Volume : 3 | Issue : 4 | April 2014 • ISSN No 2277 - 8179

Research Paper

Medical Science

KEYWORDS : Acute renal dysfunction; Cardiac surgery; Risk factors

Risk Factors Assessment in Acute Renal Dysfunction Following Cardiac Surgery in Tirana, Albania

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ABSTRACT

Background. Acute kidney dysfunction (ARD) is a serious complication after cardiac surgery. It may require the use of renal replacement therapy. Many risk factors and algorithms are found.

Methods. Data from 72 cardiosurgery patients were collected. Age, diabetes mellitus, clamp and pump time, operation type, were studied. The patients were categorized into group 1: Patients with post operative normal kidney function and group 2: Patients with post operative ARD. All patients were followed with measurement serum creatinine post-operatively.

Results. ARD incidence was 13.9%. Mean age in group 1 was 60.95±9.52 and in group 2 was 63.00±10.7 years. There was not any significant correlation between duration of clamp time and post operation acute renal dysfunction. Fifteen patients (93.75%) of group 1 and one (6.25%) in group 2 were diabetic.

Conclusion. Acurate scoring algorithms should be available for prediction of post-cardiac surgery complications.

Introduction

Acute renal dusfunction (ARD) is considered as a serious complication of cardiac surgeries occurring in 1-30 % of patients and is associated with high morbidity and mortality. It is noted that 1-5% of these patients require renal replacement therapy.[1-3]On the other hand, it has been reported that a transient kidney dysfunction (i.e. decline in glomerular filtration rate) is a regular consequence of extracorporeal circulation.[4] ARD can arise from a variety of causes including intra operative such are hypotension or postoperative cardiac complications that impair renal perfusion, atheroemboli and exposure to contrast media. Other studies have demonstrated, a similar relationship between post operative ARD and a rise in preoperative serum creatinine.[3-5]

Other important independent risk factors for developing ARD are New York Heart Association functional class 4, emergency surgery, peripheral arterial disease, valve surgery and the need for preoperative intra-aortic balloon pump.[1-6] Advanced age, left ventricular ejection fraction less than 50% and diabetes mellitus were shown as risk factors generally associated with increased risk of renal failure.

As patients undergoing cardiac surgery at Hygeia Hospital Tirana, Albania, had commonly more than one of the above baseline risk factors, this study was performed to identify whether diabetes mellitus, type of operation, intensive care time and age were associated with increase in the risk of postoperative renal dysfunction among our patients.

Materials and Methods

According to the definition of the Society of Thoracic Surgery (STS), ARD was defined as an increase of serum creatinine >2 mg/dl with a minimum doubling of the preoperative valve, or a new requirement for renal replacement therapy. Clamp time was defined as a period of time between clamping of ascending aorta till releasing the clamp of the aorta and pump time was considered as duration of cardiopulmonary bypass. 72 patients referred at Cardiac Surgery Ward of Hygeia Hospital Tirana, from september 2011 and may 2012 were enrolled. End stage renal disease patients under routine hemodialysis and renal transplant recipients or patients with intra aortic balloon pump, were excluded from study. The variables measured at the baseline included history of diabetes mellitus, age, sex, weight, type of intervention, serum creatinine, etc. Serial measurements of serum creatinine were undertaken for all patients in an interval of 24 hours in the post-operative period during ICU admission. Clamp time and pump time (minutes) were also considered as intra-operative risk factors, and the type of operation was considered as an independent risk factor too. All operations were categorized in three groups including coronary artery bypass graft, valvular replacement, and their combinations (Table 1).

Table 1: Type of operations

Type of operation	No. (%)
CABG (Coronary artery bypass graft)	59 (81.9)
Valve Replacement	8 (11.2)
Valve & CABG	5 (6.9)

Statistical analysis was performed using SPSS program (version 16, Chicago, IL, USA). Wilcoxon's rank-sum and Mann-Whitney tests were used to compare continuous variables between patients with postoperative ARD. Pearson Chi-Square and student T tests were used to determine the relationship between the type of operation and postoperative renal dysfunction. All continuous variables were expressed as mean ± standard deviation. The results were considered statistically significant when p value was < 0.05.

Results

The mean age of patients was 61.30±9.7 years. The baseline plasma creatinine was 1.14±0.45 mg/dl. Demographic characteristics of the study group were shown in Table 2. The incidence of renal dysfunction among our patients was 13.9%. (Male: 55, female: 17). The patients were categorized in two groups including group 1: Patients with postoperative normal kidney function and group 2: Patients that developed ARD in the postoperative period. Mean age of patients in group 1 was 54.24±15.88 and in group 2 was 52.85±18.20 years (p=0.805).

