

Blood Urea Level After on Pump and Off Pump Coronary Artery Bypass Grafting

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Abstract:

AIM- To compare and analyze the variations in Blood Urea level during the pre and post-operative period in patients undergoing On-pump and Off-pump CABG.

SAMPLES- This observational comparative study was conducted among 242 patients (121 each group).

RESULTS- Blood urea level got elevated in both On-pump and Off-pump patient population post operatively

CONCLUSIONS- Randomized trials comparing blood urea level after on-pump and off-pump CABG have not demonstrated a consistent benefit of off-pump techniques.

Keywords: Off-pump CABG, On-pump CABG, Coronary Artery Disease

INTRODUCTION

Coronary Artery Bypass Graft Surgery (CABG), is the surgical procedure to restore normal blood flow to an obstructed coronary artery. It reroutes blood flow around a blockage in the coronary artery so that the heart muscles can maintain a good blood supply. Yusuf et al. reported that patients who underwent CABG had significantly lower mortality than those who opted for medical treatment ^[1]. Two alternative techniques are available to perform CABG. Either with the heart stopped, a procedure called “On-Pump beating” surgery or on a beating heart, a procedure called “Off-Pump beating” surgery. The only difference is that the heart is stopped using Cardioplegia for On-Pump Surgery, which is decided by the Surgeon at the time of surgery. There are a lot of physiological changes occurring throughout the body which can be different in these two techniques of doing CABG. On-pump CABG is the more traditional method of performing bypass surgery. However its resultant inflammatory effects cause renal dysfunction, gastrointestinal distress and cardiac abnormalities which have forced the surgeons to look for alternatives to the procedure ^[2]. Renal dysfunction is a well-recognized major complication after CABG, hence the parameter being used in this study is Blood urea level. The biological role of urea in chronic kidney disease and in the uraemic syndrome remains a matter of debate ^[3,4] The rationale of the study is to analyze and bring out different physiological variations, if any, between these two techniques of doing CABG and to find out if there is any benefit to On-pump in comparison to Off-pump CABG, in bringing out better physiological outcomes.

METHODOLOGY

STUDY DESIGN: Descriptive comparative design has been used for this study.

STUDY PERIOD: The study was conducted in between February 2020 to August 2020.

STUDY SETTING: The study was conducted at Department of Cardiovascular and Thoracic Surgery, Little Flower Hospital, Angamaly, Kerala.

POPULATION: A total of 242 samples with 121 in each group were analyzed in this study.

SAMPLING TECHNIQUE: Simple random sampling.

INCLUSION CRITERIA: Male and Female patients aged between 30-80 years of age, Willing participants, Patients not suffering with any other major complications.

EXCLUSION CRITERIA: Unwilling patients, Patients with any clinically significant valve diseases, Patients whose surgical technique could not be defined, Clinical reservations of the surgical team regarding patients with risk factor profiles that predisposed them to an extremely high risk of an adverse effect

STATISTICAL ANALYSIS: Kolmogrov smirnov test is used for normality tests. Variable with $p > 0.05$ is considered as normal. All variables in the group are equally distributed.

RESULTS:

Table 1: Distribution of urea in pretest- posttest assessment periods

Urea	Pre test		Post test	
	Frequency	Percentage	Frequency	Percentage
Low (<15 mg/dL)	3	2.5	6	5.0
Normal (15-40 mg/dL)	106	87.6	87	71.9
High (>40 mg/dL)	12	9.9	28	23.1
Total	121	100.0	121	100.0

