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Recess or Lymphadenopathy? Role of Dynamic Diffusion MRI in Differentiating Right Lower Paratracheal Lesions

Recess mi?, Lenfadenopati mi?; Sağ Alt Paratrakeal Alandaki Bu Karışıklılığı Gidermede Dinamik Difüzyon Manyetik Rezonans Görüntülemenin Yeri

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ABSTRACT

Objective: The aim of this study was to evaluate the accuracy of dynamic diffusion magnetic resonance imaging (MRI) in the identification of recesses that were interpreted as lower paratracheal LAP on thoracic CT, resulting in unnecessary procedures.

Methods: This study included 211 patients who underwent dynamic thoracic MR and CT at our hospital between March 2016 and February 2017.

Results: High-riding superior pericardial recess (HSPR) was observed on dynamic MRI in 118 patients. On CT, this structure was interpreted as the HSPR in 98 (83.1%) of these patients and as the lower right paratracheal LAP in 20 patients (16.9%). The mean largest diameter of the areas interpreted as HSPR in both modalities was 13.9±8.7 mm on dynamic MR images and 12.1 ± 6.7 mm on CT images. This difference was statistically significant (*P*=.04). Areas interpreted as HSPR on dynamic MRI and lower right paratracheal LAP on CT were significantly larger than those interpreted as lower right paratracheal LAP in both modalities (*P*=.03).

Conclusion: Compared with thoracic CT, dynamic MRI may be more effective for lung cancer staging and preventing unnecessary diagnostic procedures and long-term follow-up because of misinterpretation of the pericardial recess as a lower right paratracheal LAP.

Keywords: Computed tomography, diffusion magnetic resonance imaging, high-riding superior pericardial recess

ÖZ

Amaç: Çalışmamızda toraks bilgisayarlı tomografide alt paratrakeal lenfadenopati olarak yorumlanarak gereksiz işlemler uygulanan reseslerin toraks dinamik difüzyon manyetik rezonans (MR) ile doğruluğunu teyit etmeyi amaçladık.

Yöntemler: Hastanemizde Mart 2016-Şubat 2017 tarihleri arasında toraks dinamik MR ve toraks BT çekilen 211 hasta çalışmamıza dahil edildi. Hastaların dinamik MR ve toraks BT görüntüleri iki farklı radyoloji uzmanı tarafınca değerlendirilip sonuçları yorumlandı.

Bulgular: Dinamik MR değerlendirme sonucunda 118 hastada superior perikardiyal boşluk (HSPR) gözlendi. Bu hastaların 98'inde (%83,1) BT'de bu oluşun HSPR lehine değerlendirilmesine rağmen 20'sinde (%16,9) sağ alt paratrakeal LAP olarak yorumlandı. Her iki incelemede de HSPR olarak yorumlanan alanın en geniş çaplarının ortalamalarının değerlendirmesinde dinamik MR'da 13,9±8,7 mm iken BT'de 12,1±6,7 olarak gözlendi. İki radyolojik değerlendirme arasında ise istatistiksel olarak anlamlı düzeyde farklılık gözlendi (*P*=,04). Toraks dinamik MR'da HSPR olarak değerlendirilen toraks BT'de HSPR ve sağ alt paratrakeal LAP olarak yorumlanan lezyonların ortalama çaplarının karşılaştırmasında ise sağ alt paratrakeal LAP olarak yorumlanan lezyonların istatistiksel olarak anlamlı düzeyde yüksek olduğu gözlendi (*P*=,03).

