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Clinical Significance of Small Pulmonary Nodules Detected by Chest CT. Benjamin MS, Drucker EA, Shepard JO, Ko JP, Aquino SL, McLoud TC (Massachusetts General Hospital, Boston, MA 02114, edrucker@partners.org)

INTRODUCTION: To determine clinical significance, defined by growth on follow up CT or histologic proof, of small pulmonary nodules detected by CT.

METHODS/MATERIALS: Retrospective review of records of all patients undergoing helical chest CT over a 6m period (7/1/96-12/31/96). Patients were included if CT report described at least one pulmonary nodule < 1 cm in long axis, for which CT follow up was recommended, unless they were < 18 years old, had undergone lung transplantation, or had an additional pulmonary nodule > 1 cm in long axis. Records were studied to determine (1) whether CT follow up had been obtained at our hospital, and if so, whether the initial nodule(s) had increased in size, remained stable, or resolved and (2) whether nodule resection had been performed.

RESULTS: Approximately 3000 chest CTs were performed. 334 patients satisfied study inclusion criteria. 185/334 patients (56%) underwent follow up CTs at our hospital, of whom 13 were excluded because follow up scans were unavailable or because initial nodules were obscured on follow up studies. 2/334 (1%) underwent nodule resection. Of the 172 patients undergoing follow up CT, 78 (45%) underwent final follow up CTs 2y after the initial study or had nodules completely resolve on follow up exam over the 2 year interval, 40 (23%) underwent final follow up CT 1-2 y after initial study, and 54 (31%) underwent final follow up CT < 1y after the initial study. Of these 172 patients, the initial nodules increased in size in 8 cases (5%). Of the 8 patients in whom nodule size increased, 7 had a history of malignancy. Increase in size was on the first follow up scan in all cases. This occurred in < 6m in 5 cases, in 7-12m in 2 cases, and at 22m in 1 case. 3 of the patients had nodules 1-3mm in initial size, and 5 of the patients had nodules 4-8 mm in size. The 2 patients undergoing nodule resection had known malignancies. All resected nodules had positive histology, 1 nodule was 1-3mm in long axis, and 3 were 5-9mm in long axis.

CONCLUSIONS: CT commonly identified small pulmonary nodules in patients undergoing chest CT. Increase in size occurred infrequently, and almost exclusively in patients with a known malignancy. This study suggests that clinical recommendations for following small pulmonary nodules should emphasize early follow up, especially for patients with a history of malignancy.

T1 Lung Cancer at CT: Frequency of Extrathoracic Metastases. Jung K-J, Lee KS, Kim H, Kwon OJ, Kim J, Shim YM, Kim TS (Samsung Medical Center, Sungkyunkwan Univ School of Medicine, Seoul 135-710, Korea, kslee@smc.samsung.co.kr)

PURPOSE: To determine the frequency of extrathoracic metastases in T1 non-small cell lung cancer.

MATERIALS AND METHODS: Ninety patients with T1 lung cancer at CT were included. Evaluation of extrathoracic metastases was made at the time of initial diagnosis and at one-year follow-up study. The frequency of metastases was compared in terms of cell type (squamous vs. nonsquamous), size (≤ 2 cm vs. > 2 cm) and the initial CT findings of the tumor.

RESULTS: Twelve (13%) of 90 patients had extrathoracic metastases demonstrated at the time of diagnosis and ten at one-year follow up study (total, 22/90 [24%]). Tumors with ground-glass attenuation at CT showed significantly lower prevalence of metastases ($p = .042$). Area of ground-glass attenuation ($n = 23$) was seen in 11/13 (85%) patients with bronchioloalveolar carcinoma and 12/53 (23%) patients with adenocarcinoma other than bronchioloalveolar carcinoma ($p < .001$). There was no significant difference in the prevalence of metastases between squamous and nonsquamous cell carcinoma, between tumors of ≤ 2 cm ($n = 17$) and of > 2 cm in diameter ($n = 73$) and between tumors with or without mediastinal nodal metastases ($p > .05$).

CONCLUSION: Extrathoracic metastases are evident at presentation in 13% of patients and at one-year follow-up in an additional 11% of patients. The prevalence is significantly lower in tumors with ground-glass attenuation at CT.



TRANSBRONCHIAL NEEDLE ASPIRATION: GUIDANCE WITH CT-FLUOROSCOPY

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Introduction: Bronchoscopy with transbronchial needle aspiration (TBNA) is valuable to diagnose lesions in the mediastinum and lung but conventional fluoroscopic guidance may be suboptimal. We describe the use of CT-fluoroscopy to provide real-time, transaxial TBNA localization, facilitating biopsy.

Methods: Patients were selected because of prior unsuccessful bronchoscopy or anticipated difficulty due to small size or inaccessibility of the lesion. CT-fluoroscopy consists of a spiral CT scanner adapted using a rapid reconstruction algorithm and hardware that permits "real-time" in-room imaging. The bronchoscope was inserted on the CT scanner, which was used to guide TBNA instruments into the target lesion.