Table 2: Demographic characteristics of the patients

Patients' characteristics	No. (%) or Mean±SD
Mean age (years)	61.3 ± 9.7
Male	55 (76.4%)
Female	17 (23.61%)
Weight (kg)	77.81 ± 14.66
Baseline creatinine (mg/dl)	1.15 ± 0.45
Diabetic patients	17 (23.6%)

There was not any significant correlation between duration of clamp time and postoperative ARD. Clamp time in group 1 was 69.82 ± 25.91 and in group 2 was 66.5±16.6 min. Duration of pump time in group 1 was 81.31±35.64 and in group 2 was 79.02±19.8 min. The difference was statistically significant (p=0.044).. Fifteen patients (93.75%) of the group 1 and one (6.25%) in group 2 were diabetic (p=0.021). (Table 3). The linear association between age and risk of developing acute renal dysfunction is shown in Figure 1.

Volume : 3 | Issue : 4 | April 2014 • ISSN No 2277 - 8179

Table 3: Relationships between variables of group 1 and group 2

Variables	Postoperative normal kidney function (Group 1)	Postoperative ARD (Group 2)	P value
Number	62	10	-
Male	46	9	-
Female	16	1	-
Age (years)	54.24±15.88	52.85±18.20	0.805
Diabetes mellitus	15	1	0.021
Pump time (min)	63.31±12.56	78.07±10.85	0.044
Clamp time (min)	51.49±11.88	53.48±13.40	0.506

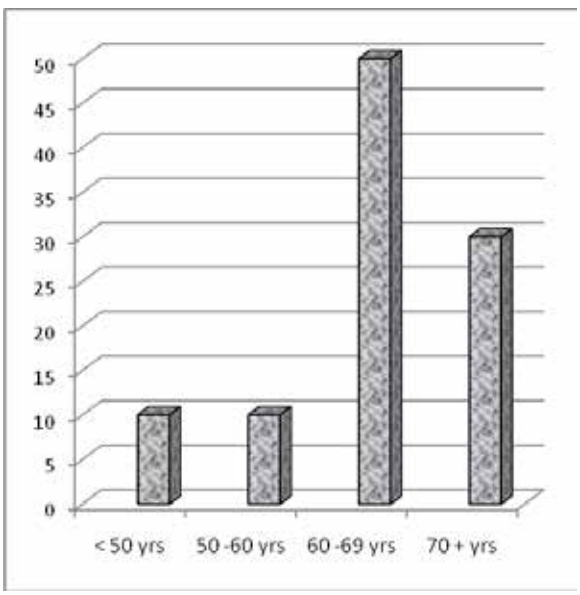

Figure 1. The linear association between age and risk of developing acute renal dysfunction (ARD) according to patients' age

Discussion

Post-cardiac surgery ARD is still a leading cause of morbidity, mortality, prolonged hospitalization and increase in the health care cost.[7] According to these studies, numerous variables were identified as risk factors for the development of ARD including age, male sex, diabetes mellitus, duration of bypass and aortic cross-clamping.[9,10] Thakar *et al.*,[6] developed a clinical score to predict ARD after cardiac surgery. In a cohort study of 24,773 patients,[1] Chertow *et al.* developed a risk stratification algorithm to estimate the risk and design interventions to improve the outcome. A large study designed a bed side tool for predicting the risk of postoperative ARD too.[8] Among our patients, no relationship between the age and development of postoperative renal dysfunction was noticed (p=0.805).

Effect of diabetes mellitus on postoperative ARD has been controversial. In some studies, diabetes mellitus is associated with the increase in risk of postoperative ARD, while others have failed to show this association.[11] In our study, diabetic patients had a higher incidence of postoperative ARD.

In this study, duration of pump time was significantly related to postoperative ARD, but there was not any significant correlation between duration of clamp time and postoperative ARD.

Several studies[1,6,8] reported the risk factors of postoperative ARD and predictive score charts were designed for prediction of postoperative complications such as Euro SCORE, Parsonnet score and Cleveland clinic score. These scoring systems might be beneficial for prediction of postoperative complications but their usefulness among our patients was unclear.

Although several scoring algorithms are available for prediction of post-cardiac surgery complications, these can also be matched with our patients' criteria enhancing their accuracy for our situation. Considering controversies, more studies still seem necessary to determine the risk factors of ARD after cardiac surgery.

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