Influence of Perfusion Defects on Survival after Coronary Revascularization

Simonsen, Jane Angel; Gerke, Oke; Tamadoni, Mohammad; Rask, Charlotte Krogh; Thomassen, Anders; Hess, Søren; Johansen, Allan; Mickley, Hans; Jensen, Lisette Okkels; Hallas, Jesper; Høilund-Carlsen, Poul Flemming

Published in:
European Journal of Nuclear Medicine and Molecular Imaging

Publication date:
2012

Document version
Publisher's PDF, also known as Version of record

Citation for published version (APA):

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain.
• You may freely distribute the URL identifying the publication in the public portal.

Take down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Download date: 30. dec., 2018
within 60 days; 4 patients who underwent revascularization or had any cardiovascular events between PET and ICA were excluded. Myocardial blood flow at rest (rMBF), at stress with adenosine (sMBF) and myocardial flow reserve (MFR=sMBF/rMBF) were estimated using the 1-compartment Lortie model. (Flow = 1.4 arteriolar territories×10⁻⁶ ml/sec×10⁻⁶ ml) for image processing using computer-based automated edge detection (QCA). MFR was divided in 3 groups: G1:MFR<1.5, G2:1.5≤MFR<2 and G3:≥MFR2. Stenosis severity was graded as non-significant (<50% or FFR ≥0.8), intermediate (50%<stenosis<70%) and severe (≥70%). Correlation between MFR and percentage of stenosis were assessed using a non-parametric Spearman test. Results: In G1 (44 vessels), 17 vessels (39%) had a severe stenosis, 11 (25%) an intermediate one, and 16 (36%) no significant stenosis. In G2 (13 vessels), 2 (15%) vessels presented a severe stenosis, 7 (54%) an intermediate one, and 4 (31%) no significant stenosis. In G3 (9 vessels), 0 vessel presented a severe stenosis, 1 (11%) an intermediate one, and 8 (89%) no significant stenosis. Conclusions: Intermediate (50%<stenosis<70%) and severe (≥70%) stenosis were significant in 11 patients. Mean age in this group was 64±11 years and 6 males:4 females. The ratio of patients with diabetes: nondiabetic was 4:7. Among these patients, 8 patients (73%) had a history of MI (chronic or acute). The prevalence of risk factors was as follows: 39% NYHA class III/IV, 30% smoking, 30% hypertension, 27% hypercholesterolemia, 27% obesity, 24% diabetes mellitus, 24% previous MI, 20% family history in 1st degree relatives, 18% current smokers, 15% with a previous history of MI, and 15% previous smokers. The prevalence of the following medications was as follows: 81% were on aspirin, 72% on statins, 71% were on β blockers, 61% on angiotensin-converting enzyme (ACE) inhibitors, 41% on diuretics, 41% on nitrates, 30% on calcium channel blockers, 24% on angiotensin II (AT II) receptor blockers, 15% on angiotensin II receptor blockers, and 10% on angiotensin II receptor blockers. The prevalence of revascularization was 50% (20% vein grafts, 50% percutaneous). Perfusion defects were graded using the summed stress score (SSS) and a-ventricular ejection fraction. Materials and methods The study comprised 540 consecutive patients who underwent a CT attenuation corrected (99mTc-sestamibi) myocardial perfusion imaging protocol with either ergometer bicycle- or pharmacological stress. Patients were referred to MPI by a cardiologist if they had an equivocal risk of ischemic heart disease (IHD), had a history of IHD with renewed suspicion of ischemia, or prior to renal transplantation because of chronic renal insufficiency. A total of 318 patients were included on the basis of a normal myocardial perfusion distribution, a normal left ventricular ejection fraction (LVEF), and a successful assessment of CACS. Data on patient risk factors, history, and events were retrieved from hospital files. Evaluated risk factors were: CACS ≥ 400 male gender, family history of coronary artery disease, hypertension, chronic renal insufficiency, diabetes, smoking, age > 63 years, known IHD, inability to perform ergometer bicycle stress, and hypercholesterolemia. Median follow-up time was 980 days. End points were myocardial infarction or need for revascularisation of significant coronary artery stenosis, among 11 patients were referred for death. Results: CACS ≥ 400 in 256 patients (81%) and ≥ 400 in 62 patients. The annualized event rate of ischemic events or death was higher in the group of patients with CACS ≥ 400 (6.6%) compared to patients with CACS 0-399 (1.5%). When comparing ischemic events only the event rate was 4.6% and 0.9% in patients with CACS ≥ 400 and CACS 0-399 respectively. Cox regression analysis showed that CACS ≥ 400 (RR 3.4, p = 0.011, CI 1.3 to 9.0) and inability to perform ergometer bicycle stress (RR 4.8, p = 0.036, CI 1.1 to 21.4) were the most powerful predictors of ischemic events or death, whereas CACS ≥ 400 (RR 4.0, p = 0.034, CI 1.1 to 14.2), diabetes (RR 5.1, p = 0.016, CI 1.4 to 19.0), and male gender (RR 3.8, p = 0.059, CI 0.95 to 15.1) were the most powerful predictors of ischemic events only. Conclusion: CAC ≥ 400 is an important risk factor for ischemic events and death or ischemic events only in patients despite normal MPI and LVEF. CACS should subsequently be considered performed alongside MPI procedure.

