Original Article

The Accuracy of Ultrasonography in Compared with Computed Tomography in Detection of Anterior Mediastinal Neoplasms

Hashemi A MD[1], Nafisi Moghadam R MD[2], Ghilian R MD[3], Shahbaz S MD[4], Dehghani tafti A BSc[5]

1-Department of Pediatricts, Hematology, Oncology and Genetics Research Center, Shahid Sadoughi University of Medical Sciences and Health Services, Yazd, Iran
2- Department of radiology, Shahid Sadoughi University of Medical Sciences and Health Services, Yazd, Iran
3- Department of Internal Medicine, Shahid Sadoughi University of Medical Sciences and Health Services, Yazd, Iran
4-General Practitioner, Shahid Sadoughi University of Medical Sciences and Health Services, Yazd, Iran
5-Hematology, Oncology and Genetics Research Center, Shahid Sadoughi University of Medical Sciences and Health Services, Yazd, Iran

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Abstract

Background

The aim of this study was to evaluate sensitivity and specificity of mediastinal sonography, and compared with CT, in detection of anterior mediastinal neoplasms.

Materials and Methods

The sonography with convex probes (5.0 and 7.5 MHz) was done prospectively for 34 patients (from 2 to 25 years old) with mediastinal mass. The results were compared with the results of contrast computed tomogphy.

Results

Standard protocol of mediastinal ultrasonography showed a high diagnostic accuracy. In our study the sensitivity of ultrasonography in detection of anterior mediastinal adenopathies in compared with CT was 84.6% (CI95% 65.2-100). Its specificity, PPV and NPV were 90.5% (CI95% 77-100), 84.6% and 90.5%, respectively.

Conclusion

Trasonography may have a good role in detection of anterior mediastinal adenopathies, so that, it may be used to complement CT, and allowing a reduction of frequency of in patients.

Key words

Sensitivity and Specificity, Mediastinal Neoplasms, Ultrasonography

Corresponding Author
Ghilian Rozita MD. Internal Medicine. Hematology, Oncology and Genetics Research Center, Shahid Sadoughi University of Medical Sciences and Health Services, Yazd, Iran

Introduction

The anterior mediastinal compartment is anterior to the pericardium and includes lymphatic tissue, the thymus, the extra pericardial aorta and its branches, and the great veins. Masses in anterior compartment may be benign or malignant tumors or cysts or aneurysms and may arise from the lung, pleura or any of the components of the anterior mediastinum. The most common diagnosis in order of frequency in adults are lymphoma (Hodgkin's or non-Hodgkin), thymoma , germ cell tumor, granuloma , bronchogenic carcinoma, thyroid tumors, bronchogenic cyst and cystic hygroma (the The most common diagnosis in children are essentially the same and vary only in order of frequency) (1).

Patients may present with signs or symptoms that include chest pain or fullness, dyspnea, cough, sweats, superior vena cava obstruction, hoarseness, syncope or dysphagia; or patients may be asymptomatic and have a mass diagnosed on a screening chest radiograph or computed tomography (CT) scan (2). The mediastinum has been studied by using different imaging techniques, each of them which have a different indication in diagnosis, treatment and follow-up. The CT scan will show the site, the severity, and the extent of the airway compromise. With modern fast CT scanners, this can be accomplished with scan times less than 20s **(**2). One study of 25 patients with intrathoracic masses due to Hodgkin's disease found that no patient showed the pathognomonic pattern of variable intrathoracic obstruction on flow-volume loop, even though nine of 25 patients had moderate or severe intrathoracic tracheal compression on CT scan (3).

Mediastinal sonography is used rarely; it might play a role in the diagnostic work up of mediastinal pathology as an adjunctive examination technique to chest radiography, CT, and MRI imaging. Ultrasonography (US) is characterized by good compliance, absence of patient risks, low cost, easy reproducibility, multiplanar images and qualitative and quantitative lesion assessment (4). Normal mediastinal lymph nodes cannot be seen with standard sonographic probes because the echogenicity of normal lymphatic tissue is similar to surrounding fat and connective tissue. They become visible only with a change in echogenicity due to inflammatory or neoplastic changes (5). Sonography of mediastinum should be performed with convex probe. In the suprasternal approach, the patient lies supine with a cushion under the shoulders to enable full extension of the head; the transducer is placed in the jugular fossa, and scans are made in the coronal, sagittal and semisagittal planes, providing easy exploration of the aortopulmonary window and supraaortic and paratracheal regions. In the parasternal approach, the patient lies in the right and left lateral position; the transducer is placed in the intercostal spaces, and scans are made in the sagittal and transverse planes (6). The aim of this study was to assess the value of mediastinal sonography for the diagnosis and follow-up of patients as compared with CT.

