Immediate and long-term results of coronary revascularization in patients undergoing chronic hemodialysis

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Abstract

Objective: To evaluate morbidity and long-term survival in end stage renal disease (ESRD) patients, undergoing coronary artery bypass graft surgery. Methods: We identified 22 such patients who underwent bypass grafting between 1987 and 1997. Symptomatic status of angina was rated using the classification of the Canadian Cardiovascular Society (CCS) and the functional status, was assessed using the Karnofsky scoring system. The patients were hemodialyzed the day before surgery and 24–48 h after surgery. Results: Two patients operated on for acute myocardial infarction died after 4 days. Follow-up was completed in the remaining 20 patients (the mean follow-up time was 25 ± 15 months). The survival rates at 1, 2 and 3 years was 84.5%, 74% and 59%, respectively. The symptoms diminished and the functional status was significantly improved. Conclusion: We conclude that elective coronary artery bypass in dialysis patients can be performed with acceptable morbidity and mortality. We advocate early surgical treatment. However, long-term survival is limited and this requires further investigation. © 1999 Elsevier Science B.V. All rights reserved.

Keywords: Coronary artery bypass grafting; Dialysis; End stage renal disease

1. Introduction

Myocardial infarction and other cardiac disorders such as pericarditis or bacterial endocarditis remain the leading causes of death in patients treated for end stage renal disease (ESRD) [1–3].

It is reported [4] that between 30% and 53% of deaths among long-term dialysis patients are due to coronary artery disease and the European Dialysis and Transplantation Association, reported increased rates of death due to coronary artery disease in dialytic patients in comparison with non-dialytic patients.

In Italy, [5] in 1996, 33% of patients treated for ESRD died from coronary artery disease, 18.5% from cachexy, 11.6% from ineffective disease and 10.6% from vascular problems. This outcome is probably due to dialysis-induced accelerated atherosclerosis or to risk factors associated with ESRD [6].

With growing numbers of older patients undergoing renal replacement therapy, the number of patients with severe renal disease who will present for cardiac surgery is likely to increase. The feasibility of general surgical procedures has been demonstrated in patients with chronic renal failure [7], but special attention is needed during procedures that require the use of cardiopulmonary bypass (CPB), for balance of fluid and electrolytes, adequate red cell mass, perioperative bleeding diathesis and time of perioperative dialysis. We retrospectively examined the outcome of patients with dialytic dependent renal failure who required surgical revascularization and the purpose of our study was to analyze perioperative morbidity and mortality, early and late functional outcome and long-term survival.

2. Patients and methods

We reviewed the records of all ESRD patients who needed cardiac surgery from June 1987 to March 1997 and identified 22 patients who underwent coronary artery bypass grafting (CABG).
Symptomatic status of angina was rated using the classification of the Canadian Cardiovascular Society (CCS) [8]. The functional status was assessed using the Karnofsky scoring system [9]: normal activity is considered 100%, inability to work and requiring some help scores 50% and requiring institutional care scores less than 40%. All patients underwent standard CPB at moderate hypothermia (30°C) with crystalloid cardioplegia and membrane oxygenator. Hemoconcentrator was used in ten cases. Aprotinin was given to all patients who underwent operation after 1990. All patients were dialysed the day before surgery and 2 days after surgery except patients with pulmonary capillary wedge pressure more than 18 mmHg or hyperkalemic ones who were dialysed also the day after surgery.

Twenty patients were operated on elective surgery and two in emergency for acute myocardial infarction in cardiogenic shock. Operative mortality was defined as a death within 30 days of surgery. Long-term follow-up data were collected from patients’ medical records through dialysis centres.

Follow-up was complete in all patients. Comparisons of group data were made by using chi-squared analysis. The results of survival rates are presented as an actuarial analysis with 0.95% confidence limits. Variables are expressed as mean ± SD.

3. Results

The characteristics of 22 dialysis patients are listed in Table 1. They had at least 44 months of dialysis with a mean duration of 54.4 months before operation. The variety of causes of renal failure are listed in Table 2.

