

Comparison of changes in creatinine values in heart failure patients pre and post angiography in the reduced with preserved ejection fraction group

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Abstract. *Background and aim:* Sudden changes in renal function are a common complication of coronary angiography, and percutaneous coronary intervention, especially due to contrast-induced acute kidney injury or contrast-induced nephropathy. Iodine contrast media is essential in invasive and interventional cardiac procedures. Increased use of contrast media, and an increasing number of invasive cardiac procedures performed on high-risk patients. This study aims to determine the comparison of changes in creatinine values of pre- and post-angiography patients in the HFrEF and HFpEF groups. *Methods:* Retrospective cohort with 85 samples of Heart Failure patients with HFrEF and HFpEF who underwent angiography. The data collection method uses secondary data, namely medical record data at the Integrated Heart Center of RSUP Dr. Wahidin Sudirohusodo. Statistical analysis used the Wilcoxon Signed Ranks Test and Mann-Whitney. Statistical test results are considered significant if the test p value is <0.05. *Results:* Comparison of pre and post angiography creatinine values in all study samples. There was a significant difference in mean creatinine values, namely post angiography, $1.06 + 0.45$ mg/dL compared to pre angiography, namely $1.00 + 0.40$ mg/dL ($p < 0.05$). HFrEF patients were found to have significantly higher creatinine values post angiography, $0.91 + 0.27$ mg/dL ($p < 0.05$). There were no significant results for pre-angiography creatinine values in HFrEF and HFpEF patients and post-angiography in HFrEF and HFpEF patients (0.062). *Conclusion:* HFrEF patients who underwent angiography experienced an increase in creatinine values after angiography. (www.actabiomedica.it)

Key words: angiography, HFrEF, HFpEF, creatinine

Introduction

Heart failure is a progressive health problem with high mortality and morbidity rates in developed and developing countries, including Indonesia. The prevalence of heart failure is estimated to increase by almost 46% until 2030 and approximately 50-75% of patients with heart failure die within 5 years of diagnosis (1-3).

The prevalence of heart failure in Indonesia in 2013 based on doctor's diagnosis was 0.13% or estimated at around 229,696 people. Patients with an

ejection fraction of 40-50% have a significant mortality rate and have symptoms 1.3 times more severe than patients with an ejection fraction >50%. Patients with chronic heart failure show a 14% increased risk of death for every 5% decrease in ejection fraction below 45% (4).

Coronary angiography is the main component of cardiac catheterization which aims to examine all blood vessel branches. Until now there are no absolute contraindications for coronary angiography. The relative contraindications for coronary angiography can

be seen from the renal and non-renal aspects which should be corrected first before carrying out coronary angiography (5-7).

Contrast media (CM) is administered to patients before certain radiological imaging examinations to highlight image features to aid diagnosis. Postcontrast exposure, serum creatinine values peak between two and five days and usually return to baseline within 14 days. Iodine contrast media is essential in invasive and interventional cardiac procedures. The increasing use of contrast media, and the increasing number of invasive cardiac procedures performed in high-risk patients with chronic kidney disease, diabetes mellitus, hypertension, and renal failure due to contrast-induced nephropathy have become a concern. Sudden changes in renal function are a common complication of coronary angiography, and percutaneous coronary intervention, especially due to contrast-induced acute kidney injury or contrast-induced nephropathy (8-10).

Materials and methods

Patient population

This study used the Retrospective Cohort method from July to August 2023. In this study, HFrEF and HFpEF patients underwent angiography. The number of samples used was 85 samples that met the inclusion and exclusion criteria.

Inclusion and exclusion criteria

The inclusion criteria in this study were patients who were diagnosed with heart failure, aged > 18 years and underwent echocardiography and were grouped into HFpEF (LVEF > 41%) with HFrEF (LVEF ≤ 40%) then underwent angiography. Heart failure is defined as a complex clinical syndrome with symptoms and signs resulting from structural or functional disturbances of ventricular filling or ejection of blood.

Clinical data and sample collection

The data collection method in this research uses secondary data, namely data obtained not from respondents, but from other sources, namely recorded

data at the Integrated Heart Center of RSUP Dr. Wahidin Sudirohusodo. The samples used in this study were HFrEF and HFpEF patients who underwent angiography at the Integrated Cardiac Center Dr. Wahidin Sudirohusodo.

