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Multivessel Coronary Angioplasty with Drug Eluting Stents in a Chronically Hemodialyzed Diabetic Patient with Impaired Left Ventricular Systolic Function

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ABSTRACT

We present a case of staged multivessel percutaneous coronary intervention (PCI) with drug-eluting-stents (DES) in a diabetic patient with three-vessel coronary heart disease (CHD), dialysis-dependent chronic renal failure and impaired left ventricular (LV) systolic function. The optimal method of coronary revascularization in dialysis patients is controversial. Surgical treatment (CABG) is a high-risk procedure. CABG in the pre-DES era was associated with a better long-term prognosis, but at the cost of higher in-hospital mortality. PCI using DES may be a feasible therapeutic alternative. The revascularization strategy is reviewed.

CASE REPORT

A 50 year-old man admitted to our hospital with NYHA class III symptoms. He had no previous history of coronary heart disease (CHD) and had never experienced chest pain. He had a medical history of hypertension, insulin-dependent diabetes, and chronic renal failure that required hemodialysis the last two years. He had been a heavy smoker (40/daily) for 35 years. Blood pressure was 140/80 mmHg and heart rate was 92 beats/min. A twelve-lead ECG showed sinus rhythm, QS in V1-V3 and ST-T abnormalities in the inferior leads. Transthoracic echocardiography revealed hypokinesia of the anterior and inferior wall, akinesia of the apex and reduced systolic function with an estimated LV ejection fraction 35%.

Cardiac catheterization showed 3-vessel disease with an 80% proximal and a 70% stenosis distal stenoses in the left anterior descending (LAD) coronary artery. A 70% stenosis was shown in the left circumflex (LCx). In the right coronary artery (RCA) four stenoses were revealed, 80% proximally, 80%, and 70% in the mid segment and an 80% stenosis involving the bifurcation distally.

The patient had been under medical therapy with perindopril 2 mg p.o bid, carvedilol 6.25 mg bid, aspirin 100 mg qd, and nitrates and had shown a significant clinical improvement.

It was estimated, based on the EuroSCORE (European System for Cardiac Operative Risk Evaluation), that this patient had a high surgical risk (>6%), calculated at 9%. Based on this and considering also the preferences of the patient and his family, surgical treatment was not selected and a PCI with use of DES was scheduled.

An Intek (paclitaxel-eluting) stent 3.5 x 18 mm was implanted in the proximal stenosis of the LAD and a second Intek stent 2.5 x 10 mm in the distal lesion. An Omega stent (also paclitaxel-eluting) 3 x 15 mm was implanted in the LCx. Three Intek stents (3x10 mm/3.5x18 mm/3.5x28 mm) were implanted in the RCA together with a Cypher stent (3.5x8 mm). The patient was discharged with an optimal treatment for heart failure (HF), aspirin lifelong and clopidogrel for at least 12 months.

The patient was re-evaluated 3 months post PCI. Unfortunately he remained in NYHA III, with an unchanged LVEF 35%. However, it turned out that the patient had stopped taking his medications except for aspirin and clopidogrel.

DISCUSSION

Patients with chronic renal failure (CRF) constitute about 10% of all patients with CHD undergoing PCI. These patients have a higher rate of in-hospital and long-term major adverse cardiac events. The leading cause of death in chronic renal dialysis patients is cardiovascular disease (1). As the number of advanced renal failure patients increases, we are encountering more patients with severe ischemic heart disease requiring coronary intervention. The optimal method of coronary revascularization in dialysis patients is controversial.

Surgical treatment of these patients is a procedure of high risk as estimated with various well validated risk scoring systems. The EuroSCORE risk model on the basis of objective risk factors (patient-related, cardiac-related and operation-related factors) (Table 1) has been already extensively validated for the prediction of early mortality following open-heart surgery. Although there is evidence highly suggestive that additive EuroSCORE performance generally over-estimates mortality at lower EuroSCOREs (EuroSCORE≤6) and under-estimates mortality at higher EuroSCOREs (EuroSCORE>13), it is used worldwide and several studies have documented its role as a relevant predictor of immediate and late outcome after on-pump CABG (2). Based on EuroSCORE estimated peri-operative mortality risk is often unacceptably high in dialysis patients with multivessel CHD especially when LV systolic function is impaired or in an unstable/acute condition.

Several centers investigated the effectiveness and safety of different revascularization strategies in this challenging situation and their results were compared directly or indirectly. In the pre-DES era of PCI coronary stents improved prognosis in CRF patients, however long-term survival remained poor.

CABG was associated with a better long-term prognosis but at the cost of higher in-hospital mortality. In a large retrospective study from 1995 to 1998, dialysis patients in the United States had better long-term survival after CABG surgery than after PCI. The 2-year survival was 56.4±1.4% for CABG patients, 48.2±1.5% for PTCA patients, and 48.4± 2.0% for stent patients (p<0.0001) (1). In the ARTS trial a multivessel PCI with bare-metal stent (BMS) implantation was compared with bypass surgery for multivessel CHD in patients with renal insufficiency. At 5 years, there was no significant difference between the two groups in terms of mortality (14.5% in the stent group vs. 12.3% in the CABG group, P: 0.81), or combined endpoint of death, cerebrovascular accident (CVA), or myocardial infarction (MI) (30.4% in the stent group vs. 23.3% in the CABG group, p: 0.35). Among patients who survived without CVA or MI, 18.8% in the stent group underwent a second revascularization procedure when compared with 8.2% in the surgery group (p: 0.08). The event-free survival at 5 years was 50.7% in the stent group and 68.5% in the surgery group (p: 0.04). (3)