Results: Of 27 patients who underwent TBNA with CT-fluoroscopic assistance, 15 had mediastinal nodes and 12 had lung nodules or focal infiltrates. Mean lesion size was 1.7 cm in the mediastinum, 2.1 cm in the lung. A correct diagnosis was established in 10 (83%) of 12 mediastinal lesions for which follow-up was available and 8 (67%) lung lesions. Diagnoses included small cell and non-small cell lung cancer and invasive aspergillosis. False negative results were due to sampling errors or inability to reach the lesion as documented by CT-fluoroscopy. Post-procedure CT-fluoroscopy reveal no complications.

Conclusion: CT-fluoroscopy provides effective, real-time guidance for TBNA, and may be particularly valuable in patients with small or less accessible mediastinal or lung lesions.

Image-guided Transthoracic Needle Biopsy of Pleural and Chest Wall Lesions: Results in 40 Patients. Benedict M, Klein JS, Hayton AS (JSK, Department of Radiology, Fletcher Allen Health Care, Medical Center Hospital Campus, 111 Colchester Avenue, Burlington, VT 05401, jeffrey.klein@vtmednet.org)

INTRODUCTION: Published reports of image-guided transthoracic needle biopsy (TNB) have focused predominantly on the biopsy of lung and mediastinal lesions. The utility of TNB in the sampling of pleural and chest wall lesions has received limited attention.

MATERIALS AND METHODS: We retrospectively reviewed our experience with image-guided needle biopsy of 43 pleural and chest wall lesions performed in 40 patients; 39 under CT and 4 using real-time sonographic guidance. The most common lesion sampled was a pleural mass or thickening (n = 12); additional lesions included soft tissue masses of the chest wall (n = 10), axillary lymph node masses (n = 6), lytic rib lesions (n = 7), juxtadiaphragmatic nodes (n = 3), lytic clavicle lesions (n = 3), and one case each of neck and vertebral lesions.

RESULTS: Sufficient tissue for diagnosis was obtained in 42 of 43 lesions; a correct diagnosis was made in all 42 (overall sensitivity = 98%). Of 39 malignant lesions, a correct diagnosis was made by needle biopsy in 38 (sensitivity = 97%), while all 4 benign lesions were correctly characterized. Based upon clinical followup or results of other diagnostic procedures, there were no false positive biopsies (specificity = 100%). Complications occurred in one patient who experienced a pneumothorax (2%) that did not require drainage.

CONCLUSIONS: Image-guided biopsy, predominantly using CT guidance, is a highly accurate and safe technique in the evaluation of pleural and chest wall lesions.

Diagnostic Role of percutaneous transthoracic biopsy for the thoracic lesions: Comparison of fine needle aspiration (FNA), percutaneous cutting needle biopsy (PCNB) and combination of both methods. Choi YH, Lee KY, Myoung NH, Ha MN (Dankook Univ Hosp, Cheonan, KOREA 330-715, choiyh@anseo.dankook.ac.kr)

Introduction : To assess the accuracy and safety of FNA, PCNB and combination of both methods and to determine the diagnostic role of percutaneous transthoracic biopsy.

Methods/Materials : We retrospectively reviewed consecutive 213 cases, which composed of 79 benign and 134 malignant diseases. We assessed the accuracy, sensitivity, specificity, and positive and negative predictive value for three groups of FNA, PCNB and combination of both methods in the diagnosis of malignancy, tuberculosis, non-tuberculous infection and benign tumors and differentiation of small cell lung cancer. We assessed the rate of complications.

Results : The sensitivity of combination method (95%) was significantly better than FNA (83.9%) or PCNB (84.9%) for the diagnosis of malignant disease. In the differentiation of small cell lung cancer, FNA had significantly better sensitivity and specificity than PCNB. In the diagnosis of tuberculosis, FNA had better sensitivity and accuracy than PCNB especially with the acid-fast bacilli staining. FNA was useful in the specific diagnosis of infecting organisms in most infections. For the benign tumors, PCNB provided tissue diagnosis in more cases than FNA did. The rate of pneumothorax were 10.6%, 6.7% and 16.2% in each groups respectively and rate of hemoptysis were 7.1%, 13.3% and 2.9% respectively, which had no statistically significant difference.

Conclusions : Combination of FNA and PCNB can provide more accurate differentiation of malignant diseases without increasing the rate of complications. FNA is indicated initially in the most of the patients. PCNB alone is indicated for the diagnosis of benign lung tumor.

REFERRALS FOR PORTABLE CHEST RADIOGRAPHS FROM THE INTENSIVE CARE UNITS AND THE CUMULATIVE RADIATION EXPOSURES. Diethelm L, Espenan G, Pandit-Bhalla M, (LSUHSC New Orleans, LA 70112)

Introduction: To determine the frequency of referrals for portable chest radiographs from medical and [non-cardiac] surgical intensive care units (MICU and SICU) and their respective step down units (MICA and SICA). Additionally, to determine the cumulative entrance skin exposure (ESE) using an ion chamber traceable to the National Institute of Standards and Technology.