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Sonuç: Dinamik MR; özellikle yanlışlık ile sağ alt paratrakeal LAP olarak değerlendirilerek akciğer kanseri evrelendirilmesi başta olmak üzere, gereksiz tanısal işlem ve uzun süreli takiplerin önüne geçmede toraks BT'ye nazaran daha etkili olabilir.
Anahtar Kelimeler: Bilgisayarlı tomografi, difüzyon manyetik rezonans görüntüleme, superior perikardiyal boşluk

INTRODUCTION

Mediastinal lymph nodes play important roles in the diagnosis of pulmonary and mediastinal diseases, particularly lung cancer. When planning interventional procedures, it is essential to accurately distinguish between mediastinal pathologies and physiological structures that can mimic such pathologies.[1,2] The high-riding superior pericardial recess (HSPR) is the physiological structure that most often mimics the lower paratracheal lymph nodes. HSPR may appear on thoracic computed tomography (CT) as triangular, round, or oval in shape.[3,4] It projects superiorly along the posterolateral wall of the ascending aorta into the right paratracheal region posterior to the brachiocephalic veins and the right brachiocephalic artery and along the left lateral anterior wall of the aortic arch. This anatomic variation can be observed even in the absence of any pathology and is often confused with lymphadenopathy (LAP) or bronchogenic and pericardial cysts.[5,6]

Compared with CT, magnetic resonance imaging (MRI) is known to provide superior visualization of fluid, fat, and soft tissues.[7] Although not pathological, the appearance of HSPR on CT images can be misleading because of its low density and high fluid content.[8,9] However, MRI plays an important role in preventing this problem, as HSPR can be easily distinguished from LAP because of its low density.

Clinical misinterpretation of the pericardial recess on CT can lead to unnecessary interventional procedures. Therefore, in the present study, we aimed to determine whether the use of MRI to detect HSPR contributes to the use of CT alone in the differentiation of recess and LAP.

METHODS

This was a retrospective observational study. In our study, local ethics committee approval was obtained. The study included 211 patients who underwent thoracic CT and lung/mediastinum dynamic MRI at our hospital between March 2016 and February 2017. We retrospectively analyzed patients diagnosed with lower paratracheal lymphadenopathy (LAP) on CT images to determine the frequency at which these areas were interpreted as HSPR on MRI. All the images were evaluated independently by two radiologists.

Patients who underwent both thoracic CT and dynamic MRI for the evaluation of suspected mediastinal pathology were included. Patients with incomplete imaging data or poor image quality were excluded.

CT and MRI Techniques

All patients underwent contrast-enhanced CT scans of the chest on a second-generation Somatom Definition Flash 256-slice dual-source multidetector CT scanner (Siemens Healthcare, Forchheim, Germany). CT examinations were performed while the participants held their breath during deep inspiration. All CT examinations were performed. CT images were acquired with a slice thickness of 1–2 mm and reconstructed with a standard mediastinal algorithm. Intravenous contrast material was administered according to standard clinical protocols.

MRI was performed with a 3-T scanner (Skyra, Siemens Healthcare, Erlangen, Germany). MRI sequences included axial gradient-echo T1-weighted imaging (WI), axial and coronal turbo-spin–echo T2WI, axial fat-suppressed turbo-spin–echo T2WI, and diffusion-weighted imaging (DWI) with free breathing. Diffusion-weighted imaging was performed using at least two b values (e.g., 0 and 800 s/mm²).

Image Analysis

All the images were transferred to a commercial workstation (Singo via. Workstation, Siemens, Erlangen, Germany). The images were assessed by two radiologists who were blinded to the patients' identities. The first reader had 10 years of experience in thoracic radiology, and the second reader had 3 years of experience in radiology. Each reader evaluated the size, location, and number of lesions and interpreted the findings.

Statistical Analysis

The study data were analyzed using IBM SPSS Statistics Version 20.0 (IBM Corp., Armonk, NY, USA) software. Categorical variables are expressed as numbers and percentages, whereas numerical variables are expressed as the mean and standard deviation. The Kolmogorov–Smirnov test was used to assess whether the data were normally distributed. The Mann–Whitney U test was used for between-group comparisons of nonnormally distributed data. A *P* value of <.05 was considered to indicate statistical significance.

