

# MYOCARDIAL PERFUSION IMAGING IN RENAL TRANSPLANTED RECIPIENTS – A PILOT STUDY

Sotiria Alexiou<sup>1</sup>, Andreas Fotopoulos<sup>1</sup>, Evangelia Dounousi<sup>2</sup>, Vasilis Koutlas<sup>2</sup>, Loukas Astrakas<sup>3</sup>, Irimi Tzalavra<sup>2</sup>, Lampros Lakkas<sup>4</sup>, Katerina Nakka<sup>4</sup>, Charalambos Pappas<sup>2</sup>, Michalis Mitsis<sup>2</sup>, Chrissa Sioka<sup>1</sup>

<sup>1</sup>Nuclear Medicine Physician, Department of Nuclear Medicine, University Hospital of Ioannina, Ioannina, Greece

<sup>2</sup>Nephrologist, Renal Transplant Unit, Department of Surgery, University Hospital of Ioannina, Ioannina, Greece

<sup>3</sup>Physicist, Department of Medical Physics, University Hospital of Ioannina, Ioannina, Greece

<sup>4</sup>Cardiologist, 2<sup>nd</sup> Department of Cardiology, University Hospital of Ioannina, Ioannina, Greece

# Abstract

**Introduction:** Myocardial ischemia after kidney transplantation may predict graft loss, major adverse cardiac events, and may influence prognosis.

**Purpose:** The goal of this single center retrospective study, was to evaluate the frequency of myocardial ischemia in renal transplanted recipients (RTRs), subjected to myocardial perfusion imaging (MPI) single photon emission computer tomography (SPECT), in comparison with a control group.

**Methodology:** All 17 MPI SPECT studies of RTRs that had MPI for myocardial ischemia evaluation were retrieved from our archive and compared with 21 control individuals. Both patients and controls had MPI for atypical cardiac symptoms. Traditional cardiovascular risk factors, smoking, hypertension, diabetes mellitus, dyslipidemia, obesity and cardiac heredity were recorded and compared between RTRs and control group. MPI was assessed using 17 segment polar map and with a scale of 0 to 5 scoring. Summed stress score (SSS), summed rest score (SRS) and summed difference score (SDS) were assessed.

**Results:** RTRs 10/17 (58.8%) were found to have significantly increased prevalence of abnormal MPI results (SSS  $\geq$  4) compared with the control individuals 8/21 (38.1%) (likelihood ratio  $p=0.027$ ). Moreover, there were significantly higher values of SSS in RTRs compared to controls ( $P=0.016$ ), suggesting the presence of more severe myocardial ischemia. However, there was a trend towards better reversibility of their ischemia in RTRs as suggested by the higher SDS values ( $p=0.009$ ). Among known assessed traditional cardiovascular risk factors in patients with abnormal MPI, only obesity was different between RTRs and controls ( $p=0.013$ ).

**Conclusions:** In our MPI study, RTRs had more frequent and more severe myocardial ischemia compared to controls. Among traditional cardiovascular risk factors only obesity was found to be an important risk factor in our population.

**Keywords:** myocardial perfusion imaging, renal transplanted recipients, myocardial ischemia

# Purpose

Candidate patients for kidney transplant are at higher risk for coronary artery disease if they possess cardiovascular risk factors, even if they are asymptomatic, and should be evaluated with noninvasive cardiac imaging such as myocardial perfusion imaging single photon emission tomography (MPI SPECT). (1)

MPI SPECT represents a highly reliable noninvasive imaging method to assess myocardial ischemia in both symptomatic and asymptomatic patients (2).

Among renal transplant recipients (RTRs), MPI SPECT could predict future cardiac events as well as cardiovascular death

The goal of this single center retrospective study was to evaluate the frequency of myocardial ischemia in RTRs, compared with a control group utilizing MPI SPECT.

# Methodology

Seventeen RTRs undergone MPI SPECT for evaluation of their myocardial ischemia were compared with 21 age and gender-matched, randomly selected individuals in our database that had undertaken the test because of atypical, non-specific cardiac complaints (control group, C).

RTRs and C had glomerular filtration rate (GFR), urea, creatinine, sodium, potassium, hemoglobin, albumin, cholesterol, high-density lipoprotein, triglycerides, low-density lipoprotein blood screening within a period of 1 month prior or post MPI SPECT.