Materials and Methods: We retrospectively reviewed the medical records of all adult patients admitted to the MICU, SICU, MICA and SICA at a tertiary referral center over a six month interval. The length of stay and the number of portable chest radiographs were determined for each patient. The measured ESE's from all portable X-ray units ranged from 5-15 mR, average of 10mR. The cumulative radiation exposure for each patient was calculated based on the average value times the number of views.

Results: There were 567 patients admitted to the units: 146 surgical and 421 medical. Their ages ranged from 15-87 years. The length of stay varied from 1 to 68 days. A total of 3794 portable chest radiographs were obtained. The number of radiographs per patient varied from 1 to 94. The number of radiographs and the corresponding cumulative radiation doses were as follows: 406 patients (72%) had less than 5 radiographs (< 50 mR); 76 (13%) had 5-10 radiographs (< 100 mR); 35 (6%) had 11-20 (< 200 mR), and 50 (9%) had more than 20 chest radiographs (> 200 mR). The cumulative ESE ranged from 10 to 940 mR; it exceeded 450mR in only 9 (1.5%).

Conclusion: Patient exposure from portable chest radiographs in this population is below the average annual exposure from background radiation in the USA (450-500mR), and is obviously within a safe limit. The benefits of portable chest radiographs outweigh the risk of radiation exposure.



Sternal Dehiscence in Patients with and without Associated Mediastinitis: Frequency of Sternal Wire Abnormalities and Time Interval from Surgery to Diagnosis. Boiselle PM, Mansilla AV, Fisher MS (Beth Israel Deaconess Med Ctr, Boston, MA 02215, pboisell@caregroup.harvard.edu)

PURPOSE: 1) to determine the frequency of mediastinitis in patients with sternal dehiscence (SD); 2) to compare the time interval from surgery to diagnosis in these 2 subsets; and 3) to assess the frequency of sternal wire abnormalities in these patients.

METHODS: We used our computerized hospital information system to identify all patients with a diagnosis of SD from January 1993 through April 1999. We obtained clinical data by a retrospective chart review. A CXR from the date of diagnosis of SD was retrospectively compared to the 1st postoperative CXR following median sternotomy by 2 radiologists, who assessed for sternal wire displacement, rotation, and disruption.

RESULTS: There were 35 patients with proven SD, including 25 men and 10 women, who were 43 to 85 years old (mean, 65 years). Sixteen (46%) of 35 patients had evidence of associated mediastinitis. The mean time interval from surgery to diagnosis was 18 days in patients with mediastinitis and 9 days in patients without mediastinitis ($p < 0.05$). Sternal wire abnormalities were observed radiographically in 10 (63%) of 16 patients with mediastinitis and in 17 (89%) of 19 patients without mediastinitis. Sternal wire displacement was the most common abnormality (63% of patients with mediastinitis and 84% of patients without mediastinitis), followed by rotation (50% and 53%, respectively) and disruption (19% and 21%, respectively).

CONCLUSION: SD is associated with mediastinitis in roughly half of cases. Such patients generally present later in the postoperative period than SD patients without associated mediastinitis. Sternal wire abnormalities are evident radiographically in the majority of SD patients with and without mediastinitis and may help to detect or confirm this important postoperative complication.

The relationships between structure and function in pleural disease as evaluated by chest radiography and computed tomography. S.J.Copley, A.U.Wells, M.B.Rubens, F. Chabat, W. Musk, R. Sheehan, D.M.Hansell. (Royal Brompton Hospital, Sydney St., London SW3 6NP England. s.copley@rbh.nthames.nhs.uk)

Introduction: Diffuse pleural thickening may contribute to impairment in lung function in patients exposed to asbestos. However, the functional significance of pleural disease is difficult to quantify in the presence of parenchymal disease. The purpose of this study was to determine which CT or chest radiographic scoring system for pleural disease provides the strongest correlation with lung function impairment in subjects with isolated pleural disease.

Methods/Materials: The extent of pleural thickening and/or plaques was measured in 50 patients using 1) CXR (International Labour Organization based system); 2) a simple subjective CT system; 3) comprehensive subjective CT system; 4) an objective non-automated method; and 5) an objective semi-automated method.

Results: The lung function indices most closely related to the extent of diffuse pleural thickening were FVC or TLC; correlations for FVC were strongest with the simple CT system ($r = -0.71$; $p < 0.0001$) and weakest for the objective semi-automated method ($r = -0.65$; $p < 0.0005$). For TLC similar correlations were observed. Increases in K_{CO} were significantly, but less strikingly associated with severity of pleural thickening ($r = 0.42$ to $r = 0.66$; $p < 0.005$ and $p = 0.04$ respectively). After controlling for the extent of diffuse pleural thickening, pleural plaque scores were functionally irrelevant.

Conclusions: We conclude that functional-morphological relationships in pleural disease can be adequately quantified using a simple subjective CT system, which is readily applicable to patients with asbestosis.

Notes