

## Cardiac Surgery in Patients with Impaired Renal Function

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**ABSTRACT.** Cardiac surgery in patients with impaired renal function carries higher risk than average. Several factors may contribute to deterioration in renal function post operatively. These include the nonpulsatile flow of cardiopulmonary bypass, hypothermia, and blood transfusion.

Several thousands of those patients have been operated upon with good results. This report describes our experience with those patients.

**KEY WORDS:** Cardiopulmonary bypass, Renal failure, Haemodialysis.

### Introduction

Between February, 1992, and October, 1993, one hundred and thirty patients underwent open cardiac surgery at Al-Hada Cardiac Center. Six patients (0.05%) had impaired renal function that ranged from mild to severe renal failure. In this report, we reviewed the perioperative course, the outcome, and the precautions needed to be taken for those patients.

### Patients and Methods

The demographic and clinical details of six patients with combined renal and car-

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diac disease are shown in Table 1. Five patients were admitted with unstable angina and following cardiac catheterization underwent coronary bypass grafting using the left internal mammary artery in three cases and only sphenous veins in the other two cases as one of them was 88 years old and the other one was an emergency operation. One patient was admitted with thrombosed mitral mechanical valve and underwent emergency thrombectomy after failure of thrombolysis therapy. The cause of renal failure was diabetic nephropathy in three, calcular in one, low cardiac output in one, and glomerulonephritis in the last patient. Only one patient was on chronic three times a week haemodialysis for two years before coronary surgery. All patients were seen and followed by the nephrologist. Careful and meticulous preoperative management of fluid, electrolyte, and bleeding tendencies were undertaken.

TABLE 1. The clinical details of the 6 patients with renal insufficiency who underwent cardiac surgery.

Patient no.	1	2	3	4	5	6
Age/sex	71 male	56 male	88 male	60 male	61 male	48 male
Diagnosis	I.H.D.*	I.H.D.	I.H.D.	I.H.D.	M.V. thombus	I.H.D.
Cause of RF*	Diabetic	Diabetic	Calcular	Glomerulo nephritis	Low cardiac output	Diabetic
Procedure	C.A.B.G.*	C.A.B.G.	C.A.B.G.	C.A.B.G.	M.V. thrombectomy	C.A.B.G.
Creatinine* preop.	216	185	155	1320	129	127
Creatinine postop. D.1	251	292	144	860	179	195
Creatinine postop. D.7	174	141	116	1070	86	136
Urea* preop.	23.7	12.1	8.4	35.6	15.9	6.4
Urea postop. D.1	22.7	13.9	13	23.8	18.7	10.3
Urea postop. D.7	19.7	11.2	11.9	39.6	8.7	8
I.P.P.V.*	12 hours	12 hours	18 hours	18 hours	15 hours	14 hours
Hospital stay	8 days	14 days	10 days	16 days	14 days	10 days
Follow up	3 months	12 months	7 months	8 months	2 months	6 months

Abbreviation

\*R.F. Renal failure, I.H.D. Ischaemic heart disease, C.A.B.G. Coronary artery bypass grafting, Creatinine in  $\mu\text{mol/l}$ , Urea in  $\mu\text{mol/l}$ , M.V. Mitral valve.

We used cefuroxime as a prophylactic antibiotic in all cases. The dose was adjusted according to kidney function. Intraoperatively, we monitored closely haemodynamics, arterial gases, electrolytes, and fluid balance before, during and after cardiopulmonary bypass to avoid hypotension, acidosis, hyperkalaemia, or fluid overload. The haemodialysis patient was dialysed on the day before and after surgery. Strict precautions were taken in positioning the patient to avoid compression on the arteriovenous fistula with subsequent thrombosis. We included a

haemofilter in the cardiopulmonary bypass circuit routinely in all our patients. Single venous cannula was used in five patients and double venous cannulation in the haemodialysis patient to achieve total bypass and to drain the cardioplegia via a right atriotomy and thus avoiding fluid and electrolyte overload.

