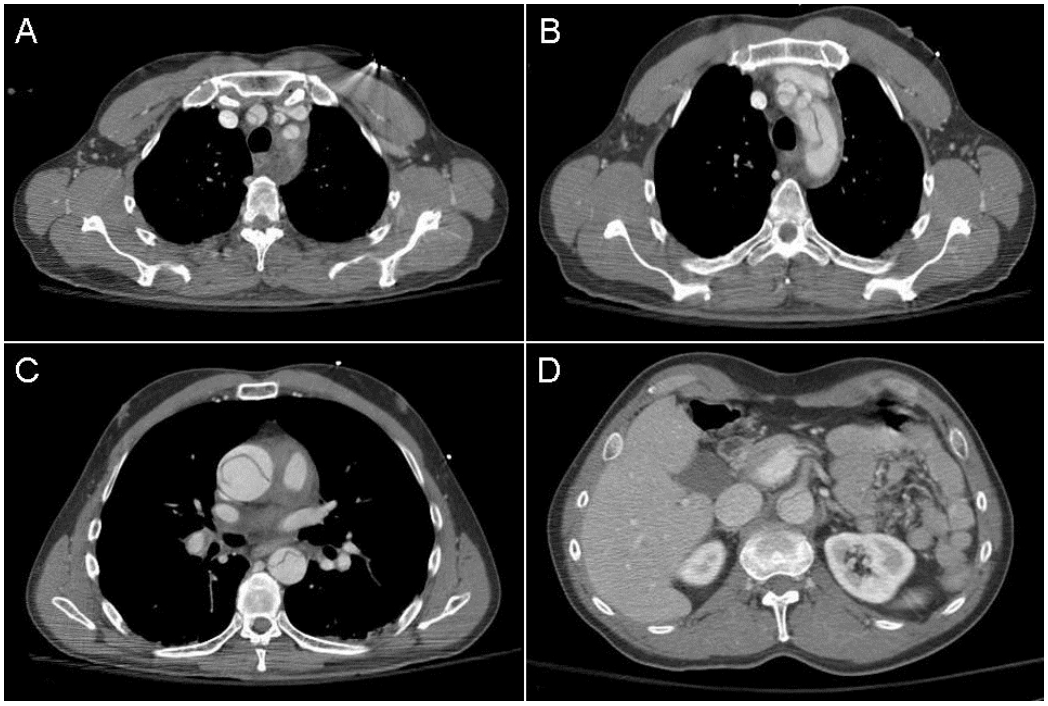

Figure 2. Representative images from the contrast-enhanced thoracic CT scan in soft tissue windows.

What is the ***cause of the blockage*** of blood flow to the patient's arms and neck?

1. Aortic dissection
2. Arterial embolism
3. Compression of the aorta
4. Compression of the subclavian and carotid arteries by hypertrophied muscles
5. Diffuse atherosclerosis

Correct!
1. Aortic dissection

The most common cause of blood pressure differing by more than 10 mm Hg in the extremities is compression by a hypertrophied muscle in the young and atherosclerosis in the old (1). However, in this acute situation aortic dissection would be the leading cause of these diffuse changes with multiple arterial emboli as a less possible cause. The thoracic CT scan clearly shows the dissection (Figure 3).