Materials and Methods

In this diagnosis study we evaluated 34 patients with mediastinal lymphoma and acute lymphocytic leukemia at the Department of Pediatric oncology of Shahid Sadougi hospital. Inclusion criteria were all patients with mediastinal widening in chest radiographs. The criteria described by glazer et al (7). For differentiation of pathologic from normal lymph nodes were used for the evaluation of the CT. All lymph nodes with a short axis diameter greater than 1.0 cm were considered as disease. Sonography was performed with transducers of 5.0 and 7.5 MHZ. Each patient was examined in the supine position via the suprasternal

approach, which allows visualization of the supraaortic, paratracheal, and aortic pulmonary regions to advantage. Sonography was then performed via the parasternal approach, in both right and left decubitus positions, to assess the prevascular, pericardial, and sub cranial regions. All mediastinal lymph nodes were classified according to their echogenicity as either hypo echoic, which were just delineated from surrounding connective tissue and hyper echoic, which were difficult to delineate from surrounding connective tissue. The US examinations evaluated prospectively by the same radiologist, unaware of the results of the other two studies. The radiologist systematically explored the mediastinal regions in search of disease locations and accurately determined size, morphology and structure of each adenopathy, which was then classified based on location. The CT scans were analyzed by two independent radiologists without knowledge of the clinical outcome and sonographic findings. Finally the diagnostic information obtained from two examinations was compared.

Afrer collecting data, statistical analysis was performed via Spss 16. Differences were considered significant at the level of PV less than 0.05.

Results

We prospectively evaluated 34 patients (eighteen girls, sixteen boys; age range: 2-25 years) with mediastinal lymphoma and acute lymphocytic leukemia. In 13 patients multiple lymph nodes 1-6 cm in diameter (mean 3 cm) were evident in several mediastinal regions at initial investigation (supraaortic region,13 patients; paratracheal region,11 patients; aortic-pulmonary window, two patient; prevascular region,4 patients; subcranial region, 3 patients and pericardial region, one patient). The lymph nodes were hypo echoic in 7 cases, echogenic in three and hyper echoic in three cases. CT, the gold standard, revealed the presence of lymph adenopathies in 13/34 cases. US yielded 11/13 positives, 19/21 negatives. In 11 (32.4%) cases sonography and CT showed identical results regarding mediastinal lymph adenophaty. In two of 13 patients, CT detected adenophaties in various mediastinal regions. In the other hand 19 (55.8%) of patients sonography and CT did not detect mediastinal mass thus 30 (88.2%) of cases both sonography and CT were similar.

In our study diagnostic sensitivity of US in compare CT was 84.6% (CI 95% 65.2-100) and diagnostic specificity of US in compare CT was 90.5% (CI95% 77-100). Positive predict value and negative predict value of sonography were 84.6% and 90.5% respectively.

Discussion

Chest radiographs are usually used to monitor the therapeutic response of patients with mediastinal tumors. Almost CT and MRI imaging are reserved for cases with equivocal findings on chest radiographs due to time-consuming and expensive. The availability of mediastinal sonography offers an effective and inexpensive imaging method (8). The development of devices equipped with transducers enabling evaluation of anatomical compartments with limited acoustic windows and the growing interest among radiologists have extended the use of US (9,10).

Previous studies have compared US with CT, so the value and potential of US have been analyzed in relation to the results obtained with CT. Our study, conducted on patients with mediastinal HL and NHL, and ALL, revealed advantage of US for surveillance and adds to other previous studies on different types of mediastinal malignancies. We determined sensitivity and specificity of US for each mediastinal region, taking CT as the reference standard. Our results indicate that sensitivity and

specificity (84.6% and 90.5%) of US. In particular, analysis of results revealed a much higher sensitivity and specificity for US.

In agreement with the studies by Wernecke et al and Dietrich et al. on accuracy and feasibility of US in detection of mediastinal lymph nodes(10,11). Our statistical data revealed good sensitivity, specificity and DA compared with CT.

Wernecke et al evaluated sensitivity of mediastinal sonography compared with computed tomography (CT) and chest radiography in detection of mediastinal tumors. The sonograms, CT scans, and chest radiographs of 182 patients were interpreted blindly by three observers, and the results were compared. The proportion of diagnostic sonographic examinations varied for the different mediastinal compartments from 85% (subcarinal region) to 96% (supraaortic region). These results showed that sonography is superior to chest radiography in diagnosis of mediastinal tumors. In certain mediastinal regions (supraaortic, pericardial, prevascular, and paratracheal), sonography is more sensitive than that of CT (12).