RESULTS

The 211 patients included in the study had a mean age of 56.8±9.7 years; 148 (70.1%) were men, and 63 (29.9%) were women. When the patients were evaluated separately, lymph nodes were detected on both imaging

Table 1. Findings in patients undergoing Dynamic MRI and CT imaging

	HSPR (n/%)	Right lower paratracheal LAP (n/%)	Normal (n/%)
Dynamic MRI (n=211)	118 (55.9)	56 (26.6)	37 (17.5)
CT (n=211)	98 (46.5)	76 (36)	37 (17.5)

MRI: Magnetic resonance imaging, CT: Thorax computer tomography, HSPR: high-riding superior pericardial recess, LAP: Lymphadenopathy

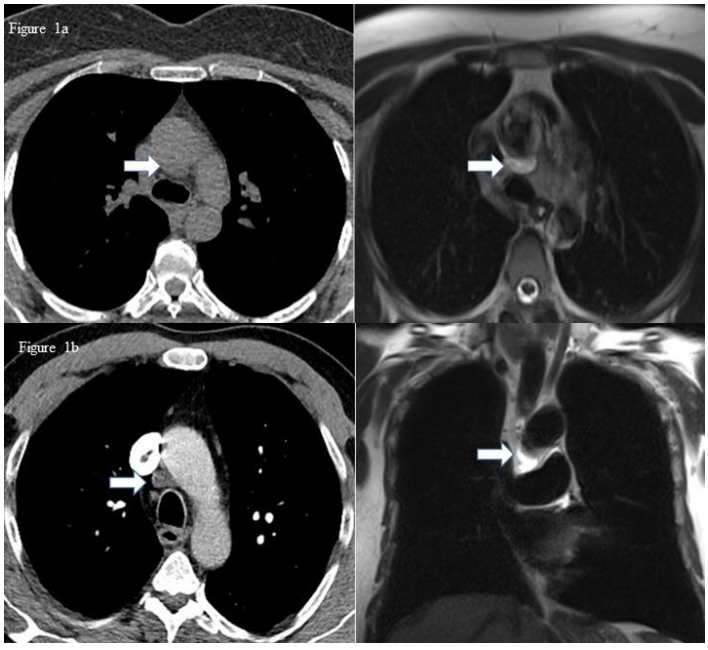

Figure 1a–b. Comparison of the high-riding superior pericardial recess observed in the lower paratracheal region on computed tomography and diffusion magnetic resonance imaging

modalities in 56 patients (26.5%). In 37 patients, no pathological lymph nodes were detected by CT or MRI. The lymph nodes detected on CT were slightly larger than those detected on MRI, but the difference was not statistically significant. The mean largest diameter of LAPs detected on CT was 15.8±8.7 mm, whereas that detected on dynamic MRI was 14.9±7.9 mm. There was no statistically significant difference in the sizes of the LAPs evaluated by the two radiological methods (*P*=.379).

HSPR was observed in 118 patients on dynamic MR. On CT, this formation was interpreted as HSPR in 98 (83.1%) of these patients and as lower right paratracheal LAP in 20 patients (16.9%). The mean largest diameters of the areas interpreted as HSPR were 13.9±8.7 mm on dynamic MR images and 12.1±6.7 mm on CT images. This difference was statistically significant (*P*=.04). For areas that were interpreted as HSPR on dynamic MR images and as right lower paratracheal LAP on CT, the mean largest diameter was 16.6±5.6 mm on dynamic MR images and 15.7±6.8 mm on CT images. The mean diameter measurements did not differ significantly between the two radiological evaluations (*P*=.646). Lesions interpreted as recesses in both imaging modalities were significantly smaller than those interpreted as LAP on CT but recess on MRI (*P*=.03).

DISCUSSION

Among the 211 patients in this study, structures detected in the lower right paratracheal region on CT images were interpreted as a lymph node in 36.1% of the patients (n=76) and as a recess in 46.4% (n=98). It was determined that 26.3% of the structures identified as a lymph node on CT were identified as recesses on MRI (n=20), whereas all of those interpreted as recesses by CT were also interpreted as recesses on MRI (n=98). We found that CT was inferior to MRI in terms of recess/lymph node distinction; if it was identified as a recess on CT, it was also interpreted as a recess by MRI, but when it was interpreted as a lymph node on CT, it was evaluated as recesses on MRI. Comparisons of the mean largest diameters of the suspicious areas that were assessed as HSPR or lower right paratracheal LAP on CT revealed that the areas interpreted as lower right paratracheal LAP were larger in diameter.

