

CASE REPORT

REDUCED PERFUSION ON NITRATE ENHANCED STUDY COMPARED TO RESTING WITH ^{99m}Tc-SESTAMIBI IMAGING FOR MYOCARDIAL VIABILITY

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Patients with ischemic heart disease and left ventricular dysfunction need evaluation for myocardial viability. Two cases of myocardial perfusion imaging for viability study are discussed. Viability imaging is performed with ^{99m}Tc-Sestamibi (^{99m}Tc-MIBI), acquiring images with and without nitrate enhancement. Improvement in perfusion in nitrate enhanced images is suggestive of myocardial viability. In these cases, there was paradox effect showing reduced uptake on nitrate enhanced images than on resting images. Technical factors of equal radiotracer dose in both studies, pre-imaging time and processing were considered. Since no such contributing factor was delineated, it is postulated that phenomena can occur due to differential effects of oral glyceryl triglyceryl trinitrate (GTN) on normal and diseased vessels.

Keywords: Myocardial viability; Glyceryl trinitrate; ^{99m}Tc-Sestamibi; Radiotracers

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INTRODUCTION

Patients with ischemic heart disease and left ventricular dysfunction need evaluation for myocardial viability.¹ Prediction of viable myocardium has important clinical and prognostic implications.² Patients having viable myocardium show improvement in left ventricular function after revascularization.³

Nitrates such as sublingual glyceryl trinitrate administration before injection of radiotracer appears to enhance detection of viable myocardium.^{4,5} Definitely, the effect of nitrates is to balance positively left ventricular oxygen demand by altering by reducing burden on left ventricles.⁶ Another possible explanation for effect may be effect of nitrates on coronary vessels causing vasodilatation of diseased vessels, increasing flow in collateral vessels or could be redistribution of flow to the ischemic areas, particularly through collateral vessels.⁷

In scenario of viability study perfusion is improved in segments involved on Glyceryl Trinitrate (GTN) enhanced ^{99m}Tc-MIBI study compared to the rest study. However, these two cases showed paradoxically reduced uptake in the involved segment on GTN enhanced study which showed relatively good perfusion on rest study.

According to two-day cardiac imaging protocol, both the patients underwent Rest SPECT study out with 20 mCi of ^{99m}Tc-MIBI. Viability study was carried out on the next day, after sublingual administration of 0.5 mg of GTN. Heart Rate (H.R) and Blood Pressure (B.P) were monitored. A drop of 20 mm Hg was noted in the patient's systolic BP was noted 5 minutes after sublingual GTN. At 10th

minute, about 20 mCi of Tc-99m-MIBI was injected. The stress and recovery phases were uneventful. Gated SPECT study or SPECT study was carried out 15 minutes after the injection.

CASE-I

A male patient of 65-years with history of Non-ST Elevation Myocardial Infarction and streptokinase injected was referred for Viability scan. He was complaining of typical chest pain. His ejection Fraction on Echo was 40%. His angiography revealed severe disease in mid-course of left anterior descending artery. Left circumflex artery was non-dominant and totally occluded. Right coronary was dominant and showed severe disease in proximal course.

Myocardial perfusion study of the patient revealed reduced tracer uptake in inferior wall, apex, apical-anterior segment and septum on GTN study with rest imaging showing relatively improved perfusion throughout myocardium.

Gated SPECT Studies reveal dilated LV and significantly reduced Left Ventricular Ejection Fraction (LVEF). Moderate global hypokinesia was seen.

GTN-Study showed LVEF of 26 %, End-Diastolic Volume (EDV):195 ml and End-Systolic Volume (ESV): 145 ml

Suggestive most likely of 1) Likely global balanced hypo perfusion; 2) Left Ventricular myocardium appears viable at basal perfusion of >50% and 3) Global moderate hypokinesia with dilated LV cavity and significantly reduced EF suggest ischemic dilated cardiomyopathy.

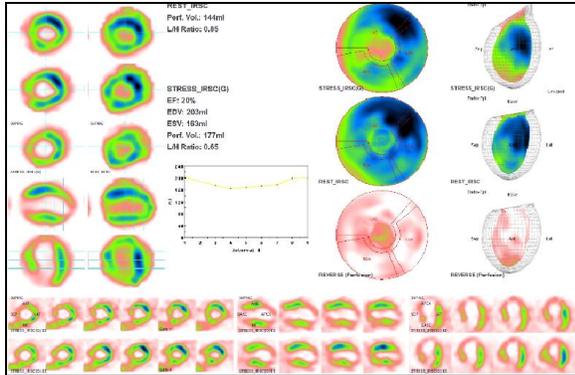


Figure-1: Case-I ^{99m}Tc-MIBI Myocardial Viability Study showing GTN-enhanced and rest-images

