



Evaluation of coronary microvascular dysfunction in long-standing asymptomatic diabetic patients with $^{13}\text{N-NH}_3$ cardiac PET

Tinu T. Lukose, MBBS¹, Ashwani Sood, DNB¹, Bhagwant R. Mittal, MD, DNB¹, Parag Barwad, MD, DM², Pinaki Dutta, MD, DM³

Departments of ¹Nuclear Medicine, ²Cardiology and ³Endocrinology, Post Graduate Institute Of Medical Education and Research, Chandigarh, India.

INTRODUCTION

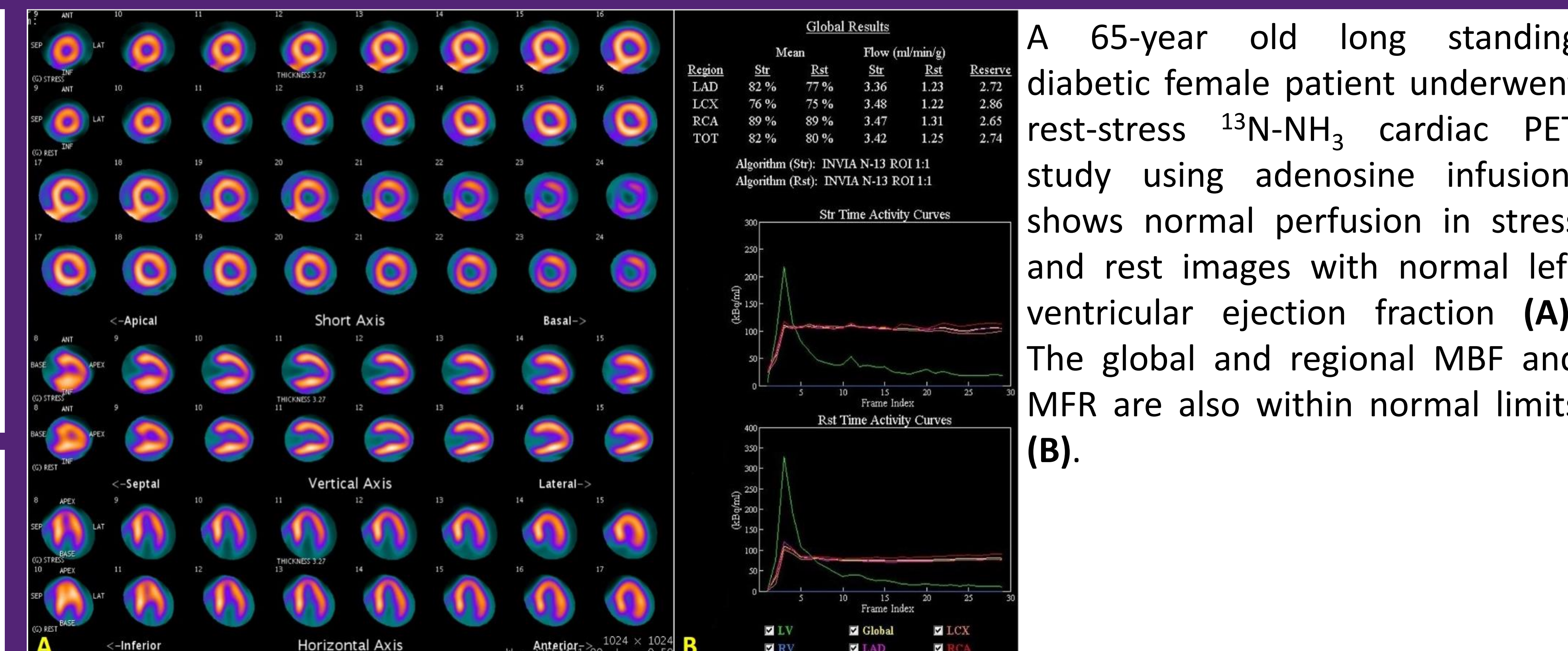
- ❖ Diabetes- **coronary heart disease equivalent**
- ❖ Initial pathological change- **coronary microvascular dysfunction**
- ❖ Conventional imaging (2D ECHO, coronary angiogram, CCTA)- fails to identify the microvascular dysfunction at an early stage.
- ❖ **Dynamic cardiac PET myocardial perfusion imaging (MPI)**- considered gold standard for non invasive evaluation of myocardial flow reserve.