Graph 1: Distribution of urea among pretest- posttest assessment periods

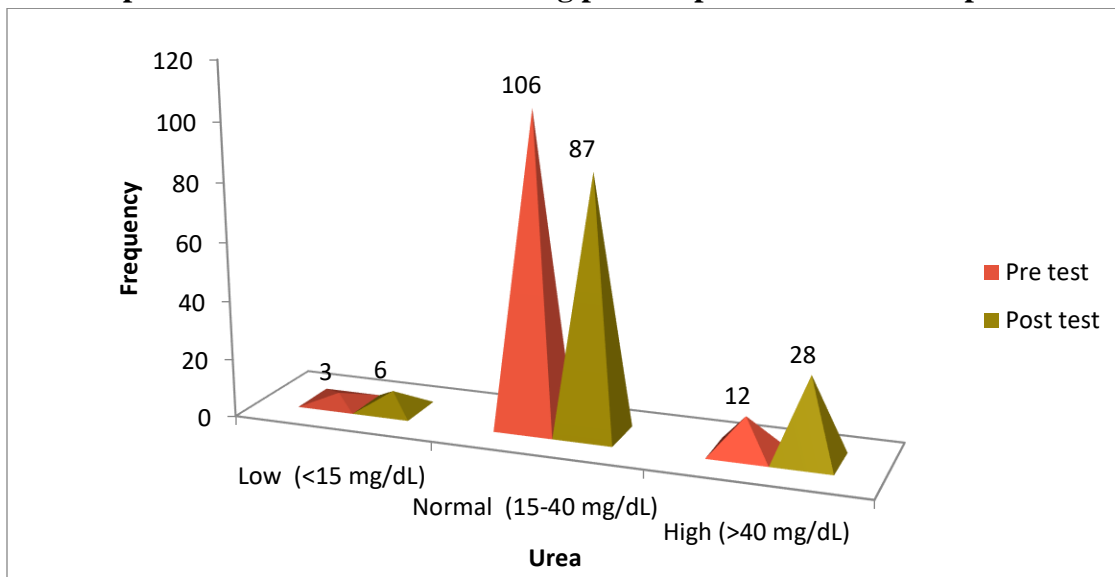


Table 1 shows the distribution of urea among the on-pump patient population. Level of urea can be divided into three as low, normal and high. In the pre-test period only 3 had low urea level and it becomes 6 in post-test period. The level of urea was normal in 106 patients in pre-test period and it reduced to 87 in post-test

period. Also level of urea was high in 12 patients in pre-test period and it was 28 in post-test period. Thus we can say that majority of the on-pump patient population had normal urea level.

Table 2: Pre & Post-test comparison of Urea among on-pump patients

UREA	Mean	Standard deviation	Z-Statistic*	P-Value**
Pre-test	26.19	11.51	-5.302	.000
Post-test	33.55	15.68		

*Wilcoxon Signed Ranks Test, **P<0.05 considered as statistically significant

Table 2 shows the pair wise comparison of urea among on pump patients. The mean urea level in the pre test period was 26.19±11.51 and it turns to 33.55±15.68 in the post op period. We can see an increase in the level of urea in the post operative period and the observed difference was highly statistically significant (p=.000). Thus we conclude that level of urea will increase in on pump patient population after the surgery and it was highly statistically significant (p=.000).

Table 3: Distribution of urea in pretest- posttest assessment periods

Urea	Pre test		Post test	
	Frequency	Percentage	Frequency	Percentage
Low (<15 mg/dL)	17	14.0	9	7.4
Normal (15-40 mg/dL)	104	86.0	95	78.5
High (>40 mg/dL)	0	0	17	14.0
Total	121	100.0	121	100.0

Graph 3: Distribution of urea among pretest- posttest assessment periods

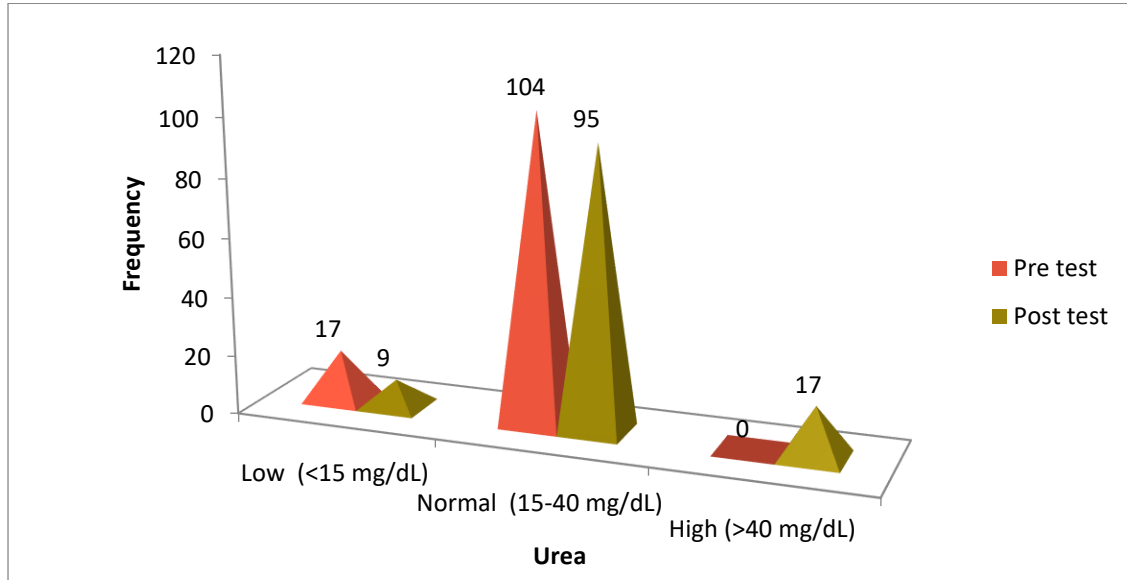


Table 3 shows the distribution of urea among the off-pump patient population. Level of urea can be divided into three as low, normal and high. In the pre test period only 17 had low urea level and it becomes 9 in post test period. The level of urea was normal in 104 patients in pre test period and it reduced to 86 in post test period. The level of urea is high for 17 patients in post test period. Thus we can say that majority of the off-pump patient population had normal urea level.

