Chest CT finding in 409 patients with chest pain: Can chest MDCT provide comprehensive evaluation for the cause of chest pain?

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Purpose

Chest pain is one of the most common complaints in the patient's care setting and a challenging clinical problem in the emergency department and even in the outpatient clinic. Despite advances in clinical diagnosis, many patients with atypical chest pain are needlessly hospitalized and others are mistakenly discharged.

Major cases of chest pain include cardiac, gastroesophageal, musculoskeletal (chest wall), pulmonary disorders and pleural illness. It is important to diagnose a cardiac etiology in patients presenting with chest pain. In addition, noncardiac causes of chest pain may be serious. Actually, many of the patients with chest pain entering emergency and outpatient clinic were proved noncardiac causes [1]. Patients with chest pain who present for the first time to ambulatory care or to the emergency room, only 11% to 39% are ultimately diagnosed with coronary artery disease [1, 2]. Many cases of noncardiac chest pain resemble real heart pain and moreover, the pattern of the chest wall pain not rarely mimics the cardiac pain resulting that the decision about first line imaging study is difficult.

Faced with the specific clinical situation in which a patient has chest pain, an initially normal or inconclusive electrocardiogram, and normal cardiac biomarkers, multislice CT has proven useful for ruling out the conditions that involve the greatest morbidity and mortality and for establishing the cause of pain. Diagnosis of noncardiac chest pain is mainly derived from history taking, laboratory finding and imaging study and among these, history of the patient and laboratory finding is limited to reveal the causes of the pain, therefore imaging finding is the most important in evaluation of the chest pain.

The current technology of heart CT is presented by advanced MDCT and CT is becoming the first-line evaluation tool for the detection of significant coronary artery stenosis with a high sensitivity over 80% and specificity over 90% [3, 4]. On the other hand, it is the fact that the relative assessment of noncardiac chest pain remains a significant challenge and there is no more advanced way but conventional chest simple radiograph and routine CT scan as the first line imaging tool. However, to our best knowledge, there has been no report about the role of chest CT including the positive rate of imaging finding, the kinds and proportion of the causes of the noncardiac chest pain which reveals by the imaging study. This study reviews the current usefulness and clinical results for multislice chest CT in diagnostic workup of patients presenting at the emergency and outpatient clinic with chest pain.
Methods and Materials

Patients

Patients presenting in our emergency and outclinic department with chest pain between May 2005 and February 2011 were approached for recruitment in this study. Chest pain in our institute is classified into two main categories - acute coronary chest pain and no coronary chest pain on the basis of the initial clinical impression. These are clinical categories based on the patient’s chief complaint, symptoms and signs, risk factors, ECG and not final diagnoses but rather simple, practical, and functional categories along a continuum adopted broadly by physicians. At our institution, heart CT has performed in the patients with suggesting cardiac chest pain and these patients were excluded in this study. Therefore, the patients involving in this study have the pain of which pattern does not show the typical heart pain with non-specific ECG changes (ST segment depression of less than 1 mm, T-wave inversion) and negative results at initial testing of biochemical markers for myocardial ischemia. The symptoms of this patients were definite chest wall pain and probable not heart pain. The chest CT study was done early in these patients in the interval immediately after the ECG was done and blood samples drawn and before a decision was made as to further care or studies for the patient. Four hundred and nine patients with chest pain were enrolled.

Image acquisition

Chest CT scans were performed using a 16-channel MDCT scanner (SOMATOM Sensation) and 64-channel MDCT scanner. The parameters for 16-channel MDCT imaging were 120 kVp, 80-100 mAs, 3mm thickness, and a 1.5 mm collimation. Contrast enhanced chest CT scans were obtained after injection of 30 g of iodinated contrast agent (100mL iopromide, Ultravist 300) at a rate of 2.3 mL/s with the use of a power injector (OP100, Medrad, Pittsburgh, PA USA). The parameters for 64-channel MDCT imaging were 120 kVp, 100 mAs, 3 mm thickness and 1.2 mm collimation. Contrast enhanced chest CT scans were obtained after injection of 30 g of iodinated contrast agent (100mL iopromide, Ultravist 300) at a rate of 2.3 mL/s with the use of a power injector (Stellant, Medrad, Pittsburgh, PA USA). The scan data were displayed directly on monitors (two monitors, 512 × 512 image matrices, 12-bit viewable gray scale) of a picture archiving and communication system (PACS) (Starpacs, Infinitt, Seoul, Korea).

