Clinical vignette

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Quantitation in Dextrocardia on myocardial perfusion imaging: how to perform quantitative analysis using Cedars-Sinai software

Mohsen Qutbi[1], Mehdi Soltanshahi[1], Mojtaba Ansari[2], Hoda Hashemi[2], Babak Shafiei[1], Isa Neshandar Asli[1]

[1]Department of Nuclear Medicine, Taleghani Educational Hospital, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[2]Department of Nuclear Medicine, Imam Hosein Educational Hospital, School of Medicine, Shahid Beheshti University of Medical Sciences, Tehran, Iran

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Abstract

Dextrocardia, although a rare cardiac abnormality, carries the same risk for cardiac events as other people. SPECT Myocardial perfusion imaging is a potentially helpful diagnostic tool in patients with dextrocardia. Due to swapping of lateral and septal walls on SPECT slices, although visual analysis is possible, quantitation is substantially limited. Here, we introduce a simple practical method to make quantitative analysis feasible and accurate.

KEY words: dextrocardia; SPECT myocardial perfusion imaging; quantitation; Cedars-Sinai software.

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Case report

A 50-year-old male patient with known history of dextrocardia with situs inversus presented for cardiac evaluation. A dipyridamole gated SPECT myocardial perfusion imaging (G-SPECT MPI) was performed with same-day stress-rest protocol. As we knew that the patient had dextrocardia, we modified the acquisition protocol. The patient was positioned supine and imaging was acquired from left anterior oblique (LAO) to right posterior oblique (RPO) views. Other acquisition parameters were as routine (e.g., orientation: feet-in, number of projections: 32 and number of frames for gating: 8). First, Images were reconstructed and processed with routine protocol, then, with modified protocol (Figure 1). In modified protocol, we changed orientation of images from "Feet-in" to "Head-in". Analysis for gating was also performed with both protocols (Figure 2).

Correspondence to: Mohsen Qutbi, Department of Nuclear Medicine, Taleghani Hospital, Yaman St., Velenjak, Tehran, Iran; mobile phone: 00989197975902, Nuclear medicine department phone: 00982123031250, fax: 00982122432596, e-mail: mohsen.qutbi@gmail.com, mohsen.qutbi@sbmu.ac.ir

Discussion

Dextrocardia is a rare congenital abnormality of the heart with incidence of less than 0.01% [1]. The heart is positioned on the right side and the axis of left ventricle (LV) is directed toward the left side. In dextrocardia with situs inversus or mirror-image dextrocardia, the LV is positioned posterior and left to the right ventricle (RV). The position of other organs including visceral organs (e.g., liver, stomach and etc.) is also reversed [1].

It has been shown that the risk of coronary artery disease in patients with dextrocardia is the same as that in general population [2, 3]. SPECT MPI is a potentially helpful modality for cardiac assessment in these patients, although some modifications in acquisition protocol are required. Otherwise, perfusion abnormalities in LV myocardium will occur. The acquisition arc ranges from LAO to RPO. When images are reconstructed as routine, tomographic slices are visualized mirrored in a way that interventricular septum and lateral free wall are swapped and RV is located on the right side of image. Quantitative analysis usually reveals perfusion defect and motion abnormality in lateral segments of polar map, because septal wall of patients are compared to lateral wall in normal database. Therefore, quantitative analysis is not helpful in these situations and images are interpreted solely visually.

