Quantitative identification of sarcoidosis with FDG PET

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PURPOSE

FDG PET imaging has been shown effective in imaging sarcoidosis, an inflammatory disease that affects the heart in nearly 60% of sarcoid patients.

The objective of this study was to evaluate a quantitative method for the detection of cardiac sarcoidosis (CS) in patients undergoing a high fat preparatory diet (HFPD).

METHODS

Patient Population

Study population consisted of 51 patients with known or suspected CS.

Twenty-two of the patients were found not to have cardiac involvement by independent measures beyond FDG imaging.

Nine of these patients (Controls) were used to identify abnormality thresholds for the detection of CS.

The remaining 13 from the non-CS group were pooled with 29 patients confirmed to have CS to determine the effectiveness of the quantitative method.

Patients underwent a pre-imaging preparation consisting of a HFPD + heparin to minimize uptake in normal myocardial tissue.

Image Acquisition

Each patient underwent rest Rb-82 perfusion and FDG PET imaging with standard vendor recommended parameters to quantify standard uptake values (SUV).

Quantitative Processing

LV surfaces are defined from Rb82 images using standard surface algorithm in Corridor4DM (INVIA, Ann Arbor, MI).

Using indirect registration between datasets, Rb82 ↔ Rb82 CT ↔ FDG CT ↔ FDG the Rb82 LV surfaces were transferred to the FDG images.

Transform Matrices

Using the Controls, mean peak myocardial SUV (pSUV), mean global SUV (mSUV), and the coefficient of variation of global SUV (COV) were computed to determine thresholds at a 95% confidence interval.

Example Normal Pt

pSUV = 1.5
mSUV = 1.1
COV = 0.18

Example Abnormal Pt

pSUV = 4.6
mSUV = 2.4
COV = 0.29

RESULTS

From the Controls, the mean normal values were

pSUV = 1.78 +/- 0.33
mSUV = 1.36 +/- 0.21
COV = 0.12 +/- 0.03

Both patients confirmed to have Sarcoidosis based on biopsy and MRI.

Left: TP by all three methods.

Right: TP by pSUV, FN by other two methods.

For the identification of CS in the patient group, the mSUV, pSUV and COV were computed and compared to the Controls.

mSUV had high sensitivity (92%) but suboptimal specificity (69%) so it was omitted from consideration.

pSUV had significantly better (p<0.05) sensitivity than COV.

When combining pSUV or COV (pSUV+COV) as an indication of a positive test, sensitivity increased to 86% compared to pSUV alone (p=NS).

CONCLUSIONS

A quantitative method based on SUV myocardial polar maps provided very good accuracy for the detection of CS, with the pSUV threshold performing better mSUV and the COV threshold.

The method described minimizes the effort needed to manually draw regions of interest for regional SUV estimation.

Further analysis with a larger clinical population is warranted.