PATIENTS AND METHODS

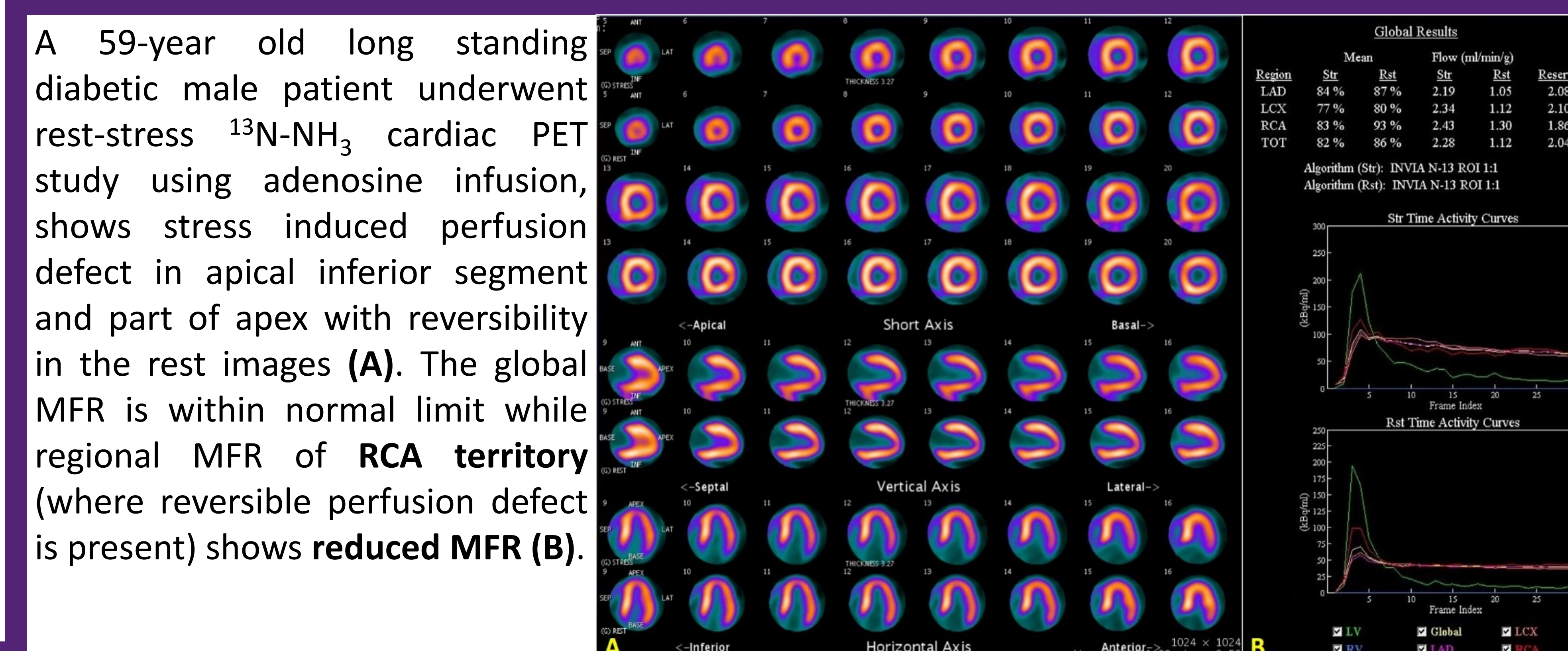
- ❖ Prospective study
- ❖ 2 groups – **diabetic** group without CAD and **symptomatically normal subjects** (non-diabetic group) without DM and CAD.
- ❖ 30 patients in diabetic group.
- ❖ 28 patients in non-diabetic group.
- ❖ All patients underwent HbA_{1c} testing before or just after the study (within 1 month)
- ❖ After clinical examination, all patients underwent **dynamic rest MPI** using $^{13}\text{N-NH}_3$.
- ❖ **Dynamic stress MPI** was done in the same sitting after rest study, using adenosine as vasodilator.
- ❖ Data were acquired in list mode for 10 minutes and was reconstructed using 3D PET algorithm.
- ❖ Reconstructed data was processed using commercially available software (**Corridor 4DM**, version 2013.1.1.39, Invia solutions).