The CPB time ranged from 56 to 233 min with a mean of 121 and the aortic cross-clamp time ranged from 25 to 155 min with a mean of 66 min, depending on the complexity of the procedure. Fourteen patients had three-vessel disease, and eight patients two-vessel disease. All patients had left main coronary artery disease; nine patients had diffuse coronary atherosclerosis with single stenosis more than 80%. Endarterectomy was performed in three patients. Both saphenous vein and internal mammary artery were used: the left internal mammary was used in 11 patients (50%). Ejection fraction was good in six patients (27.2%), fair in 12 (54.5%) and poor in four (18.1%). Six patients (27.2%) had CCS class IV, ten patients (45.4%) had class III and six patients (27.2%) had class II. Fourteen patients (63.6%) had previous myocardial infarction as documented by electrocardiogram.

Postoperative blood loss in patients treated with aprotinin was less than without aprotinin (390 ± 299 vs. 820 ± 320; P < 0.001); the perioperative use of red cell transfusion was high in all patients (5.6 ± 2.8) because the preoperative hematocrit was low (29.6 ± 3.8). Three patients were reoperated for bleeding (13.6%), respiratory failure occurred in four patients (18%), myocardial infarction in two (9.09%) and mediastinitis in one (4%).

Two patients operated on for acute myocardial infarction requiring intra-aortic balloon pump (IABP) preoperatively, died in Intensive Care after 4 days. Among the 20 patients who were alive at the time of hospital discharge, the total number of ICU days after operation was 3.5 ± 2.7 and the days spent in the hospital were 13.5 ± 6.

All survivors obtained good symptomatic relief after surgery and functional status as assessed by the Karnofsky scale increased significantly from 34 ± 15 preoperatively to 66 ± 7 at discharge (P < 0.01). Follow-up was complete in all survivors with a mean time of 25 ± 15 months (3–67 months). The survival rates based on all 20 patients discharged from the hospital at 1, 2 and 3 years were 84.5%, 74% and 59% respectively. One patient 15 months after bypass underwent successful renal transplantation and he is still alive after 118 months.

Eight patients died after discharge within 36 months: six died of ischemic heart disease or sudden cardiac arrest; death cause for the remaining two patients was unknown. The median time to death after discharge was 20 months (8–67 months).

4. Discussion

We initiated this retrospective study to evaluate our experience and examine risk factors associated with surgery in these patients. The first report of CABG in a patient with ESRD, was published by Menzoian and co-workers in 1974 [10]; since then, numerous reports have documented the
feasibility of CABG in patients with chronic renal disease [11,12]. These patients should be dialyzed prior to surgery, to obtain optimal fluid and electrolyte balance, but a lot of care is needed because the rapid shift in intravascular volume which occurs during hemodialysis, can cause severe hyper or hypotension and these situations may be fatal in patients with a critical coronary stenosis.

Anaemia, present in all patients, and bleeding tendency (renal patients have platelets dysfunction such as adhesion and aggregation deficiencies), increased transfusion rates, but the number of units infused correlated more to a low preoperative hematocrit than to postoperative blood loss because the use of aprotinin reduced blood loss [11,12].

We did not use internal mammary artery at the start of our experience because we were afraid of poor wound healing and increased bleeding due to platelet dysfunction in patients on renal dialysis. However, soon after, Blakeman [13] inferred that use of internal mammary artery in these patients was as safe as that of venous grafting and we started to use arterial conduits without increased morbidity. Patients with ESRF have multiple disorders (in our series, peripheral vascular occlusive disease was present in eight patients and diabetes in six) and hemodialysis accelerates the progression of atherosclerotic disease [6]. Six patients out of eight who died within 36 months presented extensive atherosclerotic lesions in native coronary arteries, poor run off and in two cases, need for endarterectomy. Since five of these patients had only vein grafts, it is difficult to say if early mortality was associated with the degree of atherosclerosis or with early graft occlusion.