Image interpretation

The images were evaluated for causes of chest pain by location (rib, pleura, subpleural lung, cardiovascular, and etcetera) and by disease in each location. Specific noncardiac
disease entities by each location that were evaluated included, but were not limited to: rib lesions (fractures, metastasis, malignant/benign tumor, arthritis); subpleural lung lesions (pneumonia, active/chronic tuberculosis (TB), atypical infection); pleural lesion (empyema, nonspecific thickening with fibrosis, malignant thickening, effusion, pleuritis); cardiovascular disease (myocardial infarction, pulmonary thromboembolism) and etc (pneumothorax, foreign body). All imaging observations were agreed on by consensus of the two radiologists. A final CT assessment of the cause of the chest pain was recorded on a case report form. In additional to the chest CT, information on other relevant diagnostic tests was recorded, including sputum AFB, PET/CT, or coronary angiography obtained within 1 month of presentation to the emergency and outpatient clinic. A consensus group consisting of two radiologists, one physician in each clinical department was included to determine a final diagnosis. Correlation was made between the presence of significant findings on CT and the final clinical diagnosis based on history, examination, and any subsequent workup at the 1-month follow-up by a consensus group. We defined normal chest CT and location of pain is not concordant with lesion suggested at CT as negative finding.
Results

The 409 patients who met all criteria for enrollment in the study with chest CT included 247 men (60.4%) and 162 women (39.6%) with a mean age of 50 years (range, 18-88 years). Two hundred and eleven patients (211/409, 51.6%) had no significant CT findings and a final diagnosis of clinically insignificant chest pain. 198 patients (198/409, 48.4%) had significant CT findings concordant with the final diagnosis. The most common location of the cause of chest pain presented at CT is pleura (73/409, 17.8% in all patients with chest pain; 73/198, 36.9% in patients with chest pain and positive CT findings) followed by rib (63/409, 15.4%; 63/198, 31.8%) and subpleural lung parenchyma (46/409, 11.2%; 46/198, 23.2%). The most common disease of the cause of chest pain is rib fracture (56/409, 13.7% in all patients with chest pain; 56/198, 28.3% in patients with chest pain and positive CT findings) followed by TB (50/409, 12.2%; 50/198, 25.3%) and pneumonia (40/409, 9.8%; 40/198, 20.2%). The other causes of chest pain in this study were nonspecific pleural thickening, pneumothorax, myocardial infarction and etc.

RIB

Among the cases of the chest pain is derived from rib (n=63, 15.4%), old rib fractures were noted in 20 cases (31.7%) and acute fractures were 36 cases (57.1%). Rib tumor was seen in three cases (2 metastasis, 1 multiple myeloma).

TB

In total fifty TB cases, there are 36 stable TB (72%) and 14 active TB (28%). Among these, fifteen cases that has known duration from the day of initial diagnosis of TB to the day developed chest pain; mean duration is 132 days in active TB, and 71 months in stable TB. The most common cause of chest pain in TB patients by pleural lesion was pleural thickening (n=20) and others were acute and chronic empyema (n=5) and active pleuritis (n=4). Sub pleural lung lesion as the cause of chest pain were stable pulmonary TB (n=14) and active pulmonary TB (n=6) and one rib lesion (TB arthritis). Sub pleural located pulmonary infection except TB as the cause of chest pain was demonstrated in three cases; fungal pneumonia, actinomycosis and Paragonimiasis westermani infection.

Among the patients with chest PA and chest CT (n=178), the cause of chest pain is suggested in 65% cases and the remaining 35% of lesions was not found at chest PA. The most common location of missed at chest PA is rib (n=63, 54%) and the most common disease is rib fracture. In four of the 409 patients (1%) had no significant CT findings with final diagnosis were myocardial infarctions. The decision on final diagnosis was based on clinical data (n=4), coronary angiography (n=4), heart CT (n=1), and stress echocardiography (n=1).
Fig. 1: A) 42-year-old woman with 1 day of right chest pain. A nodular lesion is noted in right middle lobe with satellite nodules, diagnosed as active pulmonary tuberculosis. B) 44-year-old man with 20 days of right chest pain. A necrotic nodule is found in posterior basal segment of right lower lobe, diagnosed as lung abscess.

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Fig. 2: A) 34-year-old man with 30 days of right chest pain. Diffuse pleural thickening with calcification is noted in right hemithorax. He had been treated for tuberculous pleurisy 16 years ago. B) 31-year-old woman under tuberculosis medication with 7 days of right chest pain. Focal pleural based low density is noted along right lower lobe, suggestive focal empyema. She still had CT findings of active pulmonary tuberculosis.

Fig. 3: 33-year-old woman with abrupt right flank pain. On chest plain radiograph (A), no definite abnormality is seen, but on chest CT (B), there is acute fracture in right 5th rib.

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**Fig. 4**: 60-year-old man with 20 days of palpable mass in right anterior chest with pain. On chest plain radiograph (A), no definite abnormality is seen. On following chest CT (B), a large mass with internal low density area is noted in right anterior chest wall extending to anterior diaphragmatic area. This mass was pathologically diagnosed as pulmonary actinomycosis by aspiration biopsy.

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Conclusion

In conclusion, MDCT appears shows promise as a comprehensive method for evaluating of chest pain in 48% patients in stable emergency department and outpatient clinic. Active and stable TB and subpleural located pneumonia are also the main causes of chest pain (12% and 10%, respectively) with rib related lesions (15%) in the outpatient clinic and emergency room.
References