Various diseases are considered in patients who present with mediastinal lesions on the basis of their clinical and radiological findings. Malignant causes, such as lung cancer, lymphoma, and thymoma, as well as nontumoral etiologies, such as tuberculosis and sarcoidosis, are frequently suspected.[10] Although noninvasive diagnostic methods such as CT and positron emission tomography (PET) provide valuable information on the basic radiological features and metabolic activity of the lesion when evaluating a patient with mediastinal LAP with or without parenchymal lesions, an appropriate treatment method cannot be determined without first diagnosing the pathological tissue.[11,12]

The leading histopathological verification procedures for identifying mediastinal LAPs are mediastinoscopy and endobronchial ultrasonography with transbronchial fine needle aspiration (EBUS-TBNA).[13] Although mediastinoscopy has long been accepted as the gold standard diagnostic method for mediastinal LAP, the number of lymph node stations that can be viewed is limited, and patients have higher morbidity rates because of general anesthesia, thus leading to increased use of the nonsurgical EBUS-TBNA procedure.[14,15]

In some cases, it may not be possible to establish a histopathological diagnosis for lymph nodes of pathologic

size detected on CT despite repeated surgical and nonsurgical procedures. These lesions, most of which are actually benign, are followed-up long term for possible progression, causing psychological stress for the patient in addition to increased healthcare expenditures. HSPR is the physiological structure most often confused with lower paratracheal LAP and misinterpreted as pathological.[16,17]

The superior pericardial recess is a residual extension of the transverse sinus of the pericardial cavity.[18] It is usually located below the aortic arch. However, in some cases, it may also extend downward between the trachea and brachiocephalic vein. It is called HSPR because of its location and can often be confused with LAP and cystic pulmonary diseases of the mediastinum.[19] On thoracic CT, the HSPR appears as a lesion of fluid density in the lower right paratracheal region that is not bounded by a clear wall structure.[20] Low-density LAP and bronchogenic cysts are important in the differential diagnosis; however, internal homogeneity and lack of peripheral enhancement on contrast CT images are findings that can facilitate the differentiation of HSPR from LAP.[3,19]

According to the findings of this study, the higher accuracy rate of HSPR detection with dynamic MRI when the largest diameter on dynamic MRI and thoracic CT is compared can be largely attributed to the superior fluid visualization provided by MRI. The fact that structures identified as HSPR on dynamic MRI and lower right paratracheal LAP on CT had larger mean diameters than those evaluated as HSPR on CT may be because LAP is the first thing that comes to physicians' mind when they encounter an enlarged structure during anatomic localization. We believe that CT findings that resemble lymph nodes in the paraaortic, lower paratracheal area but cannot be definitively identified as lymph nodes and have neither cystic nor solid (borderline) HU density values should be evaluated with MRI before initiating follow-up or performing an interventional procedure.

In this study, we evaluated existing anatomical structures on the basis of radiological findings, and the lack of histopathological confirmation through interventional procedures represents an important limitation. In addition, although image interpretation was performed by two radiologists with different levels of experience, no formal interobserver agreement analysis (such as Cohen's kappa or intraclass correlation coefficient) was conducted, which may have introduced variability in the findings. Furthermore, clinical variables such as respiratory symptoms, comorbid systemic diseases, smoking history, and medication use were not included in the analysis. These factors may influence mediastinal dynamics and imaging characteristics and therefore should be considered in future studies. Despite these limitations, we believe that our findings provide clinically relevant insights, particularly in preventing unnecessary invasive procedures and follow-up strategies.

CONCLUSION

Although CT is currently used as the first choice for evaluating mediastinal structures, we demonstrated that MRI was equally effective at identifying LAP and superior at differentiating recesses. Therefore, dynamic MRI evaluation can be used safely in cases where thoracic CT is insufficient for malignant/benign differentiation of lesions in the lower paratracheal area to prevent unnecessary invasive procedures, radiation exposure, and long-term follow-up.

