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Case report-Olgu sunumu

Incidentally detected large diaphragmatic hernia in Tl-201 myocardial perfusion scintigraphy; no substantial effect on the study results

Miyokard perfüzyon sintigrafisinde tesadüfen saptanan ve çalışma sonuçlarını etkilemeyen büyük boyutlu bir diafragmatik herni

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Abstract

A case of diaphragmatic hernia, detected incidentally by Thallium 201 (Tl-201) myocardial perfusion scintigraphy (MPS), was presented. We recognized a large photon deficient area in the right lung and middle mediastinum regions, also attenuating cardiac activity in the first 10 projections during the evaluation of stress and rest single-photon emission computed tomography (SPECT) projections of the subject. Computed tomography (CT) examination of the mass revealed a diaphragmatic hernia of Morgagni type of from which the patient was unaware. We thought that this huge mass would have mask cardiac activity and cause important defects in cardiac sections and thus might lead to false results. Therefore, another rest examination was performed with a different acquisition angles that would avoid the attenuating effect of the mass on the heart. However, no substantial difference was observed, interestingly, between the outcomes of these two data sets. On the other hand presented case reminds that it is important to examine whole data set of a MPS study for incidental diagnosis.

Keywords: Thallium-201, diaphragmatic hernia

Özet

Bu makalede Talyum-201(Tl-201) ile yapılan miyokard perfüzyon sintigrafisi sırasında tesadüfen saptanan bir vaka sunuldu. Stres ve rest SPECT projeksiyonlarının değerlendirilmesi esnasında ilk 10 projeksiyon görüntüsünde orta mediastende ve sağ akciğer alanında geniş bir foton defektli alan izlendi. Yapılan tomografide hastanın da haberdar olmadığı Morgagni tipte bir diafragmatik herni saptandı. Büyük boyutlu bu kitlenin kardiak aktiviteyi engelleyeceği, kardiak kesitlerde önemli defektler yaratabileceği ve yanlış sonuçlara neden olabileceği düşünüldü. Bundan dolayı kitlenin kalp üzerindeki attenüasyon etkisini engelleyebilecek farklı açıda yeni bir rest çekimi yapıldı. Ancak ilginç olarak bu iki farklı rest çalışma sonuçları arasında anlamlı bir fark izlenmedi. Diğer taraftan bu vaka, MPS çalışmasının tüm verilerinin incelenmesinin raslantısal tanıdaki önemini bize hatırlatmaktadır.

Anahtar sözcükler: Talyum-201, diafragmatik herni

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Introduction

Myocardial perfusion scintigraphy (MPS) is a non-invasive method, commonly used to evaluate the left ventricular wall feeding with a high sensitivity and specificity. Although myocardial perfusion imaging with SPECT is an accurate and reliable diagnostic study, attenuation artifacts and some variations decrease the specificity of MPS. Therefore, one should carefully inspect the extracardiac fields, as much as cardiac images in the raw data set while evaluating the MPS.

In this case report, we present a very large diaphragmatic hernia, determined incidentally during the myocardial perfusion SPECT that interestingly did not cause an important artifact in processed tomographic sections, although quite visibly masking the heart in first 10 projections.

Case report

A 54 year old male, complaining chest-pain, palpitation and dyspnea has been referred to Cumhuriyet University Faculty of Medicine Department of Nuclear Medicine for MPS. The coronary angiography which had been performed a week ago before' the MPS showed a 50% stenosis in the first diagonal branch of left descending coronary artery (LAD-D1), 100% in the beginning of second diagonal branch (LAD-D2), 100% in the third obtus margin branch of left circumflex coronary artery (LCx-OM3) and 30% in the right coronary artery (RCA). The left main coronary artery (LMCA) was intact. The T1-201 MPS was performed with treadmill exercise. In our clinical routine, SPECT data acquisition for MPS starts from right anterior oblique thoracal region (RAO) thorough left posterior oblique position (LPO) in 180 degree. In this patient, imaging was performed realized with a single head gamma camera (GCA 7100, Toshiba Corporation, Tokyo, Japan) using 64x64 matrix and 32 projections (50 s. each). The raw images were reconstructed using filtered backprojection and a Butterworth filter was applied. Following the stress acquisition, we observed a large photon deficient area, attenuating cardiac activity at the regions of right lung and middle mediastinum, in first 10 projections of the raw data (Fig. 1A). After that, first rest SPECT imaging with the routine positioning (45º RAO to 225º LPO) was performed. Following the first study, second rest SPECT study was performed to observe the attenuation effect of the mass on the heart in the first acquisition. This time, the second study was performed from anterior (ANT) to posterior position (90º to 270º), keeping the other parameters same as the first one, in which superposition of the mass with the heart was tried to be omitted (Fig. 1B). Thus, 8 of 32 projections were shifted ahead according to first acquisition.