In these patients, diffuse fatty degeneration, cloudy and swollen myocardial fibres and fibrosis are frequently seen, and these changes may be related to anaemia, hypertension and associated atherosclerosis [14]; elevated triglycerides and vascular calcification due to secondary hyperparathyroidism, may be contributing factors [15]. These patients have a greater incidence of systemic hypertension, diabetes mellitus and lower concentrations of protective high-density lipoprotein [16]. Additionally, an abnormal carbohydrate metabolism in diabetic patients (who are overrepresented in ESRD group) may also contribute to the development of hyperlipemia [17]. The question of long-term survival is more challenging; a small number of previous studies have examined long-term survival following CABG in patients with chronic renal failure and data must be interpreted with caution, because a lot of factors must be taken in consideration for the prognosis. Perioperative infarction is a factor of poor early prognosis; in our study, both patients with perioperative infarction, diagnosed by enzymatic changes, died within 8 months.

Two patients operated on in emergency for acute myocardial infarction and with perioperative IABP, died a few days after operation for low cardiac output, but this emergency was shown to be an independent predictor of perioperative mortality. In a recent study, Braxton and co-workers [18] referred that patients operated of CABG within the first 48 h after myocardial infarction had a 50% perioperative mortality, and that surgical mortality fell to 7.7% (without risk factors associated) after the first 48 h.

In the study of Ofsahl [19], patients undergoing CABG while on maintenance dialysis had 92% 1- and 2-year survival estimates rates; Batiuk [20] had a 95% and 77% one and two year probability of survival rates. Recently, Jahan-giri [12] presented a retrospective analysis of 19 dialysis patients who underwent coronary revascularization. In this study, the actuarial survival at 1, 2 and 3 years was 87%, 78% and 59%, respectively. Kaul [11] has reported survival rates similar to our results with a very long follow-up of 35 patients (not only CABG but also valve replacement). In our study, 1 and 2 year survival rates were 84.5% and 74% and 3 year actuarial survival was 59% and our figures are comparable with those of Kaul and Jahangiri but not with those of Ofsahl and Batiuk. Though it is difficult to compare data with other series because of different inclusion criteria, the only explanation for the differences is the observation that the mean duration of preoperative dialysis in our patients was 54.4 months instead of 19.2 and 45.7 in the other studies.

At any rates, it is difficult to say whether the recurrent coronary artery disease that mainly occurred in the left coronary artery in some patients after myocardial revascularization, was due to accelerate atherosclerosis or simply to an abundance of additive coronary risk factor.

An alternative treatment which may be considered is percutaneous transluminal coronary angioplasty (PTCA). Reusser [21] recently reported a retrospective cohort of 13 hemodialysis patients, matched with 13 non-hemodialysis patients, all of whom underwent PTCA. At 2 years, 50% of the dialysis group have had angina recurrence, myocardial infarction, death or bypass surgery, compared with 15% of the controls. The existence of calcified lesion in the target coronary artery resulted in poorer lesion success. Although the precise mechanisms initiating and maintaining restenosis are unknown, possibilities include abnormalities of platelet function with hyperaggregability and activation of plasma coagulation system after contact with the hemodialysis membrane. Kahan [22] concluded that although coronary angioplasty in ESRD is technically feasible,
restenosis limits the long-term benefit and thus bypass may be the preferred treatment in this patient population. The study of Ahmed [23] demonstrated a high rate of complications and poor long-term results. Rinehart [24] presented similarly results so PTCA does not appear to be an alternative to surgery in these patients.

In conclusion, CABG may be performed for patients in ESRD, the risk of mortality and morbidity is increased but acceptable. They have relief from angina with improvement in functional status. Since the best long-term survival results, as shown by previous studies [10], are correlated to a short period of dialysis before operation, we advocate early surgical treatment because CABG in these patients is associated with acceptable perioperative mortality and morbidity. The aim of surgical intervention in ESRD patients was to reduce the incidence of cardiac-related mortality resulting from myocardial infarction and according to a report [16], long-term survival is better when the duration of maintenance dialysis is shorter and when patients are free of left ventricular dysfunction. However, long-term survival is limited and this requires further investigation.

References