OP142 Impact of glycosylated hemoglobin (HbA1C) on extent of perfusion abnormalities and left ventricular dysfunction on gated myocardial perfusion imaging and clinical outcomes in diabetics.

N. Fatima1, M. u. Zaman2, M. ishaq3, D. J. Baloch3, 1Karachi Institute of Radiotherapy and Nuclear Medicine, Karachi, PAKISTAN, 2The Aga Khan University Hospital, Karachi, PAKISTAN, 3Karachi Institute of Heart Diseases (KIHD), Karachi, PAKISTAN.

Objectives: Aim of this study was to find out impact of glycosylated hemoglobin (HbA1C) on extent of perfusion abnormalities and left ventricular dysfunction on GMPi and clinical outcomes in diabetics. Material & methods: This is a prospective study conducted at Karachi Institute of Heart Diseases (KIHD) from January '09 to December '11. Total 1013 (457 diabetic: 556 non-diabetics control) were included, among diabetic cohort 254 (56%) males and 203 (44%) were females, with a mean age of 58 ± 9 years. Mean duration of diabetes, HbA1C and fasting blood sugar (FBS) were 13.6 ± 89 months, 7.6% ± 1.7 and 137 ± 48 mg/dl respectively. Hypertension, dyslipidemia, positive family history for CAD and smoking was found in 73%, 26%, 35% and 15% respectively. GMPI was performed with exercise (54%) or dipyridamole stress (46%). GMPI was evaluated for size and severity of perfusion defects, transient ischemic dilatation ratio (>1.22), and left ventricle ejection fraction (LVEF) using commercial software (Autoquant®). Coronary angiography (CA) was used as gold standard in patients with positive GMPI ± 2 months of GMPi. All these patients were followed up for period of 22 months (12-24 months).