Table 4: Pre test –post test comparison of Urea among off-pump patients

UREA	Mean	Standard deviation	Z-Statistic*	P-Value**
Pre-test	20.7438	6.51604	-7.507	.000
Post-test	27.9835	15.75224		

*Wilcoxon Signed Ranks Test, **P<0.05 considered as statistically significant

Table 4 shows the pair wise comparison of urea among off pump patients. The mean urea level in the pre test period was 20.74±6.52 and it turns to 27.98±15.75 in the post op period. We can see an increase in the level of urea in the post operative period and the observed difference was highly statistically significant (p=.000). Thus we conclude that level of urea will increase in off pump patient population after the surgery.

Table 5: Comparison of urea between on-pump and off-pump patients

Urea	Mean	Standard deviation	Z statistic	P-Value
On-pump group	7.3636	14.31258	-.131	.895
Off-pump group	7.2397	14.99557		

*Mann whitney U test, p<0.05 considered as statistically significant

Table 5 shows between group comparison of urea among the on pump and off pump patient population. We had taken the pre-test post test difference of urea in each group and compare the mean difference. The mean difference among the on-pump patient population was 7.36 ± 14.31 mg/dL and off pump population had mean difference of 7.23 ± 14.99 mg/dL. The difference observed was not statistically significant ($p=.895$). Thus we conclude that there is no difference in urea among the on pump and off pump patient population.

DISCUSSION

This study was undertaken to analyze and compare the outcomes of physiological parameters among On-pump and Off-pump techniques of doing CABG. Randomized trials comparing on-pump versus off-pump CABG have not demonstrated a consistent benefit of off-pump techniques. In this study, both On-pump as well as Off-Pump CABG's were performed more among the patients within the age group of 51 to 70 years. And this is in accordance with a study conducted by Arun Natarajan that states that an increasing number of elderly individuals are now undergoing CABG, when maximal pharmacological treatment fails to limit the symptoms of dyspnea and angina ^[5]. In patients who underwent On-pump CABG, blood urea level got elevated postoperatively and it was highly statistically significant ($p=.000$). And also in patients who underwent Off-pump CABG, blood urea level got elevated postoperatively which was highly statistically significant ($p=.000$). When a comparison of blood urea level among on pump and off pump patient population was done, the mean difference among the on-pump patient population was 7.36 ± 14.31 mg/dL and off pump population had mean difference of 7.23 ± 14.99 mg/dL. The difference observed was not statistically significant ($p=.895$). Thus we conclude that there is no difference in urea among the on pump and off pump patient population. Gamoso et al. ^[6] showed that Off-pump surgery does not provide major protection from postoperative renal impairment when compared with CABG with On-pump. In their study, it is suggested that the reduction of renal risk alone should not be used as an indication for Off-pump over CABG. It is very well in accordance with our present study where no significant difference was noticed on postoperative serum Creatinine and Urea level among both the groups. Hence, as far as the parameter Blood Urea level is concerned, both On-pump as well as Off-pump techniques of doing bypass surgery proved to give uniform results post operatively and there was no significance noticed on one over other method. Thus this study figure out and validate the fact that even though Off pump techniques has got several advantages over On-pump technique like reduced myocardial injury, inflammatory response, postoperative morbidity etc. there was no significant difference noted when the parameter Blood Urea level is considered.

CONCLUSION

CABG being one of the most common types of cardiac surgery, lowers the risk of Myocardial Infarctions and patients can remain symptom free for as long as 10-15 years. Though this surgery became more common, there are 2 methods of performing CABG, and they are On-pump and Off-pump techniques. Recent studies reveals several advantages for Off-pump technique than performing On-pump technique. So the intention of this study was to analyze if there is any physiological significance of doing On-pump over Off-pump technique. The physiological parameter being considered in this study includes Blood urea level. Post CABG results of blood urea level showed almost similar outcomes among both the techniques of performing CABG

surgery. Thus, renal function is unaffected by the technique if CABG, whether with or without cardiopulmonary bypass, in spite of the theoretical advantage of off-pump surgery.

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