

# FREQUENCY OF ACUTE KIDNEY INJURY IN PATIENTS UNDERGOING CORONARY ARTERY BYPASS GRAFTING

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## ABSTRACT

**Objective:** To find the frequency of acute kidney injury in patients undergoing coronary artery bypass grafting.

**Methodology:** The study was conducted in cardiovascular unit Lady Reading Hospital Peshawar. It was cross sectional study. Sampling technique was non probability convenient sampling. Data was collected from 20.2.2013 to 20.8.2013. Total 179 patients included in the study. All patients with known coronary artery disease were included in the study whom were planned for revascularization in the form of coronary artery bypass grafting (CABG). Post-operatively all patients' serum creatinine till 48th post op hour was observed to detect acute kidney injury. Acute Kidney Injury (AKI) was defined as more than 50 % or elevation of 0.3 mg/dl of creatinine level from base line.

**Results:** A total of 179 patients undergoing coronary artery bypass grafting were included in the study. Average age of the patients was 46.88 years  $\pm$  9.91 with range 20-60 years. Patients were divided into four groups according to age. The acute kidney injury after coronary artery bypass grafting was observed in 14 (7.82%) patients. Acute kidney injury was more common in old age and it was non significantly more common in male gender.

**Conclusion:** In spite of current highly advance cardiac surgery techniques and post operative care still there is high incidence of acute kidney injury following revascularization and subsequent worst outcomes.

**Key Words:** Coronary artery bypass grafting, Coronary artery disease, Acute kidney injury

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## INTRODUCTION

Coronary artery disease (CAD) is most frequently observed cardiovascular disease<sup>1</sup>, and it is estimated that approximately 7.6 million deaths occur worldwide each year due to coronary heart disease<sup>2</sup>.

Coronary artery bypass grafting (CABG) is a revascularization technique done in significant (>50%) stenosis of all major coronary trunks and their branches<sup>1</sup>. CABG improves both symptoms and survival<sup>1</sup>.

Several complications can occur in post CABG patients. These complications include cognitive decline in 20% to 70% patients<sup>3</sup>, Mediastinitis in 1.2%, severe renal insufficiency in 3%<sup>4</sup>, heart failure (6.8%), Atrioventricular blocks (3.4%), acute pulmonary embolism (1.7%), pneumonia and pleural effusion (5.1%) may occur<sup>5</sup>. Cerebrovascular accidents occur in 1.6 % patients<sup>6</sup>.

Acute kidney injury following cardiac surgery is one

of less common but very dangerous complication. Its incidence is 1% to 30% in different studies<sup>7</sup>. Patient with acute kidney injury who needs dialysis, is associated with high mortality up to 60%<sup>8</sup>. Even mild elevation of serum creatinine is associated with high risk of adverse outcomes<sup>8</sup>.

The pathogenesis of cardiac surgery-associated acute kidney injury (CSA-AKI) is complex which includes Toxic substances, metabolic factors, ischemia, reperfusion injury, neurohormonal imbalance, inflammation, and oxidative stress<sup>9</sup>. The end result of all these insults is tubular damage and loss of Glomerular filtration rate<sup>7,9</sup>. A proinflammatory status can result from cardiopulmonary bypass, ischemic and reperfusion injury, toxemia, and surgical trauma<sup>8</sup>, which can lead to CSA-AKI<sup>10</sup>.

Renal function is usually assessed by serum creatinine or estimated glomerular filtration rate (eGFR). It Has been found that, proteinuria is significantly associated with adverse cardiac events, renal disease progres-

sion and mortality<sup>11</sup>.

Ischemic heart disease is a common disease in our society and the quality of life is seriously disturbed for these patients subjecting them to coronary bypass surgery. AKI can occur following cardiac surgery and if not diagnosed and treated in time, it leads to further complications in these already compromised patients and also carries a high morbidity and mortality rates.

## METHODOLOGY

This was a descriptive cross sectional study performed in Cardiovascular Department Lady Reading Hospital Peshawar. Data was collected from 20<sup>th</sup> February 2013 to 20<sup>th</sup> August 2013 with a sample size of 179. Sampling technique was non probability consecutive. All patients who are admitted for CABG were included in the study. Patients who were having COPD with FEV1/FVC less than 70%, diabetes mellitus, chronic renal failure, rheumatic heart disease and history of stroke or gastroenteritis in the last one month. After informed consent all patients were worked up with detailed history and clinical examination followed by routine pre operative investigations along with serum creatinine. All the patients were put on next OT list for coronary artery bypass grafting as per ward protocols. All patients undergone standard coronary artery bypass grafting by same consultant cardiovascular surgeon having minimum of 7 years of experience. Postoperatively all patients serum creatinine till 48<sup>th</sup> post op. hour was observed to detect acute kidney injury. Acute Kidney Injury Network (AKIN) criteria, was used to define AKI as serum creatinine elevation  $\geq 1.5$  (50%) times than baseline or elevation of  $\geq 0.3$  mg/dl (measured in the hospital laboratory).

All information's were recorded in a pre designed proforma. Data analyzed on SPSS version 14. Mean  $\pm$  standard deviation were used for quantitative variables like age. Frequencies and percentages were used for categorical variables like gender and acute kidney injury. Results presented in the form of tables and graphs.

## RESULTS

A total of 179 patients undergoing coronary artery bypass grafting were included in the study. There were 111(62.01%) males and 68(37.99%) were females. Male

to female ratio was 1.63:1.

Average age of the patients was 46.88 years  $\pm 9.91$  with range 20-60 years. Patients divided in four groups according to their age and it was found that age group more than 50 years was common age group for patients undergoing CABG. Age distribution of the study population is shown in table 1.