Postoperatively, creatinine and urea were monitored closely (Table 1). Renal dose of dopamine (3-5 microgram/kg/minute) was used in all patients for the first 24 hours. Haemodialysis was done on the first postoperative day in the patient with the end stage chronic renal failure. This patient had bleeding 6 hours postoperatively which required re-exploration and haemostasis using fresh blood and fresh frozen plasma. The cause of bleeding was the pericardial adhesions, induced possibly by uraemic pericarditis and the coagulation deficiencies, including platelet dysfunction which are usually seen in these patients. This patient had also superficial wound infection which healed with local dressing. All the other five patients had no immediate postoperative complications. All patients had uneventful postoperative recovery, and were discharged home 8-16 days (average 12 days) postoperatively. During the period of outpatient follow-up, 2-12 months (average 6.3 months) there was no recurrence of cardiac symptoms and their renal function returned back to the preoperative levels with no further deterioration in five patients. The renal function of the patient with low cardiac output has actually improved and returned to normal values.

### Discussion

There is an association between coronary artery disease and renal disease because of similarity in some of the predisposing factors including atherosclerosis, diabetes mellitus, hypertension and hyperlipidaemia<sup>[1,2]</sup>. The combination of both diseases results in considerable morbidity and mortality that can be reduced by appropriate medical and surgical treatment. The incidence of cases with renal disease that will require coronary revascularization in our society is likely to increase.

Since patients with renal disease are more prone to accelerated atherosclerosis, arterial grafts are highly recommended and preferred over venous grafts in the coronary revascularization<sup>[3]</sup>. For valvular surgery, valve repair remains the best and safest procedure to avoid anticoagulation related complications of mechanical valves, calcification of tissue valves, and infection related to any prosthetic procedure, especially in renal patients who are usually immunosuppressed<sup>[4]</sup>.

Certain precautions have to be undertaken when operating on those patients to avoid further deterioration on the renal function and its metabolic consequences. Fluid and electrolyte balance, haemodynamics, arterial gases, drugs, blood urea, creatinine, and the local care of the arteriovenous fistula, when present are the main points to be looked after by the whole surgical team with cooperation of the nephrology and cardiology departments. The availability of haemofilter in the cardiopulmonary bypass circuit facilitates better adjustment of the fluid balance in these patients. The potassium load which results from cardioplegia administration can be diminished by the technique of double venous cannulation and draining the cardioplegia via a right atriotomy<sup>[5]</sup>.

The leading cause of death in renal failure patients is cardiovascular disease, estimated to be 36%<sup>[6]</sup> and this is attributed to accelerated atherosclerosis secondary to hypertension, hypertriglyceridemia, pericarditis, and hyperparathyroidism<sup>[7]</sup>. Nephrologists, cardiologists, and general physicians looking after renal patients have to consider this association to help with early diagnosis and management.

From this review, it appears that patients with mild and moderate renal impairment are likely to show a mild deterioration in their parameters during the immediate postoperative period, and this usually subsides over the ensuing days. The renal function in these patients may actually improve and return to normal, especially if the cause of renal impairment has been corrected by cardiac surgery as in patients who suffer from low cardiac output, as patient number 5. Patients with severe chronic disease on dialysis, as previously reported<sup>[8]</sup> can safely undergo cardiac surgery and usually require the dialysis to be considered in the perioperative period. Having their cardiac lesion corrected, these patients should improve symptomatically, have longer survival, and improved chances for renal transplant surgery.

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## جراحة القلب المفتوح في مرضى الفشل الكلوي

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المستخلص . في الفترة ما بين فبراير ١٩٩٢م وأكتوبر ١٩٩٣م أجريت مائة وثلاثون عملية قلب مفتوح في قسم جراحة القلب بمستشفى القوات المسلحة بالهدا . وشملت هذه المجموعة ٦ مرضى (٥٪) ممن يعانون من درجات متفاوتة من الفشل الكلوي .

وفي هذا البحث ، تمت مراجعة حالة هؤلاء المرضى قبل وأثناء وبعد جراحة القلب . وقد وجد أن هؤلاء المرضى يمكن إجراء عمليات قلب مفتوح لهم بدرجة أمان كافية بشرط اتخاذ الاحتياطات الكافية والمراقبة الطبية والمعملية الدقيقة والتدخل العلاجي المناسب والذي قد يشمل الغسيل الكلوي .