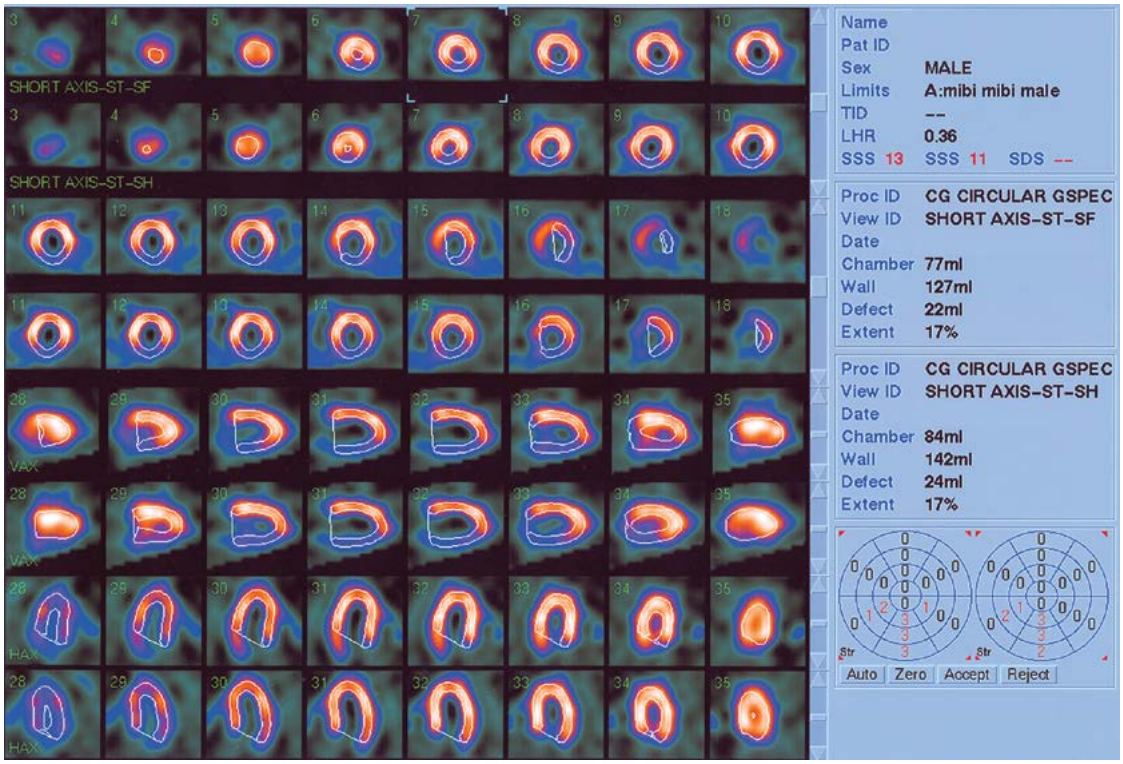
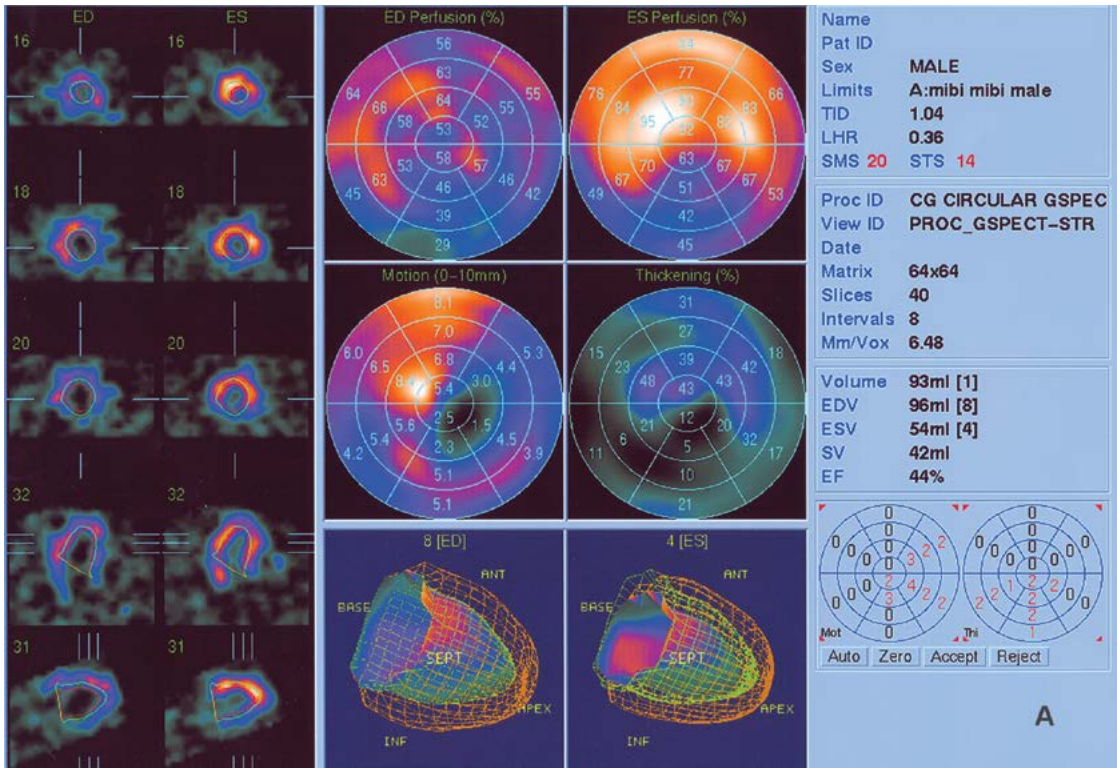