CASE-II

The second patient, a male of 60-years with history of anterior wall myocardial infarction was also referred for viability scan. He was complaining of dyspnoea. His coronary angiography revealed critical disease in left anterior descending after ostium, left circumflex artery is non-dominant showing mild ostial disease and critical disease in major obtuse marginal (OM) branch. Right coronary artery was dominant and showed mild disease in proximal and mid course. Myocardial perfusion study for viable myocardium revealed a large-sized, moderate to severe degree perfusion defect in anterior wall, apex and apical septal segment on GTN study which on rest study showed relatively improved perfusion in the range of 40–50%. Gated SPECT Studies revealed prominent LV and dilated on GTN with reduced LVEF. Severe hypokinesia of apex, anterior wall and apical septal segment was noted on GTN study and wall motion in these segments was also seen improved on rest images.

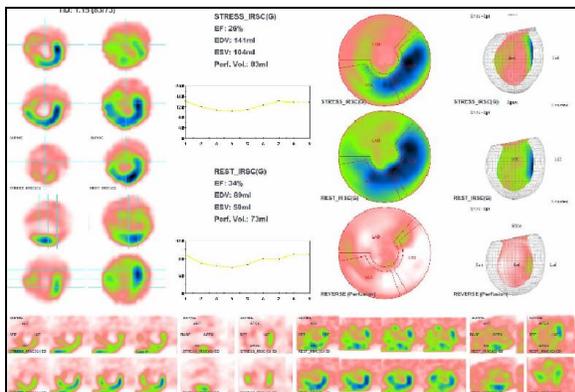


Figure-2: Case-II ^{99m}Tc-MIBI Myocardial Viability Study showing GTN-enhanced and rest-images

Rest-Study LVEF: 34 %; EDV: 89 ml; ESV: 59 ml
 GTN-Study LVEF: 23 %; EDV:141 ml ESV:104 ml
 Suggestive most likely of 1) Resting viable perfusion in anterior wall, apex and apical septal segments of left ventricular myocardium at 40–50% of maximum while

on GTN study perfusion appears reduced (coronary steal phenomena) 2) Moderate to severe hypokinesia of anterior wall, apex and apical-septal segments which also show improvement on rest study. 3) Mildly dilated LV cavity with reduced LVEF more pronounced on GTN study

DISCUSSION

Exploring the extent of viable left ventricular myocardium in long standing coronary vessel disease, history of infarction and compromised left ventricular functioning has significant effect on management and long-term outcome.⁸ Glyceryl trinitrate enhanced perfusion scan with ^{99m}Tc-MIBI show improvement in perfusion defects and also wall motion on Gated SEPCT also improves compared to rest-study.

Detection of viable myocardium in patients with infarction and chronic ischemia is a common and clinically pertinent task. This helps cardiac physicians and surgeons to select optimum therapy for such patients.⁹ In glyceryl trinitrate enhanced ^{99m}Tc-Sestamibi perfusion scan, two patterns of images are usually taken; rest images and post sublingual glyceryl trinitrate images. Enhancement in the perfusion on glyceryl trinitrate enhanced images is suggestive of viable myocardium.

However, in cases described above perfusion in glyceryl trinitrate enhanced study appears reduced than in resting images. This paradox can occur and the technical reasons can be the contributing factors.

Reduced uptake of ^{99m}Tc-MIBI in glyceryl trinitrate enhanced images relative to rest images can occur in areas supplied by contributor channels. Areas showing improvement on glyceryl trinitrate images are thought to be supplied by receiver vessels. Therapy for angina may modify resting and hyperaemic flow to myocardium, thus may be disturbing the capability to distinguish flow-limiting narrowing of vessel.¹⁰ Nitrates such as sublingual glyceryl trinitrate increase ^{99m}Tc-MIBI uptake inside viable zones of receiver vessel and could contrive a coronary steal in zones of contributor vessel. In patients with multi-vessel disease with well-developed collaterals use of nitrates can cause reduced blood flow to the zones supplied by contributor arteries, consequential flow may appear absent likely due to “steal syndrome,” nevertheless these vessels may be less stenosed on angiography and considered viable on resting perfusion study.¹¹ Ischemia with glyceryl trinitrate administration may be reflected as a silent indicator for myocardial unpredictability and contemptable prognosis in cases with deceptively steady, restored myocardial infarctions.

CONCLUSION

Myocardial perfusion scan after sublingual glyceryl trinitrate augmentation is crucial for evaluation of viability in myocardial infarction. Glyceryl trinitrate effect differs on diseased vessels, collaterals and normal vessels. It is suggested that prescription nitrates may be stopped and resting scan without glyceryl trinitrate augmentation may be undertaken first before the glyceryl trinitrate enhanced study.

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