In another study conducted by this group, the diagnostic value of mediastinal sonography was compared with chest radiographs and CT in patients with mediastinal lymphoma. In 40 patients with Hodgkin (n=29) and non-Hodgkin (n=11) lymphoma obtained before and after completion of therapy. Sonography showed complete regression in 30 patients who had complete remission. In five patients with incomplete remission, sonographic diagnoses were correct. Sonographic findings corresponded with those of CT in 25(81%) of 31 cases. They indicated that sonography was clearly superior to chest radiographs and comparable to CT for monitoring patients with mediastinal lymphoma (8).

De Pascale1 et.al investigated the role of US in responding to treatment the patients with mediastinal lymphomas. 12 patients were evaluated by chest X-ray, mediastinal sonography and contrast-enhanced CT (gold standard). Each mediastinal region was accurately assessed for adenopathies. US proved to be more sensitive and accurate (93%) than X-ray [66% sensitivity and 68% diagnostic accuracy (DA)]. In different regions US sensitivity wasn't equal. They believed US adds qualitative criteria to the quantitative criteria typical of CT. US has added a qualitative criterion for evaluation (echogenicity) to the quantitative criterion of CT (maximum diameter) (13, 14), and echogenicity appears to be a more reliable indicator of tumor activity compared with size. In some cases, US proved more precise and detailed than CT in the structural evaluation of tissues within the anterior mediastinum. Limitations of mediastinal US include site of adenopathies, dependence on the patient's characteristics (body habit, concurrent diseases and chest anatomy) and dependence on the operator (15).

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Conflict of interest

None of the authors have any conflicts of interest to declare.

Reference

1-Ferguson MK, Lee E, Skinner DB, Little AG. Selective operative approach for diagnosis and treatment of anterior mediastinal masses. Ann Thorac Surg 1987; 44(6):583-6

2-Slinger P, Karsli C. Management of the patient with a large anterior mediastinal mass: recurring myths. Curr Opin Anaesthesiol. 2007; 20(1):1

3-Vander Els NJ, Sorhage F, Bach AM, Straus DJ, White DA. Abnormal flow volume loops in patients with intrathoracic Hodgkin's disease. Chest. 2000;117(5):1256-61

4.Wernecke K, Vassallo P, Pötter R, Lückener HG, Peters PE. Mediastinal tumors: sensitivity of

detection with sonography compared with CT and radiography. Radiology. 1990;175(1):137-43.
5-Wernecke K, Vassallo P, Hoffmann G, Peters PE, Poetter R, Rummeny E, et al. Value of sonography in monitoring the therapeutic response of mediastinal lymphoma: comparison with chest radiography and CT. AJR Am J Roentgenol. 1991; 156(2):265-72.
6-Wernecke K. [The examination technic and indications for mediastinal sonography]. Rofo. 1989; 150(5):501-8.
7-Glazer GM, Gross BH, Quint LE, Francis IA, Bookstein FL, Omnger MB. Normal mediastinal lymph nodes: number and size according to American Thoracic Society mapping. AJR Am J Roentgenol. 1985; 144(2):261-5.
8-Wernecke K, Vassallo P, Hoffmann G, Peters PE, Poetter R, Rummeny E, et al. Value of sonography in monitoring the therapeutic response of mediastinal lymphoma: comparison with chest radiography and CT. AJR Am J Roentgenol. 1991;156(2):265-72.
9-Beckh S, Bölcskei PL, Lessnau KD. Real-time chest ultrasonography: a comprehensive review for the pulmonologist. Chest. 2002; 122(5):1759- 73.
10-Koh DM, Burke S, Davies N, Padley SP. Transthoracic US of the chest: clinical uses and applications. Radiographics. 2002; 22(1):e1.
11-Dietrich CF, Liesen M, Buhl R, Herrmann G, Kirchner J, Caspary WF, et al. Detection of normal mediastinal lymph nodes by ultrasonography. Acta Radiol. 1997;38(6):965-9
12-Wernecke K, Vassallo P, Peters PE, Pötter R, Lückener HG. [Diagnostic imaging of mediastinal tumors. Sensitivity and specificity of sonography in comparison with computed tomography and conventional x-ray diagnosis]. Radiologe. 1990 ;30(11):532-40.
13-etsch B, Berndt R, Knopp MV, Schmähl A, Trost U, Delorme S. [Comparison of computerized tomography and B-image ultrasound in imaging diagnosis of the mediastinum]. Bildgebung. 1994; 61(4):295-8.
14-Hirche TO, Wagner TO, Dietrich CF. [Mediastinal ultrasound: technique and possible applications]. Med Klin (Munich). 2002 15; 97(8):472-9.
15-De Pascale A, Giorcelli R, Garofalo G, Perotto F, Parvis G, Gino M, et al. Follow-up of mediastinal lymphoma: role of ultrasonography. Radiol Med. 2006; 111(6):759-72.