PATIENT CHARACTERISTICS

- ❖ **Diabetic group**
 - 30 patients (19 men, 11 women; mean age – 57.4 ± 8.5 years)
 - Mean duration of diabetes: 9.1 ± 6.1 years
 - Mean HbA_{1c}: 9.2 ± 2.2 %
 - 3 patients had associated diabetic microvasculopathy (retinopathy, nephropathy and neuropathy)
 - None had symptoms suggestive of CAD.
- ❖ **Non-diabetic group**
 - 28 patients (5 men, 23 women; mean age – 52.9 ± 12.4 years)
 - Mean HbA_{1c}: 5.7 ± 0.4 %
 - None had symptoms suggestive of CAD.



A 65-year old long standing diabetic female patient underwent rest-stress $^{13}\text{N-NH}_3$ cardiac PET study using adenosine infusion, shows normal perfusion in stress and rest images with normal left ventricular ejection fraction (A). The global and regional MBF and MFR are also within normal limits (B).



A 59-year old long standing diabetic male patient underwent rest-stress $^{13}\text{N-NH}_3$ cardiac PET study using adenosine infusion, shows stress induced perfusion defect in apical inferior segment and part of apex with reversibility in the rest images (A). The global MFR is within normal limit while regional MFR of **RCA territory** (where reversible perfusion defect is present) shows **reduced MFR** (B).

A 62-year old male patient with long standing diabetes of 22 year duration and asymptomatic for CAD, underwent rest-stress $^{13}\text{N-NH}_3$ cardiac PET study using adenosine infusion, shows severely reduced perfusion in multiple segments in stress images with partial reversibility in the rest images (A). The global and regional MBF and MFR are also correspondingly decreased and denotes a **triple vessel disease**(B).

RESULTS

- ❖ 11 subjects (36.7%) had **perfusion defects** in diabetic group, whereas only 6 subjects (21.4%) had the same in non-diabetic group.
- ❖ Significant difference of **perfusion defect quantification** between the groups (mean: 20.7 ± 10.4 % in diabetic group and 7.3 ± 2.4 % in non-diabetic group; $p=0.007$).
- ❖ No statistically significant differences in **global stress MBF** (mean: 2.35 ± 0.6 ml/gm/min in diabetic group and 2.9 ± 0.5 ml/gm/min in non-diabetic group; $p=0.63$).
- ❖ No statistical differences between **global MFR** (mean- 2.3 ± 0.7 in diabetic group and 2.7 ± 0.6 in non-diabetic group; $p=0.23$) between the groups.
- ❖ Significant negative correlation between diabetes and **MBF during stress** ($r = -0.426$; $p=0.001$).
- ❖ Diabetes was also found to have a **significant negative correlation with global MFR** ($r = -0.273$; $p=0.038$).

CONCLUSION

- ❖ Study shows the significance of **estimation of myocardial blood flow and myocardial flow reserve** in diabetic patients asymptomatic for CAD.
- ❖ Significant reduction in myocardial blood flow during stress in diabetes even without CAD points to early microvascular dysfunction.
- ❖ Thus, rest and stress MPI with estimation of absolute MBF using $^{13}\text{N-NH}_3$ cardiac PET serves to be a valuable modality in **early detection of coronary microvascular dysfunction** in asymptomatic diabetic patients.
- ❖ This modality could be of great help in understanding both the coronary blood flow abnormalities as well as the detection of coronary artery disease in patients suspected of, but asymptomatic for coronary artery disease.

LIMITATIONS OF THE STUDY

- ❖ Less number of patients in the study
- ❖ Absence of follow up
- ❖ Motion correction of the dynamic images not done.

Acknowledgements: I would like to thank Mr. Madan Parmar, Mrs. Nivedita Rana, Mr. Munish Kumar and Mr. Dinesh Rawat of Department of Nuclear Medicine, PGIMER, Chandigarh for their invaluable support and guidance in finishing this project on time.