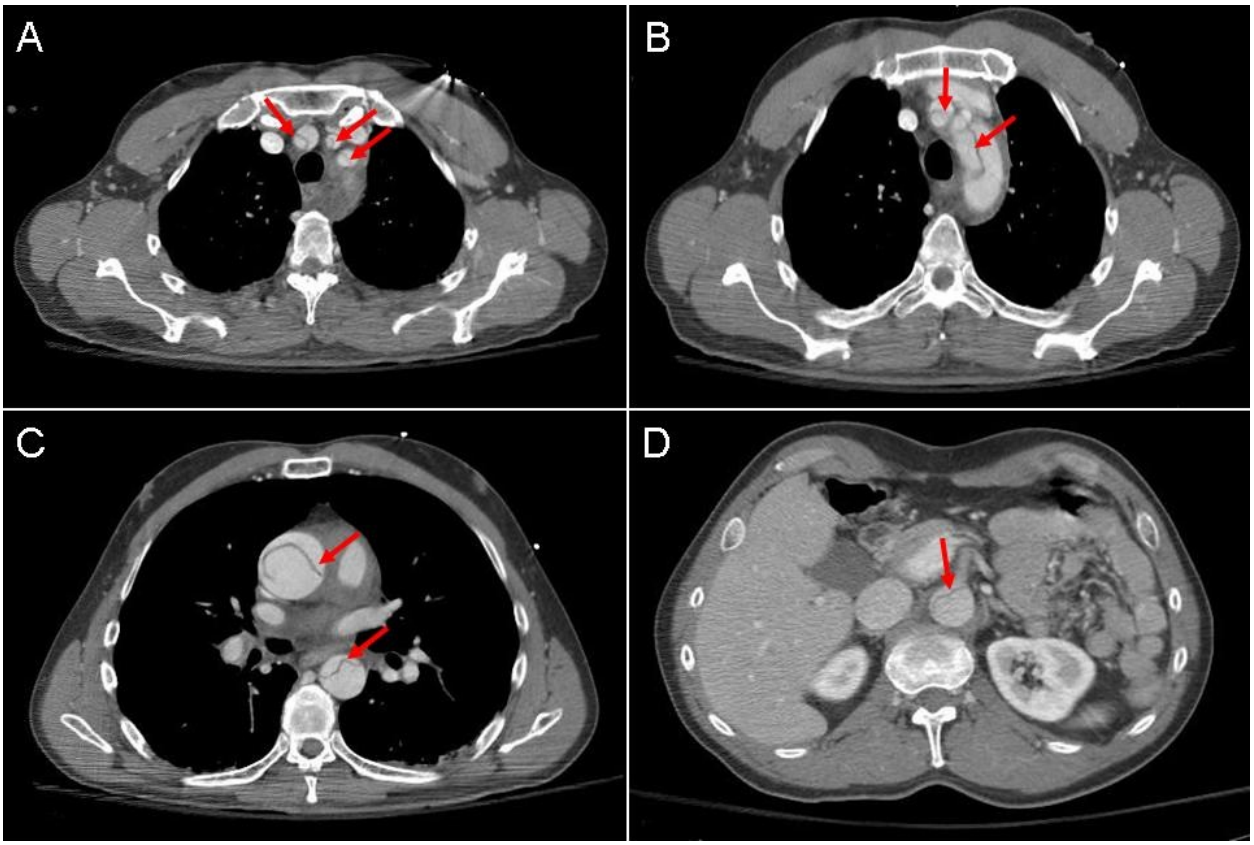

Figure 3. Contrast enhanced thoracic CT scan showing the arterial dissection separating the intimal and medial vascular layers (red arrows).

Which of the following are ***true regarding aortic dissection***?

1. Aortic dissection can be associated with aortic valve insufficiency
2. Aortic dissection can be associated with Marfan's syndrome
3. Dissections away from the heart may be conservatively managed by blood pressure lowering only
4. Surgical repair is usually required for dissections that involve the aortic arch
5. All of the above

Correct!
5. All of the above

Aortic dissection is a medical emergency and can quickly lead to death, even with optimal treatment, as a result of decreased blood supply to other organs, heart failure, and sometimes rupture of the aorta (2). Aortic dissection is relatively rare, occurring at an estimated rate of 2–3.5 per 100,000 people every year. It is more common in males for unknown reasons. Aortic dissection is more common in those with a history of high blood pressure, a known thoracic aortic aneurysm, and in a number of connective tissue diseases that affect blood vessel wall integrity such as Marfan's syndrome and the vascular subtype of Ehlers–Danlos syndrome. Symptoms usually include sudden ripping chest and or abdominal pain. A pulse deficit and mediastinal widening (> 6 cm) are common.

The main complications of ascending aortic dissection include rupture into the pericardium causing tamponade, disruption of the aortic valve ring causing acute aortic insufficiency, and ischemic vascular catastrophe's involving any of the main arteries. As can be seen in frame A of the CT scan, the patients carotid arteries were threatened. In frame D, the celiac artery can be seen to be perfused via the (tenuous) false lumen.

In this case, the patient had suffered a left MCA- distribution stroke due to dissection of the left carotid artery (later demonstrated by computerized tomography of the brain). This caused his neurological findings and the aphasia/altered consciousness that likely impaired his ability to better describe his chest pain.

The treatment of aortic dissection depends on the part of the aorta involved (2). Surgical treatment is usually required for dissections that involve the aortic arch, while dissections of the part further away from the heart may be treated with blood pressure lowering only. Since the 1990s endovascular aneurysm repair (carried out from inside the blood vessels) has been used in specific cases.

Historically, the first case of aortic dissection described was in the post-mortem examination of King George II of Great Britain in 1760 (3). Surgery for aortic dissection was introduced in the 1950s.

The patient underwent successful emergent graft replacement of his aortic arch. The surgical team acted so quickly that he did not receive beta-blockade to reduce delta pressure / delta time (the rate of change of systolic pressure upstroke) which is typically the cornerstone of medical management of acute aortic dissection. The patient recovered neurological function related to his stroke.

References

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3. Criado FJ. Aortic dissection: a 250-year perspective. Tex Heart Inst J. 2011;38(6):694-700. [PubMed]