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Real-time myocardial contrast echocardiography as a useful tool to select candidates for coronary revascularization among patients with end-stage renal disease – a 3-year follow-up study

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ABSTRACT

Purpose: To evaluate a real-time myocardial contrast echocardiography (MCE) as a tool to select candidates for coronary revascularization among patients with ESRD and to assess the rate of revascularization and mortality.
Material / Methods: 58 ESRD patients were screened for CAD using MCE. We analyzed the rate of coronary revascularization during 3-year follow-up. Patients with and without perfusion disturbances on MCE were compared.
Results: CAD was found in 46.2% patients out of 39 who underwent coronary angiography. 11 (39.3%) patients out of 28 from the group with perfusion defects on MCE underwent revascularization procedure (21.4% - PCI, 17.9% - CABG). No one from the group without perfusion defects had revascularization procedure. Perfusion defect (OR 1.37 CI 1.37-1.86, p=0.022) was related to revascularization in multivariant analysis (OR 12.87, CI 1.86-89.21, p=0.025). There was no difference in mortality between the group which underwent invasive procedures and treated conservatively (p=0.6643). In ROC analysis defects on MCE and CAD on angiography were equally good in anticipating combined end-point (AUC 0.716, CI 95% 0.544-0.851 and AUC 0.747, CI 95% 0.577-0.875, p=0.701) and death (AUC 0.752, CI 95% 0.582-0.878 and AUC 0.729, CI 95% 0.558-0.861, p=0.805).
Conclusions: Our results indicate that MCE is a safe and uncomplicated method which may help along with other methods to select candidates for coronary revascularization among ESRD patients. In our study coronary revascularization procedures were successful but they did not improve patients' survival on 3-year follow-up.

Key words: myocardial contrast echocardiography, coronary artery disease, coronary revascularization, ESRD, 3-year mortality

INTRODUCTION

Coronary artery disease (CAD) is a leading cause of death in patients with end stage renal disease (ESRD) accounting for about 40% of total mortality [1]. The high prevalence of CAD results in a rising number of dialysis patients requiring myocardial revascularization. Little is known regarding revascularization in patients with chronic kidney disease (CKD). Furthermore there is no optimal strategy for the assessment of cardiovascular risk and selection of candidates for coronary revascularization. Routine screening for CAD in asymptomatic ESRD patients is usually done only for renal transplant candidates [2]. Clinical evaluation as well as noninvasive screening tests for CAD have numerous limitations.

Patients with CKD may potentially benefit from coronary

artery bypass grafts (CABG) and percutaneous coronary intervention (PCI) although both methods in patients with CKD are associated with lower procedural success and increased periprocedural complications [3].

Thus, there is a place for a novel, non-invasive first-line test in CAD which may be safely used in ESRD patients. Myocardial contrast echocardiography (MCE) is a bedside technique recently applied for assessment of myocardial perfusion. In patients with ESRD utility of MCE was previously investigated only by our group [4-6]**.** There is no published data concerning utility of MCE in selection of candidates for coronary revascularization among patients with ESRD.

The aim of the study was to evaluate real-time myocardial contrast echocardiography as a tool to select candidates for coronary revascularization among patients with ESRD and to assess the rate, results of revascularization and mortality in this particular population.

MATERIAL AND METHODS

Between January 2005 and October 2007 fifty eight ESRD patients, (21 women) mean age 59 ± 14 years, on regular dialysis were prospectively screened for CAD. Chest pain was a main indication for the evaluation. No urgent cases with suspected acute coronary syndromes were enrolled in the study. At the study entry medical history was recorded and all patients underwent physical examination, resting ECG and routine transthoracic echocardiography and real-time perfusion myocardial contrast echocardiography as the experimental test. Thirty nine patients out of 59 underwent coronary angiography. The other patients did not give their informed consent for angiography mainly due to fear of invasive investigations and possible complications.

We analyzed the rate and kind of coronary revascularization among ESRD patients. Moreover during a 3-year follow-up period mortality, composite end-point (including death, cardiac arrest, myocardial infarction, stroke, hospitalization for cardiac reasons) as well as renal transplantation rate were assessed.

The study complies with the Declaration of Helsinki. The study protocol was approved by local ethics committee and informed consent was obtained from all subjects participating in the study.

Transthoracic echocardiography

All studies were performed using the Philips Ultrasound System Sonos 5500 equipped for harmonic imaging and 3.6 MHz transducer. Baseline fundamental imaging was used to evaluate baseline global and regional wall motion score indexes using the 17 segment model prior to myocardial contrast echocardiography according to the recommendations of the American and European Societies of Echocardiography [7]. For each wall segment, motion was scored as 1 (normal), 2 (hypokinetic), 3 (akinetic), 4 (dyskinetic). Left ventricular ejection fraction (LVEF) was derived using the bi-plane method. Wall motion score index (WMSI) was obtained by dividing the sum of the segment scores by the number of segments scored. All measurements were derived in blinded fashion by two experienced operators.

Myocardial contrast echocardiography

Baseline echocardiographic examination and real-time perfusion MCE were done on the same day prior to coronary angiography. Instrument setting was described previously [4]. Optison (Amersham, USA) containing perfluorocarbon and SonoVue (Bracco, Italy) containing sulfur hexafluoride encapsulated in an albumin or a phospholipid shell respectively was administered via a peripheral vein. The dose of 1 ml for each echocardiographic view was followed by 10 ml saline flushed through. The criterion for MCE was defined as homogenous enhancement in 50% of wall thickness in each segment. Perfusion assessment was qualitative (two perfusion patterns: 0 and 1). Adequate myocardial perfusion was scored when the segment showed homogeneous opacification in at least one view. Lack of opacification was scored as low myocardial enhancement and regarded as myocardial perfusion defects. Perfusion assessment was performed using harmonic imaging in either four or two chamber apical view.

Echocardiographic images were digitally stored in a sine loop format for off-line analysis by 2 experienced observers. Discrepancies were resolved by consensus.

MCE was performed independent of coronary angiography, and its results did not interfere with the decision to undergo revascularization.

Coronary angiography

Coronary angiography was performed by injection of contrast medium (low osmolarity, low viscosity) via 6 F catheters after 200 micrograms of ICGTN, filmed at 12.5 frames/s. The procedure was done via femoral route by standard Judkins technique. Luminal stenosis more than 75% by diameter was regarded as significant (visual assessment).

Coronary revascularization

PCI

The angioplasty procedure was considered successful when a residual stenosis was <30%, in the absence of dissection and thrombosis. Contrast flow through the epicardial vessel was graded with the standard TIMI trial flow scale of 0 to 3. All angiograms were analyzed by 2 observers blinded to clinical and echocardiography results.

CABG

CABG was done using cardio-pulmonary by-pass graft. Revascularization was performed for each patient through a midline sternotomy. EuroSCORE was calculated for every patient not only CABG patients according to the standard additive method before an operation [8, 9].