

When does extra-cardiac uptake in myocardial perfusion scintigraphy affect image interpretation? A simulation study

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Introduction

Tc-labelled myocardial perfusion agents are cleared by the liver and excreted by the biliary system. Increased liver, intestinal, or gastric activity may create a major problem in the visual and quantitative interpretation of the inferior wall, particularly at rest. The objective of the study is to determine when interpretation of the studies is affected by poor image quality

Methods

The SIMIND Monte Carlo code with the XCAT-phantom was used to simulate myocardial perfusion scintigraphy images. Inferior defects of 3 and 6 % of the left ventricle were simulated. Extra-cardiac uptake was simulated using a spherical 4 cm hot spot with the same concentration of Tc as in the myocardium. The hot spot was placed below the heart, and the position was changed from 10 mm to 0 mm from the inferior cardiac wall, with 2 mm intervals. Images were created by simulating 32 angles in a 180 arc, starting from 45° right anterior oblique position and re-constructed using the OSEM algorithm with a gaussian post filter (figure). The EXINI heart software was used to evaluate the extent and severity of the defects for the different defect sizes and distances to extra-cardiac uptake.

Results

Severity started to decrease when the hot spot was closer to the heart than 6 mm, i.e. the spillout from the hot spot to the heart started to affect the computerized interpretation. For small defect sizes, the extent decreased when the hot spot was localized less than 6 mm from the heart (table).

Hotspot distance	Defect 3%		Defect 4%		Defect 6%	
	Extent (%)	Severity (SD)	Extent (%)	Severity (SD)	Extent (%)	Severity (SD)
0 mm	0	0	0	0	2	-2.4
2 mm	0	0	2	-2.4	6	-2.9
4 mm	2	-2.4	3	-2.5	7	-3.2
6 mm	4	-3.0	7	-3.1	7	-3.7
8 mm	4	-2.9	5	-3.2	8	-3.7
10 mm	4	-2.9	6	-3.4	8	-3.6
w/o	4	-3.0	7	-3.4	9	-3.7

Conclusions

Re-examination should be considered when the extra-cardiac uptake is localized at a distance of less than half of the spatial resolution, i.e. around half the thickness of the myocardial wall.

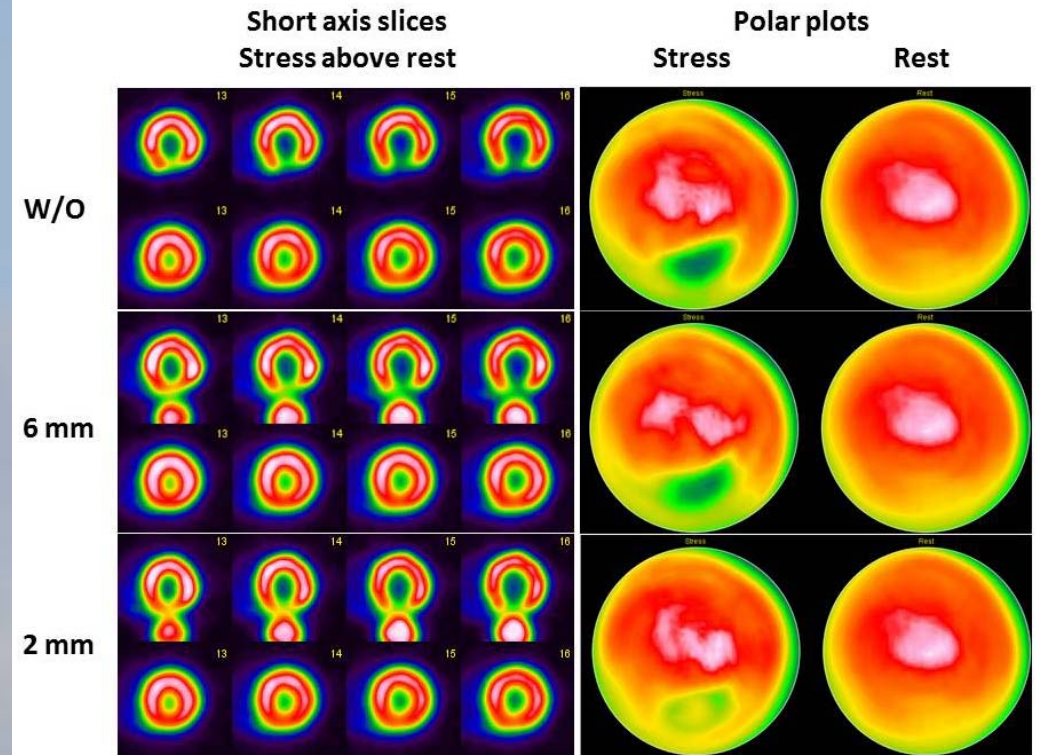


Figure: Short axis slices and polar plots of a simulation without hotspot and with the hotspot at 6 mm and 2 mm distance from the heart. In this case the extent of the defect is 6 %

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