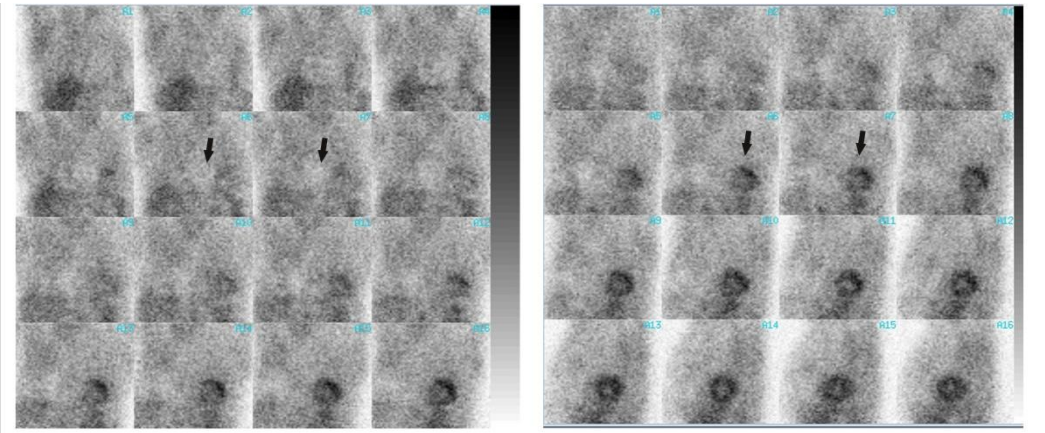

Figure 1A. First 16 projections of the first rest SPECT data. Figure 1B. First 16 projections of the second rest SPECT data.

Image quantification was performed based on a 16-segment model in bull's-eye mapping. First and second rest SPECT imaging findings were compared by calculation of regional percentage uptake values by the help of system's dedicated software with attenuation correction (Chang method) and repeated without it (Table 1). For the sake of simplicity, the means of neighboring two segments were calculated, thus regional values were reduced to 8 segments. Summed mean counts (base+middle+apex) of in 8 segments were used to calculate the regional percentage uptake values. The highest uptake value at the RAO acquisition (anterolateral wall) was considered as a reference value (e.g. 100%).

A spiral CT scan of the chest with 1 cm section thickness was performed for the determination of nature of the mass. CT image showed a large hiatal hernia (Morgagni type) with omentum and part of the transverse colon located within the thoracic cavity, displacing heart to the left (Figure 2). Although the patient has suffered from stomachache, vomiting and cough during defecation, he was unaware of the hernia. He was informed about his clinical condition.

Figure 2. CT image of the thoracal section showing bulk of hiatal hernia.

Table 1. The regional absolute (count) and percentage uptake values in polar maps of both studies (with and without attenuation correction).

	RAO		ANT		RAO (with AC)		ANT (with AC)	
	Count	**%**	**Count**	**%**	**Count**	**%**	**Count**	**%**
Anterior	1169	93	1059	84	10936	91	11130	93
Antero-septal	980	78	976	78	9031	75	10345	86
Septum	1006	80	952	76	9441	79	10148	85
Infero-septal	1024	82	1027	82	9834	82	10801	90
Inferior	993	74	990	79	9115	76	10382	87
Infero-lateral	1021	81	1059	84	9975	83	10328	86
Lateral	1243	99	1254	100	11973	99	12158	101
Antero-lateral	1254	100	1206	96	11991	100	12434	104
Total count	8628		8521		82295		87731	
	Difference at total count =107 (1.3%)				Difference at total count =-5436 (6.6%)			

AC: Attenuation correction, **ANT:** Anterior, **RAO:** Right Anterior Oblique

Findings

Stress-rest MPS imaging showed no perfusion defect at any region but, ischemia at all left ventricular walls, except lateral wall. Comparative findings of the two different acquisition data were summarized in Table 1. The difference between RAO and ANT in total counts was only 1.3%. In regional comparison, 5% count increase at inferior wall, 9% count loss at the anterior wall and almost no difference in others were observed. The attenuation correction did not influence the results of the RAO acquisition. Some amelioration (8% and 9% at anterolateral and anterior walls, respectively) was obtained in ANT acquisition. However, no significant difference was also observed in visual analysis, necessitating any modification of the reported findings of the study outcome (Figure 3).

