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Point - Counterpoint Opinion

Incidental findings on cardiac computed tomography. Should we look?

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Abstract. Although the intent of cardiac computed tomographic angiography (CTA) is to visualize the coronary, aortic, and cardiac structures, portions of noncardiac structures are visible on the scan. Because cardiac CT scanning is primarily obtained with a small field of view (to maximize coronary visualization with highest spatial resolution), some have argued that the scans should be secondarily reconstructed to further evaluate portions of the lung, breast, and bone. The suggested benefits of a routine radiologist overread of the extracardiac structures for incidental findings have not been scientifically validated and mostly come from anecdotal experiences. The same anecdotal arguments were used to support body scanning; the idea that complete visualization of all structures will lead to earlier cancer detection and therefore better outcomes. Every center that has ever offered body scanning can show a case of early detection of lung cancer, renal cancer, and colon cancer, thus proving their efficacy. However, body scanning has been uniformly discouraged, most strongly by the American College of Radiology and other professional organizations, because of the high number of false-positive findings, low ratio of true positives to false positives, high follow-up costs, and increased anxiety, all without proof of improvement in outcomes. Similar arguments were also made for routine chest x-rays in smokers, until studies showed that earlier detection of lung masses did not lead to improvement in outcomes. Preliminary studies are showing that enlarging the field for CTA scans to look for incidental findings will suffer the same fate as body scanning and chest x-rays, as another form of screening that cannot be medicolegally justified because of severely high false-positive rates and no improvement in outcomes. Until data are available to the opposite, we should use our good judgment and restraint and not perform large-field reconstructions for the explicit purpose of screening.

Extensive studies of screening CT scans in older smokers have revealed the prevalence of cancer to be between 0.3% and 1%. However, when applied to an ambulatory population of patients presenting for an evaluation of coronary artery disease, the prevalence of lung cancer or significant noncardiac findings should be significantly lower in this low-risk (for lung cancer) population. We have reviewed all the relevant literature to determine the potential benefits and harms of specifically overreading CTA scans for noncardiac disorder. The weight of the evidence suggests it is most prudent not to specifically reconstruct and re-read CTA for lung nodules. If a noncardiac abnormality is visualized by the primary interpreter of the cardiac CT scans, an appropriate referral or follow-up is prudent and recommended.

Introduction

Cardiac computed tomographic angiography (CTA) is a robust cardiovascular imaging modality with several clinical applications. The excellent spatial resolution enables

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clear visualization of both cardiac and noncardiac structures. Aortic findings, esophageal findings such as hiatal hernia, and noncoronary cardiac findings (valves, myocardium, pericardium, etc) within the cardiac field of view should be included in the primary interpretation and not considered incidental. These are easily interpreted by the cardiologist or radiologist interpreting the primary study. However, debate is ongoing in the scientific community over whether all these studies should be specifically reconstructed in a large field of view to visualize portions of the breast tissue, lung tissue, and axilla and then overread by radiologists for noncardiac disorders.

The ability to find small nodules, which may represent early stages of lung cancer (when the disease is theoretically more amenable to treatment) sounds appealing. However, the false-positive rate (detection of a noncancerous nodule), costs associated with workup, and the inability to change the natural history of lung cancer may offset the benefit. This article analyzes literature germane to the subject, including the presence of incidental findings on cardiac CT, the significance of such findings, and the available data on whether such findings do improve outcomes.

The points in favor of overreading cardiac CT studies are outlined below.

Point 1

A plethora of incidental noncardiac findings can be seen with cardiac CT scans and therefore helps detect a significant disorder such as lung cancer early. The data are all there, and we should interpret everything possible to give our patients a complete answer.

Counterpoint 1

Cardiac computed tomographic (CT) scanning of the heart includes imaging a portion of the lungs and breast, the mediastinum, the esophagus, portions of the spine and upper abdomen, in addition to the thoracic aorta. The identification of a potential disorder other than of coronary or vascular structures must be considered when evaluating the potential benefits and costs of cardiac CT scanning. The most common incidental finding is pulmonary nodules. The prevalence of incidental findings depends on the age of the population, the prevalence of smoking, and the definition of an abnormality.[1]

Hunold et al[2] sought to analyze the prevalence as well as the diagnostic and the therapeutic consequences of accidental findings in electron-beam tomographic scans performed for an evaluation of coronary artery calcification. A total of 1812 consecutive patients with known or suspected coronary artery disease underwent electron-beam tomography. In 583 (32%) patients, intravenous contrast was also administered for noninvasive coronary angiography. A total of 2055 noncoronary pathologic findings were observed in 953 (53%) patients. In 583 (32%) patients cardiac structures or the pericardium were affected, and in 423 (23%) patients aortic disease was found. Lung disease was found in 357 (20%) and disorders of other organs in 273 (15%) patients. Malignant disease was detected in only 3 patients (0.16%).[2]

Onuma et al[3] examined the frequency of noncardiac findings in a series of inpatients undergoing CTA by using images with an enlarged field of view. In that study, 382 noncardiac findings were identified in 319 (58%) of 552 patients. These included 56 patients with noncalcified lung nodules ($<$1 cm), and 12 patients with lung nodules ($>$1 cm). In the short-term follow-up of 3 months after the scan, biopsies (lung and breast) were performed in 8 case, and malignancies were identified in two cases (adenocarcinoma of the lung and intraductal carcinoma of the breast). Even with an enlarged field of view, malignancy was detected in only 0.4% of the study population, and 75% of biopsies performed were in patients without malignancy. This study was performed in a hospital setting of symptomatic patients, which should reflect a much higher prevalence of noncardiac disorders than when applied to an ambulatory population of patients being evaluated for possible angina. Therefore in a "healthier" outpatient cohort, the prevalence of malignancy may be even lower than the reported 0.4%.

In populations at high risk of lung cancer, screening studies were conducted with a range of modalities, including plain chest radiographs, sputum cytology, and CT scans. Novello et al[4] did a feasibility study with low-dose spiral CT scanning and analyzed the 3-year findings of early detection of lung cancer in 520 heavy smokers. Persons aged at least 55 years with a history of cigarette smoking of at least 20 pack-years and no previous cancer were enrolled. At baseline CT scanning, nodules that were $\geq$5 mm were detected in 114 (22%) undergoing CT scans, and the size of lung nodules ranged from 5 to 9.9 mm in 81.5% of the cases. Lung cancer was detected in 5 ($<$1%) patients. No assessment on outcomes was performed.

Swensen et al[5] analyzed the results of a 5-year prospective low-dose helical chest CT study of 1520 patients at high risk for lung cancer (participants were aged 50 years and older and had smoked for more than 20 pack-years). Participants underwent five annual (one initial and four subsequent) CT examinations. This study evaluated the roles of low-radiation dose spiral CT scans and sputum cytology in screening for lung cancer. Baseline scanning in the first 1000 patients showed 2244 uncalcified lung nodules in 66% of participants; 51% of all participants had one or more uncalcified radiologically indeterminate nodules requiring further testing.[6] CT scans detected 20 cases of lung cancer (prevalence, 1.3%). These patients underwent surgical resection. Seven benign nodules were also resected (false-positive rate for resection, 25%). Twelve (57%) of the 20 non–small cell cancers detected by CT scans were stage IA at diagnosis. The mean size of the cancers was 17 mm in diameter at time of discovery. The false-positive rate of noncalcific nodules identified at baseline CT scan was