Although use of DES has revolutionized interventional cardiology minimizing in-stent restenosis the influence of their use on survival in patients with CRF is unknown. In a cohort of dialysis patients undergoing PCI, DES versus BMS implantation was associated with improved freedom from 1-year MACE (major cardiac events defined as death, myocardial infarction (MI) or any repeat revascularization procedure at 1-year follow up) [OR= 0.24, 95% CI 0.10-0.60; p: 0.002] (4) In ARTS II study a multivessel PCI was performed and the incidence of MACE, (death/MI/CVA, and revascularization at 1 year) was classified according to clinical presentation in the sirolimus eluting stents (SES) group and compared with the BMS or CABG groups of ARTS I. After adjustment for all confounders the MACE rate observed in the ARTS II remained consistently lower than that observed in the BMS group in stable (HR 0.45, 95% CI 0.16 - 0.58, p: 0.0004) or unstable patients (HR 0.43, 95% CI 0.18 - 0.99, p: 0.034),

TABLE 1. European System for Cardiac Operative Risk Evaluation /EuroSCORE

Patient-related factors	Cardiac-related factors
Age (years)	Unstable angina
Gender	LV function
Chronic pulmonary disease	Recent MI
Extracardiac arteriopathy	Pulmonary Hypertension
Neurological dysfunction	Operation-related factors
Previous Cardiac Surgery	Emergency
Creatinine > 200 µmol/ L	Other than isolated CABG
Active endocarditis	Surgery on thoracic aorta
Critical preoperative	Post infarct septal rupture

whereas it did not differ compared to the CABG group in stable (HR 2.38, 95% CI 0.33 - 16.7, p: 0.39) or unstable group (HR 0.33, 95% CI 0.03 - 3.22, p: 0.34) analyzed separately. The results from the use of SES in patients undergoing multivessel intervention are equivalent to the rate of major adverse events as compared with CABG treatment. (5)

PCI with DES implantation may be an effective reasonable safe revascularization procedure in patients with dialysis-dependent chronic renal failure. On the other hand, when LVEF is reduced in patients in dialysis with multivessel CHD, diabetic or not and, various degrees of stunning and hibernating myocardium (HM) and remodelling of the heart may exist and more complex diagnostic and therapeutic strategies are required. In this case any revascularization procedure (PCI or CABG) may be even more crucial and life saving.

The early stage of HM, when patients have only wall motion abnormalities and remodeling either has not occurred or is only minimal may reverse to normal (6) and thus may also be the "golden time" for revascularization of HM. With time, LV remodelling progressively increases and the amount of benefit of reverse remodeling may decline. So, early revascularization is of primary importance since the benefit is time sensitive and decreases with time and progression of remodeling (7). Bax et al. showed that after revascularization in stunned myocardium, contractile function improved significantly at 3 months, without further improvement at 14 months. In HM, contractile function improved at 3 months, with a further improvement at 14 months (8).

In everyday practice, HM and stunned myocardium often coexist and contribute to progressive systolic dysfunction, remodeling, and the development of HF. Up to 60% of ischemic LV dysfunction has been attributed to dysfunctional but viable myocardium, and thus, there is a potentially good opportunity to improve outcome in many patients.

A previous study by Samady et al. revealed that lack of improvement of global LVEF after CABG is not associated with poorer outcome compared with that of patients with improved LVEF, presumably because effective revascularization of ischemic myocardium, even without improvement in ventricular function, protects from future infarction, ventricular arrhythmias and death postoperative. These findings indicate that in patients with LV dysfunction, methods for assessment of myocardial viability that focus on predicting improvement of ventricular function after revascularization may underestimate the potential for symptomatic and survival benefit achieved by CABG (9).

Tarakji and co-workers in one of the largest cohorts of patients with advanced heart failure undergoing PET/FDG proved that among systolic heart failure patients referred for assessment of ischemia and viability with PET/FDG, early intervention [defined as any cardiac intervention (surgical or percutaneous) within the first 6 months of the PET/FDG

study] may be associated with improved survival irrespective of the degree of viability (10). In the Global Registry of Acute Coronary Events (GRACE) heart failure reduced in-hospital and 6-month survival across all ACS subsets, including patients with normal markers of necrosis. In-hospital revascularization was associated with lower 6-month death rates (14.0% versus 23.7%, p: 0.0001; adjusted hazard ratio, 0.5; 95% CI, 0.37 - 0.68, p: 0.0001) (11)

Although PCI addresses a focal stenosis, whereas CABG treats an entire myocardial segment there are many limitations of the observational studies evaluating the effect of revascularization and the predictive value of viability testing in patients with ischemic LV dysfunction especially in patients at high perioperative risk. Imaging and coronary interventional techniques especially in the DES-era have improved over time, and earlier series may not accurately predict current outcomes. On the other hand a surgical operative mortality ranging from 5% to 30% was observed in previous series depending on LV function and comorbidities (6).

PCI with DES implantation may be a feasible therapeutic alternative in patients with dialysis-dependent chronic renal failure and impaired LV systolic function at unacceptable high surgical risk.

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