Multidetector CT Scan in the Evaluation of Chest Pain of Nontraumatic Musculoskeletal Origin

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KEYWORDS

• Multidetector CT • Chest pain • Musculoskeletal

Chest pain is a very common symptom resulting in emergency department visits and admissions to the hospital.[1,2] There are many potential causes of acute nontraumatic chest pain ranging from relatively benign causes, such as gastroesophageal reflux, to life-threatening causes, such as myocardial infarction. While history and physical examination, along with targeted basic diagnostic testing, remain the mainstay in the evaluation of chest pain, advanced imaging with a thin-collimation multidetector computed tomography scan (MDCT) plays an increasing role. In the emergency setting, MDCT is obtained routinely to evaluate acute chest pain in suspected cases of pulmonary embolism (PE) and aortic dissection. Additionally, at many sites the MDCT triple rule-out is being used for suspected coronary artery disease.

The MDCT-imaging protocols for PE and aortic dissection studies use relatively high kilovolts peak and mAs with thin collimation. These parameters are typically set to values that are very similar to those used in dedicated musculoskeletal imaging protocols. These imaging techniques, along with dedicated reconstructions using high-resolution reconstruction kernels and multiplanar reformatting, allow for superb imaging of the thoracic musculoskeletal structures. Thus, the images obtained with thin-collimation MDCT are excellent for evaluating PE and aortic dissection,[3] plus other causes of chest pain, including chest pain of musculoskeletal origin.

Musculoskeletal diseases are very common causes of chest pain in the general population (approximately 10%–15% adults and 24% children).[4–6] One of the most common causes of musculoskeletal chest pain, costochondritis, is routinely diagnosed by physical examination and not by chest CT scan.[7,8] However, many other causes of musculoskeletal chest pain can be visualized on thin-collimation MDCT examinations. These include (1) infectious causes, such as discitis/osteomyelitis and sternoclavicular septic arthritis; (2) rheumatic causes, such as ankylosing spondylitis (AS), with and without fracture; and synovitis, acne, palmoplantar pustulosis, hyperostosis, and osteitis (SAPHO); and (3) systemic diseases resulting in bone findings, such as osteoporosis with insufficiency fractures, neoplasm (with or without pathologic fracture), and sickle cell disease with bone infarcts or avascular necrosis. These entities are not the most common causes of acute nontraumatic chest pain and may

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not even be in the initial differential diagnosis when a thin-collimation MDCT chest CT scan is ordered. However, in total they do account for a significant minority of the causes of acute chest pain. Given the excellent capability of thin-section MDCT with coronal and sagittal reformatting to depict these musculoskeletal disease entities, the cardiothoracic imager must have a basic familiarity with their imaging appearances.

INFECTIOUS CAUSES OF CHEST PAIN

Discitis/Osteomyelitis

Discitis/osteomyelitis is an uncommon cause of chest pain but is important to diagnose given the consequences of recognition failure. In adults, discitis can have a slow insidious onset and the classic signs of infection, fever and chills, may not be present. A common presentation is back pain. In adults, the infection is thought to most often arise via hematogenous spread of infection at another site (eg, upper respiratory tract infection, urinary tract infection). The most common infectious organism is *Staphylococcus aureus*, which accounts for greater than 50% of infections. Infection begins in the disk with loss of disk space and subsequent invasion or destruction of the adjacent vertebral body. The CT scan findings of early discitis/osteomyelitis are subtle and difficult to visualize in the axial plane.[9] MDCT with sagittal and coronal reformatations improves identification of early disk-height loss and endplate destruction.[10] On the sagittal and coronal reformatted images, all of the disk spaces can be viewed simultaneously and thus even subtle changes at a single level are readily seen as being different from the adjacent levels. As the disease progresses the vertebral body involvement may become more advanced and potentially result in vertebral body collapse.

In some cases, there may be concomitant development of adjacent soft tissue infection or epidural abscess. While the disk and vertebral body involvement is often best seen on sagittal or coronal reformatted images with bone windowing, the adjacent soft tissue involvement is often best seen on the transverse (axial) images with soft tissue windowing. The exact extent and character of the soft tissue component may be better evaluated with magnetic resonance imaging.

Discitis/osteomyelitis may present with acute chest pain (**Fig. 1**). Sagittally reformatted images clearly demonstrate the disk-centered process with adjacent vertebral body destruction and provide a useful adjunct to transverse images. Windowing for bone and soft tissue allows for evaluation of both the involvement of the vertebral bodies and the adjacent soft tissues.

Disk space narrowing is very common owing to degenerative disk disease. The main diagnostic dilemma with dicsitis/osteomyelitis is differentiating it from degenerative disk disease. Degenerative disk disease results in disk-space narrowing, but is differentiated from discitis/osteomyelitis by the absence of endplate destruction at the adjacent vertebral bodies. In degenerative disk disease, the endplates can appear quite irregular because of remodeling, but are usually between normal and increased in density, without any destruction of the endplates. Additionally, discitis

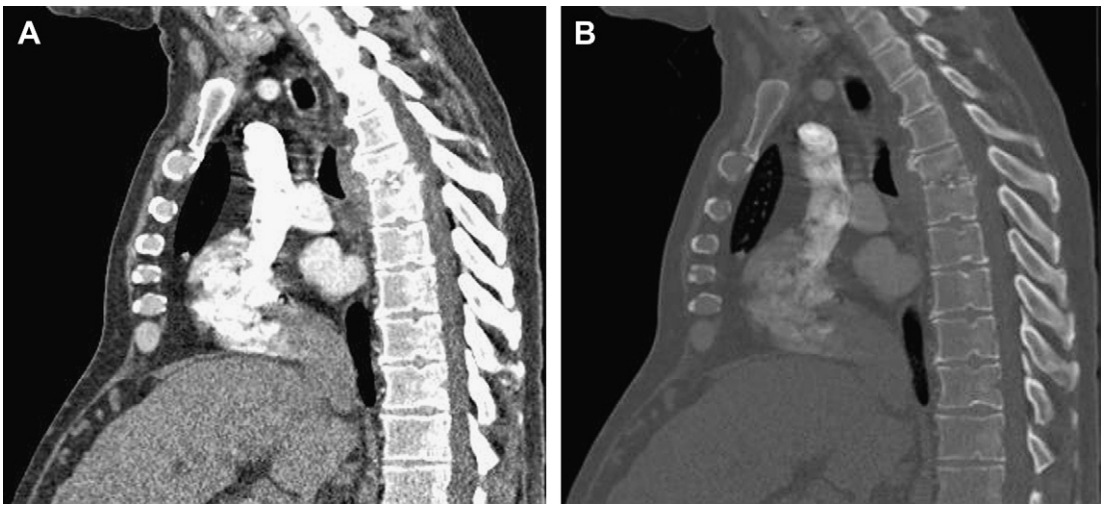

Fig. 1. Mid-sagittal image from a PE protocol MDCT examination for acute chest pain with soft-tissue (*A*) and bone (*B*) windowing demonstrating disk-centered destruction of midthoracicvertebral bodies with associated phlegmon consistent with discitis/osteomyelitis.