Traditional cardiovascular risk factors, smoking, hypertension, diabetes mellitus, dyslipidemia, obesity and cardiac heredity were recorded and compared between RTRs and C.

All study individuals were subjected, prior and after stress, to  $^{99m}\text{Tc}$ -tetrofosmin-MPI using a 1-d imaging protocol. Images were visually evaluated using 17 segment polar map and with a scale of 0 to 5 scoring as previously reported.

Summed stress score (SSS), summed rest score (SRS) and summed difference score (SDS) were assessed. SSS score  $\geq 4$  was considered to indicate myocardial ischemia.

## Results

RTRs 10/17 (58.8%) were found to have significantly increased prevalence of abnormal MPI results ( $SSS \geq 4$ ) compared with the control individuals 8/21 (38.1%) (likelihood ratio  $p=0.027$ ).

Moreover, there were significantly higher values of SSS in RTRs compared to controls ( $P=0.016$ ), suggesting the presence of more severe myocardial ischemia. However, there was a trend towards better reversibility of their ischemia in RTRs as suggested by the higher SDS values ( $p=0.009$ ).

Among known assessed traditional cardiovascular risk factors in patients with abnormal MPI, only obesity was different between RTRs and controls ( $p=0.013$ ).

# Discussion

In our MPI SPECT study, RTRs had more frequent and severe myocardial ischemia compared to controls. A previous study in 819 RTRs that had pre-transplant MPI SPECT showed that one in five patients had abnormal study which turned out to be an independent predictor of subsequent cardiovascular events.(3)

Another MPI SPECT study in 135 RTRs found 8% patients with mild perfusion defects and 10% with myocardial infarction.(4)

Furthermore, a large Canadian Organ Replacement Register consisted of 4933 patients, included 282 RPRs that had MPI SPECT. Analysis of these results showed that 41% had abnormal SSS and increased risk of cardiovascular death or hospitalization. In addition, SDS was significantly associated with cardiovascular events. (5)

# Conclusions

In our MPI study, RTRs had more frequent and more severe myocardial ischemia compared to controls.

Among traditional cardiovascular risk factors only obesity was found to be an important risk factor in our population.

MPI SPECT represents a highly reliable non-invasive imaging test, for pre-transplant evaluation and post-transplant monitoring of patients with chronic kidney disease and cardiovascular risk factors.

# References

1. Doukky R, Fughhi I, Campagnoli T, Wassouf M, Kharouta M, Vij A, Anokwute C, Appis A, Ali A. Validation of a clinical pathway to assess asymptomatic renal transplant candidates using myocardial perfusion imaging. *J Nucl Cardiol*. 2018 Dec;25(6):2058-2068. doi: 10.1007/s12350-017-0901-4. Epub 2017 May 8.PMID: 28484986
2. Fotopoulos A, Petrikis P, Iakovou I, Papadopoulos A, Sakelariou K, Gkika E, Lakkas L, Touzios C, Pappas K, Klaroudas A, Doumas A, Sioka C. The impact of depression and anxiety in prognosis of patients undergoing myocardial perfusion imaging with 99mTc tetrofosmin SPECT for evaluation of possible myocardial ischemia. *Nucl Med Rev Cent East Eur*. 2020;23(2):58-62. doi: 10.5603/NMR.a2020.0014.
3. Ives CW, AlJaroudi WA, Kumar V, Farag A, Rizk DV, Oparil S, Iskandrian AE, Hage FG. Prognostic value of myocardial perfusion imaging performed pre-renal transplantation: post-transplantation follow-up and outcomes. *Eur J Nucl Med Mol Imaging*. 2018 Oct;45(11):1998-2008. doi: 10.1007/s00259-018-4068-2. Epub 2018 Jun 7.PMID: 29882159
4. Low S, Chua HR, Wong R, Goh A, Ng YH, Teo BW, Vathsala A. Myocardial ischemia by radionuclide imaging and long-term outcomes after kidney transplantation. *Int Urol Nephrol*. 2020 Oct;52(10):1995-2003. doi: 10.1007/s11255-020-02542-7. Epub 2020 Jul 13.PMID: 32661630
5. Abuzeid W, Iwanochko RM, Wang X, Kim SJ, Husain M, Lee DS. Prognostic impact of SPECT-MPI after renal transplantation. *J Nucl Cardiol*. 2017 Feb;24(1):295-303. doi: 10.1007/s12350-016-0547-7. Epub 2016 Sep 23.PMID: 27663251