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REFERENCES

1. Yasufuku K, Chiyo M, Sekine Y, et al. Real-time endobronchial ultrasound-guided transbronchial needle aspiration of mediastinal and hilar lymph nodes. *Chest*. 2004;126(1):122-128.
2. Carter BW. Modern imaging of the mediastinum. *Radiol Clin North Am*. 2021;59(2):xiii.
3. Choi YW, McAdams HP, Jeon SC, Seo HS, Hahm CK. The "high-riding" superior pericardial recess: CT findings. *AJR Am J Roentgenol*. 2000;175(4):1025-1028.

4. Basile A, Bisceglie P, Giulietti G, et al. Prevalence of "high-riding" superior pericardial recesses on thin-section 16-MDCT scans. *Eur J Radiol*. 2006;59(2):265-269.
5. Salyer D, Salyer W, Eggleston J. Benign developmental cysts of the mediastinum. *Arch Pathol Lab Med*. 1977;101(3):136.
6. Kutlay H, İnası Yavuzer Ş, Han S, Cangir AK. Atypically located pericardial cysts. *Ann Thorac Surg*. 2001;72(6):2137-2139.
7. Sabri YY, Mahmoud NMM, Abd El-Mageed MR, et al. Mediastinal lymphadenopathy in sarcoidosis: can diffusion MRI play a role in its evaluation? *Egypt J Radiol Nucl Med*. 2023;54(1):60.
8. McMurdo K, Webb W, von Schulthess G, Gamsu G. Magnetic resonance imaging of the superior pericardial recesses. *AJR Am J Roentgenol*. 1985;145(5):985-988.
9. Black C, Hedges L, Javitt M. The superior pericardial sinus: normal appearance on gradient-echo MR images. *AJR Am J Roentgenol*. 1993;160(4):749-751.
10. Larsen S, Krasnik M, Vilmann P, et al. Endoscopic ultrasound guided biopsy of mediastinal lesions has a major impact on patient management. *Thorax*. 2002;57(2):98-103.
11. Annema J, Hoekstra O, Smit E, Veselic M, Versteegh M, Rabe K. Towards a minimally invasive staging strategy in NSCLC: analysis of PET positive mediastinal lesions by EUS-FNA. *Lung Cancer*. 2004;44(1):53-60.
12. Gupta N, Gill H, Graeber G, Bishop H, Hurst J, Stephens T. Dynamic positron emission tomography with F-18 fluorodeoxyglucose imaging in differentiation of benign from malignant lung/mediastinal lesions. *Chest*. 1998;114(4):1105-1111.
13. Herth FJ, Eberhardt R, Vilmann P, Krasnik M, Ernst A. Real-time endobronchial ultrasound guided transbronchial needle aspiration for sampling mediastinal lymph nodes. *Thorax*. 2006;61(9):795-798.
14. Ernst A, Anantham D, Eberhardt R, Krasnik M, Herth FJ. Diagnosis of mediastinal adenopathy—real-time endobronchial ultrasound guided needle aspiration versus mediastinoscopy. *J Thorac Oncol*. 2008;3(6):577-582.
15. Ge X, Guan W, Han F, Guo X, Jin Z. Comparison of endobronchial ultrasound-guided fine needle aspiration and video-assisted mediastinoscopy for mediastinal staging of lung cancer. *Lung*. 2015;193(5):757-766.
16. Grillo HC. Management of cervical and mediastinal lesions of the trachea. *JAMA*. 1966;197(13):1085-1090.
17. Yasufuku K, Nakajima T, Fujiwara T, et al. Role of endobronchial ultrasound-guided transbronchial needle aspiration in the management of lung cancer. *Gen Thorac Cardiovasc Surg*. 2008;56(6):268-276.
18. Ferreira HDP, Strange TA, Ahuja J, Patel S, Truong MT. Pericardial recesses on thoracic imaging. *Clin Chest Med*. 2024;45(2):237-248.
19. Kuperberg SJ, Shostak E. High-riding superior pericardial recess. *J Bronchology Interv Pulmonol*. 2019;26(1):71-73.
20. Ferreira HDP, Erasmus LT, Strange TA, et al. Pericardial recesses on computed tomography: implications for the pulmonologist. *Clin Chest Med*. 2024;45(2):237-248.