Figure 1. SPECT slices with routine processing (upper panel) and with modified processing (lower panel); on images with routine processing, lateral and septal walls are swapped. Lateral free wall and true interventricular septum are visually normal. Here, on semiquantitative analysis, no score is given to lateral segments on perfusion polar map. Prominent activity of septal wall (true interventricular septum) compared to lateral wall (lateral free wall) can be a reason. Severe perfusion abnormality of inferior wall is compatible with previous myocardial infarction



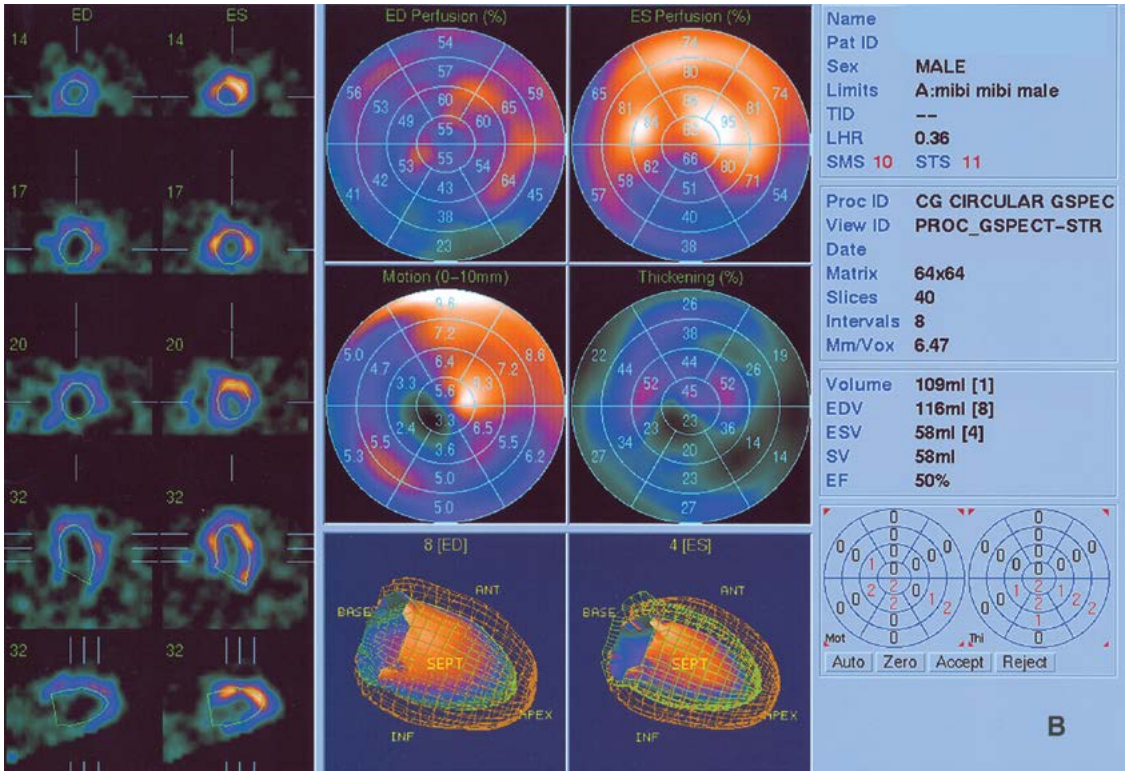


Figure 2. Results of LV systolic function indices and polar maps of wall motion and thickening of gated study with routine processing (**A**) and with modified processing (**B**); processing with routine protocol reveals wall motion abnormality on lateral wall (lateral segments on the polar map) which is normalized with modified processing. The measurement of ejection fraction (EF) and end-diastolic LV volume are also underestimated (44% vs. 50% and 96 mL vs. 116 mL respectively)

In order to make the quantitation feasible and accurate, a simple practical method is to change the orientation of images. When images are processed with modified protocol (changing of orientation from "Feet-in" to "Head-in"), the images are again mirrored, therefore lateral and septal walls are in their correct position on tomographic slices. Contours of LV walls are drawn erroneously as basal part of septal wall (true lateral free wall) is cut off. Because by default, septal wall is shorter than lateral wall. True septal walls have normally less motion compared to true lateral walls. As in this case, the true interventricular septum is compared to the lateral free wall of normal population included in normal database. Therefore, motion abnormality will be evident in lateral segments on the polar map. Contrary to motion, thickening does not show similar abnormality as the degree of thickening is almost homogeneous circumferentially in LV walls. Because the basal portion of septal wall (lateral free wall) is cut off from LV myocardial wall contours, LV volumes, particularly end-diastolic LV volume will be significantly underestimated in routine processing. Therefore, a more accurate estimation of ejection fraction (EF) can be achieved with modified processing.

Conflict of interest

No conflict of interests is declared.

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