Results: In diabetics: non-diabetics control, GMPI was normal (49%:68%; p<0.0001), fixed (21%:16%; p=0.049), reversible (30%:16%; p=0.0001) with TID (19%:10%; p=0.0001) respectively. ROC analysis revealed a diagnostic strength of HbA1C for CAD with each coronary arteries ≤0.873 with a sensitivity of 68.8% and specificity of 81.9% at a cut-off value of >7.3% (p value <0.0001). FBS and duration of diabetes was found to have poor diagnostic strength (p value >0.05). On the basis of criterion HbA1C, cohort was divided into those having value >7.3% (Group A) and those with ≤ 7.3% (Group B). In group A: B, incidence of fixed (33%:99%; p=0.0011), reversible (41%:22%; p=0.0001), sum stress score (62±5±2; p=0.0001) and sum thickness score (388±326; p<0.0001), 5LVEF(53 ± 16: 58±11; p = 0.003) with TID (32%;8%; p=0.0001) respectively. Kaplan Meier survival curves revealed event free survival for fatal MI 97.2%/98.3% (p value 0.742) and for nonfatal MI 87.1%/97.9% (p<0.05) for group A and B respectively. Conclusions: We conclude that incidence of CAD is significantly higher in diabetics than non-diabetics. HbA1C but not FBS and duration of diabetes is a reliable predictor for CAD. Extent and severity of perfusion defects, LV dysfunction and incidence of non-fatal MIs are more prevalent at a HbA1C>7.3%.
Acute myocardial infarction (AMI), using myocardial perfusion gated-SPECT (gSPECT). Method. Forty patients (mean age 61.5 years, 8 women) with AMI and primary PCI were prospectively included. They underwent two gSPECT: the first one consisted in the injection of 800 MBq of 99mTc-tetrofosmin prior to the PCI procedure. The first study (gSPECT-1) was performed when patient was considered stable immediately after PCI procedure. The second study (gSPECT-2) was performed between the fourth and fifth week following AMI. The area of real MR was quantified by assessing the perfusion defect in gSPECT-1, while the SM was measured by the difference between the MR area and the area of necrosis in gSPECT-2. The MR area in gSPECT-2 was calculated by analysing the discordance between the extension of the perfusion defect and the left ventricular motility defect. Quantification of left ventricular perfusion defects, wall motion, wall thickening, ejection fraction and ventricular volumes were assessed using the QGS software. Results. A significant improvement in perfusion, wall motion, thickening and left ventricular ejection fraction was observed (p<0.001). Although the two gSPECTs were performed by a same professional. Conclusion: Gated myocardial perfusion gSPECT performed one month after early PCI in a first AMI can be used to establish an estimate of MR and SM areas.

**OP146**
Ischemia but not necrosis is a predictor of post-stress LVEF drop 6 months after myocardial infarction: a gated myocardial perfusion SPECT study.

C. Guenancia1, A. Cochez2, L. Lorigis3, K. Stamboul1, O. Humbert1, M. Zalcko1, Y. Cottin1, University Hospital, Dijon, France; 2Centre Georges-François Leclerc, DIJON, FRANCE.

**Objective.** To compare the extent of the ischemia and necrosis, established by necropsy analysis, with the transmurality extent of the perfusion defects on gated-SPECT images. The study was prospective, observational, and monocentric. Patients who underwent a first anterior myocardial infarction were included. At necropsy, the transmurality extent of the ischemic and necrotic areas were evaluated by the pathologist. The extent of the perfusion defects was analyzed on the gated-SPECT images by the observers. The observers had no access to the results of the neutropsy analysis. The transmurality extent of the ischemic and necrotic areas were compared with the extent of the perfusion defects on gated-SPECT images. The results were expressed as percentage of the left ventricular area.

**Methods.** Among the 81 patients who had undergone a first anterior myocardial infarction, 20 patients who underwent a post mortem study were included. The extent of the ischemic and necrotic areas were evaluated by the pathologist. The extent of the perfusion defects was analyzed on the gated-SPECT images by the observers. The observers had no access to the results of the neutropsy analysis. The transmurality extent of the ischemic and necrotic areas were compared with the extent of the perfusion defects on gated-SPECT images. The results were expressed as percentage of the left ventricular area.

**Results.** The extent of the ischemic and necrotic areas were significantly larger than the extent of the perfusion defects on gated-SPECT images. The correlation between the extent of the ischemic and necrotic areas and the extent of the perfusion defects on gated-SPECT images was poor (r=0.12, p=0.22).

**Conclusion.** The transmurality extent of the ischemic and necrotic areas are significantly larger than the extent of the perfusion defects on gated-SPECT images. The correlation between the extent of the ischemic and necrotic areas and the extent of the perfusion defects on gated-SPECT images is poor. The extent of the perfusion defects on gated-SPECT images is not a reliable predictor of the extent of the ischemic and necrotic areas.

