Story from the Front Lines

An otherwise healthy 37 year-old man presented to the emergency department (ED) with four days of generalized malaise, tingling in his arms, headache, anorexia, intermittent chest pain, and dyspnea on exertion.

He had traveled from sea level to Colorado within the past week and during a recent trip into the mountains the above symptoms began. He denied diaphoresis, history of cardiac disease, or risk factors for myocardial infarction including family history, hyperlipidemia or diabetes. Additionally, he denied recent surgery, prolonged immobility, history of venous thromboembolism, malignancy, pain with deep inspiration, or hemoptysis.

Exam was notable for stable vital signs, though was mildly tachycardic to 102. He was an anxious appearing young man with a normal cardiopulmonary exam and warm, well-perfused extremities. His neurologic exam was normal.

An EKG obtained in the ED was unremarkable, troponin was negative and CT pulmonary angiography showed no of evidence of pulmonary embolus. He was admitted to the medicine ward to exclude “acute coronary syndrome”. Upon admission to the ward a D-dimer was obtained which was normal.

Diagnosis of acute altitude sickness was made and the patient was discharged the following morning after rehydration.

Teachable Moment

This patient was at low risk for pulmonary embolism as defined by a Wells score of one (1). In accordance with the PIOPED II trial, a d-dimer should be obtained prior to CT-angiography for low risk patients given an estimated negative predictive value of 96% in those with negative d-dimer (2). In a recent single center study, adherence to PIOPED II guidance was assessed in the evaluation of possible pulmonary embolism. Findings demonstrated that a total of 1908 of 3500 CT pulmonary angiograms (54.5%) did not follow recommendations of the PIOPED II investigators (3).

In addition to over-utilization of diagnostic technology, which carries excess cost to the patient and society, this patient suffered unnecessary exposure to approximately 7-14MsV during CT-angiography. This exposure is not negligible. Among 680,000 Australians exposed to a CT scan (82% with only 1 CT scan) aged 0-19 years (50% of participants were 14-19 years), cancer incidence was increased by 24%. The absolute excess cancer incidence rate was 9.38 per 100,000 person
years at risk (4). As a result of a potentially avoidable CT scan it is possible that the absolute risk of malignancy over his lifetime was increased.

Fortunately, the patient did not have any incidental findings which can require additional imaging over time. Studies have shown that at least one third of patients who undergo first-time CT pulmonary angiography go on to have repeat CT pulmonary angiography, and almost 75% have some type of CT scanning within 5 years (5).

Lastly, CT pulmonary angiography exposes patients to risk of renal failure, soft tissue injury, or anaphylaxis from intravenous contrast. In a study by Mitchell and Kline, it was estimated that approximately 8% of all patients who undergo CT pulmonary angiography develop laboratory-defined contrast nephropathy (6).

In the end, our patient could have avoided the monetary and physical cost of CT radiation exposure. A timely D-dimer could have obviated the need for CT imaging, hospital admission and the bill for his scan, which alone cost $8,950.

References: