

Off-pump coronary artery bypass surgery in patients with chronic renal failure

Kronik böbrek yetmezlikli hastalarda "off-pump" koroner arter baypas cerrahisi

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ABSTRACT

Objective: Patients with dialysis-dependent renal disease frequently present with coronary artery disease. These patients are considered to be at high risk for coronary artery bypass grafting. Therefore, off-pump coronary artery surgery may become a good option for these patients. Off-pump coronary artery bypass surgery in patients with dialysis-dependent renal failure was retrospectively reviewed in this study.

Methods: From March 2001 through May 2005, we performed off-pump coronary bypass grafting in 10 patients with dialysis-dependent renal failure. Coronary artery bypass grafting was performed on beating heart in all of the patients. The patients were evaluated for perioperative variables and postoperative outcomes.

Results: Mean age was 58.7±8.9 years with a range between 45 to 76 years. Eight of the patients were male and two were female. No perioperative and postoperative deaths or ischemic cardiac events were observed. Anginal symptoms of the patients were relieved during the postoperative period. Functional status of the patients was improved postoperatively. None of the patients needed revision due to hemorrhage. Mean distal anastomosis number was 1.8±0.6. Mean intensive care unit stay was 1.8±0.8 days and hospital stay was 5.3±0.9 days.

Conclusion: Off-pump coronary artery bypass grafting can be performed with good clinical results. We believe that off-pump coronary revascularization is a good option in patients with dialysis-dependent renal failure. (*Anadolu Kardiyol Derg 2008; 8: 213-6*)

Key words: Off-pump coronary artery bypass, chronic renal failure, coronary artery disease

ÖZET

Amaç: Diyaliz bağımlı böbrek hastalığı olan hastalar sıklıkla koroner arter hastalığı ile başvurmaktadırlar. Bu hastalar koroner arter baypas greftleme için yüksek riskli olarak kabul edilmektedirler. Bu nedenle "off-pump" koroner arter cerrahisi bu hastalar için iyi bir seçenek olabilir. Bu çalışmada diyaliz bağımlı böbrek hastalığı olan hastalarda "off-pump" koroner arter baypas cerrahisi retrospektif olarak incelenmiştir.

Yöntemler: Mart 2001 ve Mayıs 2005 arasında diyaliz bağımlı böbrek yetmezliği olan 10 hastaya "off-pump" koroner arter baypas ameliyatı uygulanmıştır. Hastaların tümünde koroner arter baypas greftleme atan kalpte yapıldı. Hastalar perioperatif değişkenler ve postoperatif sonuçları yönünden incelendiler.

Bulgular: Yaş ortalaması 58.7±8.9 yıl olup 45 ile 76 arasında değişmekteydi. Hastaların sekizi erkek ikisi kadındı. Perioperatif veya postoperatif ölüm veya iskemik kardiyak olay gerçekleşmedi. Hastaların anjina yakınmaları postoperatif dönemde geriledi. Fonksiyonel kapasiteleri postoperatif dönemde düzeldi. Hiçbir hastaya kanama nedeniyle girişim gerekmedi. Ortalama distal anastomoz sayısı 1.8±0.6 idi. Ortalama yoğun bakım takip süresi 1.8±0.8 gün ve hastanede kalma süresi 5.3±0.9 gün idi.

Sonuç: "Off-pump" koroner arter baypas greftleme iyi klinik sonuçlarla uygulanabilmektedir. Diyaliz bağımlı böbrek yetmezliği olan hastalarda "off-pump" revaskülarizasyonun iyi bir seçenek olduğu düşüncesindeyiz. (*Anadolu Kardiyol Derg 2008; 8: 213-6*)

Anahtar kelimeler: "Off-pump" koroner arter baypas cerrahisi, kronik böbrek yetmezliği, koroner arter hastalığı

Introduction

The number of patients with dialysis-dependent renal disease and coronary artery disease has increased in recent years. Coronary artery disease is one of the major causes of deaths in dialysis depending patients (1). Coronary artery

bypass grafting (CABG) has become the standard treatment for coronary artery disease in this group, yet is still considered to have increased morbidity and mortality (1, 2). The aim of this study was to evaluate the early outcomes of off-pump coronary artery bypass grafting (OPCABG) in hemodialysis-dependent patients.

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Methods

The study is a retrospective, observational study. From March 2001 through May 2005, we performed OPCABG in 10 patients with dialysis-dependent renal failure. The OPCABG was routinely done to this specific group of patients during the study period. Mean age was 58.7±8.9 years with a range between 45 to 76 years. Preoperative data of the patients are represented in the Table 1.

The etiology of renal disease was diabetes in five patients, diabetes and hypertension in four patients and hypertension and amyloidosis in 1 patient. The mean left ventricular ejection fraction of the patients was 41±9% with a range of 25 to 50%.

The indication for surgery was Canadian Cardiovascular Society (CCS) grade III-IV angina that was unresponsive to medical treatment. Preoperatively, 4 patients were in New York Heart Association (NYHA) functional class II, and the remaining 6 were in NYHA class III-IV. All patients underwent a hemodialysis procedure 24 hours before the operation so that they would have optimal fluid-electrolyte and urea-creatinine values at the time of the surgery. Full revascularization was aimed in all of the patients. Before the initiation of the surgical procedure, the patients were introduced a central venous line for intravenous fluid and drug medication and an arterial line for arterial blood pressure monitoring and arterial blood gas analysis.

A balanced general anesthesia with endotracheal intubation was achieved by using midazolam, vecuronium, fentanyl, pentothal and isoflurane with the appropriate doses for the patients. All operations were performed through median sternotomy. Heparin was administered in order to attain an activated clotting time between 200 and 250 seconds. At the time of the surgery, optimal fluid balance was reached, and caution was taken not to administer excessive fluids. The OPCABG was performed in all patients. Starfish 2 Heart Positioner (Medtronic, Inc., Minneapolis, MN, USA) and Octopus 4 Tissue Stabilizer (Medtronic, Inc., Minneapolis, MN, USA) were used for stabilizing the anastomotic fields. Starfish 2 Heart Positioner was used for circumflex anastomosis. Left internal mammary artery to the left anterior descending coronary artery bypass was used in all of the patients. The other anastomoses were performed with saphenous vein grafts.

Postoperatively, according to potassium levels and urea-creatinine values, hemodialysis was performed. If these values were stable and central venous pressures were normal, hemodialysis was not done until 2nd postoperative day. Most of the patients had previously formed vascular access sites such as arteriovenous fistula prior to the operation, which made hemodialysis easy after the operation. Hemodialysis and if needed, ultrafiltration, were performed according to the biochemical and hemodynamic status of the patients.

The patients were evaluated for perioperative variables and postoperative outcomes.

Statistical analysis

Statistical analysis was done with SPSS 10.0 statistical software program (SPSS Inc, Chicago, IL, USA). Continuous variables were expressed as the mean±1 SD.

Results

No perioperative and postoperative deaths or ischemic cardiac events were observed after the operations. Mean distal anastomosis number was 1.8±0.6. All of the severely stenotic coronary arteries were revascularized during the procedure. We performed left anterior descending coronary artery bypass in 3 patients, circumflex and left anterior descending coronary artery bypass in one patient, circumflex, left anterior descending coronary artery and right coronary artery bypass in one patient, left anterior descending coronary artery and right coronary artery bypass in 5 patients. There was not a need for emergent conversion to cardiopulmonary bypass in any of the patients. The patients did not need positive inotropic support with catecholamines during and after the operations except for two patients who had poor left ventricular function. Even these patients had minimal inotropic support. Anginal symptoms were relieved in the postoperative period. Functional status of all patients was improved postoperatively. The mean preoperative hematocrit level was 35.9±2.8% (range; 32-42%) and the mean postoperative hematocrit level was 33.4±1.9% (range; 30-36%). The mean intraoperative blood loss was 305±95 ml. None of the patients needed revision due to hemorrhage. Maximal care was done for control of bleeding. Postoperatively, mean mediastinal drainage amount was 460±134 ml. A mean of 1.1±0.7 IU of packed red blood cells was administered to the patients. The mean duration of mechanical ventilation was 8.2±3.1 hours. Mean intensive care unit stay was 1.8±0.8 days and hospital stay was 5.3±0.9 days. None of the patients needed hemodialysis early in the first postoperative day except for one.

Discussion

Renal dysfunction is a predictor of increased morbidity and mortality after CABG, whether it is dialysis-dependent or not. Several studies have shown the efficacy of off-pump technique in reducing morbidity and mortality in patients with renal dysfunction (3).

The number of patients with dialysis-dependent renal disease and coronary artery disease has increased in recent years.

Table 1. Preoperative data of the patients

Parameters	Patients (n=10)
Male/Female, n	8/2
Mean age, years	58.7±8.9
Smoking, n (%)	7 (70)
Hypertension, n (%)	5 (50)
Hyperlipidemia, n (%)	3 (30)
Diabetes, n (%)	6 (60)
Family history for coronary artery disease, n (%)	2 (20)
Mean left ventricular ejection fraction, %	41±9
Mean preoperative creatinine, mg/dl	7.0±1.3
Mean preoperative blood urea nitrogen, mg/dl	88±35
Data are represented as Mean±SD and proportion/percentage	

Coronary artery disease causes 40-50% of deaths in dialysis dependent patients (1). Coronary artery bypass surgery has become widely performed for coronary artery disease in this group (1, 2). It improves patient's cardiac symptoms, quality of life, and overall functional status (4), but is still considered as a risky procedure due to increased morbidity and mortality up to 12% (1, 2). Whether CABG can be performed safely in renal failure patients, and how, have remained questions of great concern in recent years. Fluid overload and pulmonary congestion related to cardiopulmonary bypass, anemia, and the bleeding tendency in these patients are sources of worry for most surgeons (5, 6).

Complications after CABG are seen more often in end-stage renal failure patients than in other patients. Mostly chronic renal failure is caused by primary hypertension, diabetes mellitus, or both disorders. The atherosclerotic process follows an aggressive course in renal failure. The presence of hypertension, hyperlipidemia, and abnormal carbohydrate metabolism all contribute to this accelerated atherosclerosis (2). Accelerated atherosclerosis and diffuse cholesterol embolization produce cerebrovascular and visceral vascular complications (2, 7). The high percentage of preoperative myocardial infarctions in these patients, presence of triple-vessel disease and calcific arterial lesions all point to an accelerated progression of atherosclerotic disease (7). Many of the complications associated with CABG in dialysis patients may be related to use of cardiopulmonary bypass (CPB). Hemodialysis patients who undergo conventional CABG are at the risk of CPB-related complications such as bleeding, volume overload, and cerebrovascular accidents (1).

During CPB, there is a difficulty in maintaining the fluid-electrolyte balance in dialysis-dependent patients; and in dialysis dependent patients who have undergone CPB, there is greater risk of bleeding complications. The OPCABG minimizes these problems (8). We performed CABG on beating hearts in all our patients. We did not observe any deaths or operation-related morbidity in our study group. We suggest that OPCABG can be useful in the treatment of coronary artery disease in dialysis dependent patients. Postoperative ventilator support time, length of stay in intensive care unit and hospital were favorable. The patients had improved clinical status. Although heparin was not neutralized after the operations in order to prevent early occlusion, none of the patients needed revision due to hemorrhage. Besides, instead of fresh whole blood transfusion, the blood products such as erythrocyte suspension, thrombocyte suspension or fresh frozen plasma should be preferred for replacement in order to prevent fluid overload during and after the operations.

The prevalence and extent of vascular calcification increase rapidly with time on dialysis. Because of the association between severe vascular calcification and end stage renal disease, the risk of visceral ischemic may be even higher in patients undergoing chronic hemodialysis than the general population (9). These patients frequently present with an aggressive atherosclerotic process characterized by diffuse coronary artery disease. The off-pump approach shows better outcomes in the perioperative period than the use of CPB for revascularization. However, off-pump group does not improve survival over a control group with coronary artery disease who

did not have revascularization. This may be explained by significantly fewer grafts performed in the off-pump group. On the other hand, surgical revascularization using CPB increases the life expectancy of patients with end-stage renal disease and coronary artery disease compared with patients who had no interventions (10). This was also emphasized in other studies. Complete revascularization is of critical importance for better outcomes, which is a particular challenge in dialysis-dependent patients due to diffuse coronary sclerosis and the high number of patients with 3-vessel disease (11). However, full revascularization was achieved in our study population although the mean number of revascularized artery was small. We can consider that this shall probably not adversely affect the long term outcome in this study population. Extra-anatomic CABG procedures even with or without CPB are safe and reliable in patients with severely atherosclerotic (porcelain) ascending aorta to minimize the prevalence of perioperative stroke and systemic embolization (12). Therefore off-pump procedure with aortic no touch technique may yield less neurological complication in off-pump surgery in extendedly calcified vascular beds like in hemodialysis dependent patients. Complete all-arterial revascularization has been found to be lower in hemodialysis patients due to unsuitable radial artery and due to need of it as a future alternate for the internal shunt. However, OPCABG is found to reduce the operative risk and to increase life expectancy (13).

Study limitations

The major limitation of the study is absence of a control group. The low number of the patients is another limitation. The present study mainly concerned with the early operative and postoperative outcomes of the technique on a specific group of patients. Late postoperative outcomes of these patients should be addressed in another study.

Conclusion

Chronic renal failure increases the mortality and morbidity in patients undergoing coronary artery bypass surgery. Hemodialysis dependent patients who undergo conventional CABG are at risk of CPB-related complications such as bleeding, volume overload, and cerebrovascular accidents. We believe that off-pump coronary revascularization is a good alternative in patients with dialysis-dependent renal failure.

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