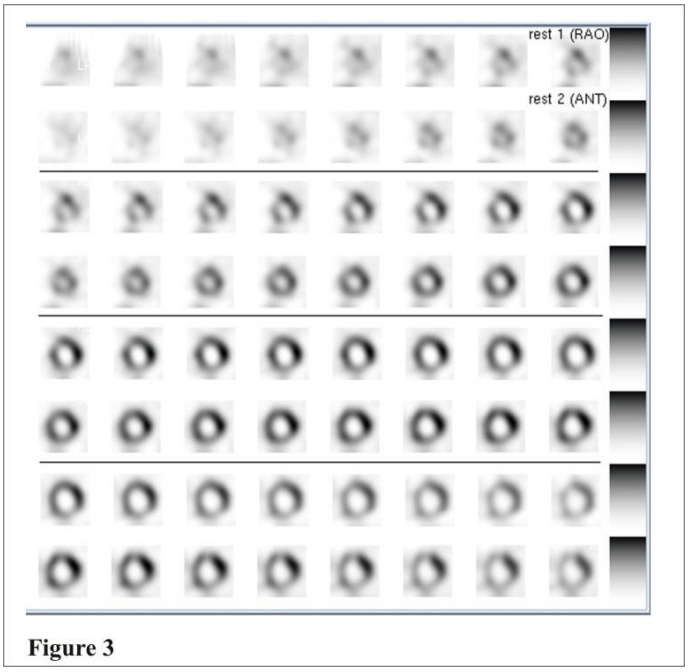

Figure 3. Short axis slices of both rest-MPS.

Discussion

This case has put forward to the importance of examination regarding raw scintigraphic raw data once again, so as to determine probable artifact and extra cardiac findings. In order to obtain accurate and reliable imaging outcome, probable attenuation factors such as, pericardial or pleural effusion etc. other than the chest wall should carefully be examined. On the other hand, projection images in MPS may play crucial role in the diagnosis of other clinical pathologies than myocardial perfusion anomalies, so as in the current case. Patient we present in this article was unaware of his huge diaphragmatic hernia before the MPS study. This study is important in showing us that even huge and asymptomatic cases can be diagnosed incidentally. The physician should evaluate all the information available as incidental findings may lead to a diagnosis of pathologic conditions that require treatment [1].

Diaphragmatic hernia may mimic anginal and other symptoms [2-4]. Indeed, Hanson et al. [5] reported an incidentally diagnosed case with hiatal hernia, having chest pain and dyspnea. However, in their patient MPS with Tc-99m sestamibi was within normal limits. On the other hand, we found this case quite interesting, since using a low energy radionuclide such as T1-201, we thought that such a huge mass could have an important attenuation effect on cardiac activity, thus might lead to false results. We compared two sets of rest data; one from starting RAO and other starting from anterior position. Although mass of hernia seemed causing considerable attenuation at first 10 projections

in raw data of first rest imaging, it was interesting to see that there was a minimal difference between two sets of processed slices in quantitative analysis. No significant gain was obtained in the second rest study as compared to the first one, both in quantitative and visual analysis, necessitating any modification of the reported findings of the study outcome. Reciprocal count modifications, namely, count loss at anterior wall and count gain at inferior wall was attributed to the fact that the number of projection was increased in inferior wall's favor, while decreasing for anterior wall. Washout phenomenon at anterior wall, between two rest-studies could also play a role. Scatter and attenuation are two main factors that compromise the accuracy of SPECT imaging. We used available attenuation correction method in the system's software, namely Chang. This method is based on μ linear attenuation factor. Since attenuation correction is a function of a constant value (μ) and the distance, the best amelioration was obtained at anterior and anterolateral walls, as expected, in ANT acquisition, following the Chang method. However, this correction did not change the outcome of the study. On the other hand, we did not observe radiopharmaceutical uptake in the hernia. Most probably this was due to the low level of hepatobiliary excretion of T1-201 in the current case (Figure 1). Obvious activity uptake was reported in a few cases with hiatal hernias during MPS studies with Tc-99m sestamibi and Tc-99m tetrofosmin [6,7].

In conclusion this case shows that it is important to examine whole data set of a MPS study. This may sometimes serve to help diagnosing not only myocardial perfusion anomalies, but also some other clinical pathologies.

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