**OP147**
Estimation of myocardium at risk and saved myocardium using myocardial perfusion gated-SPECT practiced one month after infarction

L. M. G. Sanchez, Santiago Aguadé-Bruix, Guillermo Romero-Farina, Nazarena Pizzé, Gemma Cuberas, Gustavo de León; Hospital Universitari Vall Hebron, Barcelona, Spain.

Objective. To estimate myocardium at risk (MR) and saved myocardium (SM) following percutaneous coronary revascularization (PCR) in patients with a first acute myocardial infarction (AMI), using myocardial perfusion gated-SPECT (gSPECT). Method. Forty patients (mean age 61.5 years, 8 women) with AMI and primary PCI were prospectively included. They underwent two gSPECT: the first one consisted in the injection of 800 MBq of 99mTc-tetrofosmin prior to the PCI procedure. The first study (gSPECT-1) was performed when patient was considered stable immediately after PCI procedure. The second study (gSPECT-2) was performed between the fourth and fifth week following AMI. The area of real MR was quantified by assessing the perfusion defect in gSPECT-1, while the SM was measured by the difference between the MR area and the area of necrosis in gSPECT-2. The MR area in gSPECT-2 was calculated by analysing the discordance between the extension of the perfusion defect and the left ventricular motility defect. Quantification of left ventricular perfusion defects, wall motion, wall thickening, ejection fraction and ventricular volumes were assessed using the QGS software. Results. A significant improvement in perfusion, wall motion, thickening and left ventricular ejection fraction was observed (p<0.001). Although the two gSPECTs were performed by same professional. Conclusion: Gated myocardial perfusion gSPECT performed one month after early PCI in a first AMI can be used to establish an estimate of MR and SM areas.

**OP148a**
Introduction

G. Janetschek, Austria

**OP148b**
PET/CT in Patients with Biochemical Recurrence after Primary Therapy

B. Krause, Germany

**OP149**
Salvage Therapy Options: Urology

B. Tombal, Belgium

**OP150**
Salvage Therapy Options: Radiation Oncology

V. Kho, United Kingdom

### Symposium 4 - EANM/EAU Joint Session: Diagnostics and Therapy in Patients with Biochemical Recurrence after Primary Therapy

1. **OP148a**
Introduction

G. Janetschek, Austria

2. **OP148b**
PET/CT in Patients with Biochemical Recurrence after Primary Therapy

B. Krause, Germany

3. **OP149**
Salvage Therapy Options: Urology

B. Tombal, Belgium

4. **OP150**
Salvage Therapy Options: Radiation Oncology

V. Kho, United Kingdom

**OP151**
Quantification and Whole-Body Distribution of a Novel Dopamine D2/D3 Receptor Agonist, [18F]MCL-524, in Monkeys: A Prediction for Application in Human Subjects

S. J. Finnema1, V. Stepanov2, R. Nakao3, N. Amini1, A. W. Sromek2, J. L. Neumeyer2, P. Seeman1, M. G. Stabin3, L. Fattie3, C. Hallidin2; Karolinska Institutet, Stockholm, Sweden; 2McLean Hospital/Harvard Medical School, Belmont, MA, United States; 3University of Toronto, Toronto, ON, Canada; 4Vanderbilt University, Nashville, TN, United States.

**Aim:** A fluorine-18 radiolabeled dopamine D2/D3 receptors agonist PET radioligand may be the optimal tool for investigation of the interaction between radioligand binding, endogenous dopamine and receptor trafficking in man. We recently reported the initial radiochemistry development of the promising agonist [18F]MCL-524 [1]. In the current study we performed a quantitative analysis of [18F]MCL-524 binding to central D2/D3 receptors and a whole body distribution study in nonhuman primates. Materials and Methods: A total of eight PET measurements were performed on six experimental days in four cynomolgus monkeys. Two monkeys were studied on two experimental days each using a HRRT PET system. On the first day two baseline PET measurements were performed after i.v. injection of respectively [18F]MCL-524 and [18F]MCL-524. Arterial blood was obtained for