The acute kidney injury after coronary artery bypass grafting was observed in 14 (7.82%) patients. Age wise distribution of acute kidney injury shows that acute kidney injury was more common in old age. The patients having age less than 30 years have acute kidney injury 5.9%, age group 30-40 years contain 8.3% acute kidney injury, 41-50 years age groups gave 4.7% acute kidney injury and patients having more than 50 years of age have 10.8% acute kidney injury after coronary artery bypass grafting. (Table 2)

Gender wise acute kidney injury in patients after coronary artery bypass grafting shows that male patients were having more common but non significant findings of acute kidney injury than Female patients. There was 9% acute kidney injury in male as compared to 5.8% in female patients. (Table 3)

## DISCUSSION

Patients with acute kidney injury (AKI) after coronary artery bypass graft (CABG) surgery are group of high risk patients who are more prone to atherosclerosis and cardiac complications. Patients with kidney disease are more prone to severe coronary artery disease and CABG<sup>12-14</sup>. In spite of high risk, patients with AKI and end stage renal disease are referred for coronary revascularization and CABG<sup>15</sup>.

Renal failure in patients undergoing CABG is associated with adverse outcomes<sup>16</sup>. Post operative decrease in cardiac output is a frequent cause of acute renal failure<sup>17</sup>. Various causes are responsible for renal failure in these patients which include, increased levels of circulating catecholamines, inflammatory substances release, macro and micro emboli adversely affecting kidney<sup>18,19</sup>. Previous studies shows that patients undergone cardiac surgery usually have increased renal vascular resistance, and significant decrease (25% to 75%) in renal blood flow and glomerular filtration rate<sup>20,21</sup>. In a

**Table 1: Age wise distribution of patients**

	NUMBER	PERCENT (%)
< 30 years	17	9.5
30 – 40 years	24	13.4
41 – 50 years	64	35.8
>50 years	74	41.3
TOTAL	179	100.0

**Table 2: Age wise distribution of acute kidney injury**

		ACUTE KIDNEY INJURY		TOTAL
		YES	NO	
age (in years)	<30	1	16	17
		5.9%	94.1%	100.0%
	30 – 40	2	22	24
		8.3%	91.7%	100.0%
	41 – 50	3	61	64
		4.7%	95.3%	100.0%
>50	8	66	74	
	10.8%	89.2%	100.0%	
TOTAL		14	165	179
		7.8%	92.2%	100.0%

**Table 3: Gender wise distribution of acute kidney injury**

		ACUTE KIDNEY INJURY		TOTAL
		YES	NO	
Gender	Male	10	101	111
		9%	91%	100.0%
	Female	4	64	68
		5.8%	94.2%	100.0%
TOTAL		14	165	179
		7.8%	92.2%	100.0%

study, the incidence of post-operative renal impairment varied from 3.5% to 31%<sup>22</sup>. The prognosis is usually very poor, with 28 to 64% mortality<sup>23</sup>. Chertow et al analysed a very large data set of more than 43000 patients undergoing cardiac surgery<sup>13</sup>. They found 1.1% cases of AKI in these patients, and found several risk factors for developing acute kidney injury. They proposed a risk scheme to predict risk of postoperative AKI which was later on assessed by Fortescue et al<sup>17</sup> in a smaller study of 8797 patients.

Ryden et al<sup>24</sup> found 13% frequency of acute renal failure post CABG patients in 27929 patients. In two studies with 843 and 649 patients undergoing cardiac surgery (mostly CABG), the incidence of ARF (defined as a rise in the serum creatinine of only 25%) was 17 and 24%<sup>25, 26</sup>.

In a review of over 51,000 CABG procedures performed from 1999 to 2002, the incidence of ARF was found to be 4 to 5%<sup>27</sup>. In a 2006 data analysis report from the Society of thoracic surgeon (STS), the incidence of ARF was 3.6% after isolated CABG, and 7.5 and 12.9% after CABG combined with aortic or mitral valve replacement, respectively<sup>22</sup>. This finding is similar to our findings of 7.8%. Sadighe et al<sup>28</sup> found 23 % frequency of acute kidney injury in their study. This wide variability of the results could be due to different criteria used

for diagnosis, the number and characteristics of centers involved in each study, the patients' features, and the size of the sample which may effects the outcomes of various studies.

It is still controversial whether or not age is important in predisposing to ARF. Some studies have found that ARF is more common with advance age group<sup>29</sup>. In a study by Sadighi et al<sup>28</sup>, the mean age of ARF patients was higher than that in the other group. We also found that acute kidney injury is more common with advanced age.

Regarding gender and acute kidney injury there is conflicting evidence. Some studies suggest that female gender is a risk factor for acute kidney injury in post CABG patients<sup>30</sup> but we found no statistical significant difference between male and female for development of acute kidney injury which is supported by Sadighi et al<sup>28</sup> who found that gender is not risk factor for development of AKI.

### STUDY LIMITATION

Our study had the limitation of choosing patients from a single center. Therefore, the generalization of the findings is limited. This should be tested in a large study involving multiple centers and focusing in differ-

ent gender and race.

## CONCLUSION

There is high incidence of acute kidney injury following revascularization and subsequent worst outcomes.

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### CONTRIBUTORS

SMAS conceived the idea, planned the study, and drafted the manuscript. I, AK and AS helped acquisition of data and did statistical analysis. AM and NU drafted the manuscript and critically revised the manuscript. RAK supervised the study. All authors contributed significantly to the submitted manuscript.