Statistic analysis

Data analysis was carried out using SPSS version 25. The analysis method consisted of descriptive methods and statistical tests. The descriptive method aims to obtain general information about the research sample. The statistical method used is the calculation of the mean value and standard deviation (SD) as well as the frequency distribution. The statistical test used is Chi Square. Statistical test results are considered significant if the test p value is <0.05. The results obtained will be displayed in narrative form equipped with tables and figures.

Result

Study population

In this study, the number of subjects was 85 subjects. The subjects' ages were between 34-83 years, with a mean of 57.5 ± 11.2 years. There were 73 male subjects (85.9%) while there were 12 female subjects (14.1%) (Table 1).

Comparison of creatinine values before and after angiography

In this study, a comparative analysis of pre- and post-angiography creatinine values was carried out in all study samples. In this analysis, a significant difference in mean creatinine values was found to be higher, namely post angiography, $1.06 + 0.45$ mg/dL compared to pre angiography, $1.00 + 0.40$ mg/dL ($p < 0.05$) (Table 2).

Comparison of mean creatinine pre and post angiography in HFrEF and HFpEF patients

In this study, a comparative analysis of pre- and post-angiography creatinine values was carried out in HFrEF and HFpEF patients. In patients with HFrEF,

the mean creatinine value was significantly higher, namely at post angiography, 1.04 ± 0.39 mg/dL compared to pre angiography, namely 0.91 ± 0.27 mg/dL ($p < 0.05$) (Table 3).

Table 1. Research characteristics.

Variabel	n	%
Gender		
Male	73	85.9
Female	12	14.1
Diagnosis		
HFpEF	51	60.0
HFrEF	34	40.0
Comorbid		
Hypertension and DMT2	21	24.7
Hypertension	29	34.1
DMT2	9	10.6
Not HT and DMT2	26	30.6
Creatinine Changes		
Increase	53	62.4
not increasing	32	37.6
IMT		
Low BB	1	1.2
Normal BB	29	34.1
High BB	55	64.7

Table 2. Comparison of pre and post angiography creatinine values.

Variable	Average	Median (Min-Max)	SB	p*
pre angiography	1.00	0.94 (0.95-2.95)	0.40	0.005
post angiography	1.06	0.97 (0.54-3.21)	0.45	

* Wilcoxon Signed Ranks Test; SB, gold standard

Table 3. Comparison of pre and post angiography creatinine in HFrEF and HFpEF patients.

Variable	Average	Median (Min-Max)	SB	p*
HFpEF				
Pre angiography	1.06	0.95 (0.54 - 2.95)	0.47	0.323
Post angiography	1.07	0.97 (0.59 - 3.21)	0.48	
HFrEF				
Pre angiography	0.91	0.93 (0.39 - 1.65)	0.27	0.01
Post angiography	1.04	1.00 (0.54 - 2.20)	0.39	

* Wilcoxon Signed Ranks Test; SB, standar baku

Analysis of pre and post angiography creatinine values in HFrEF and HFpEF patients

In this study, pre-angiography creatinine values were compared for HFrEF and HFpEF patients and post-angiography values for HFrEF and HFpEF patients. From the analysis, no significant results were found in pre-angiography creatinine values in HFrEF and HFpEF patients and post-angiography in HFrEF and HFpEF patients (Table 4).

Discussion

Comparison of pre and post angiography creatinine values

In this study, a comparative analysis of pre- and post-angiography creatinine values was carried out in all study samples. In this analysis, a significant difference in mean creatinine values was found, namely post angiography, 1.06 ± 0.45 mg/dL compared to pre angiography, namely 1.00 ± 0.40 mg/dL ($p < 0.05$).

In the study, Widaningsih et al. (11) reported that angiography increased the risk of kidney problems and statistically there was a significant difference in creatinine values pre and post angiography. In a study by Stolker et al. (11) which analyzed changes in creatinine

Table 4. Analysis of pre and post angiography creatinine values for HFrEF and HFpEF patients.

Variable	HFpEF Mean (Min-max)	HFrEF Mean (Min-max)	P*
Pre angiography	0.95 (0.54 - 2.95)	0.93 (0.39 -1.65)	0.374
Post angiography	0.97 (0.59 - 3.21)	1.00 (0.54 - 2.20)	0.993
Δ	0.02	0,07	0.062

* Mann Whitney test

values and blood sugar values in patients undergoing angiography, they reported that creatinine values and blood sugar values were positively correlated with an increase in creatinine values after undergoing angiography.

Comparison of mean creatinine values pre and post angiography in HFrEF and HFpEF patients

In this study, a comparative analysis of pre- and post-angiography creatinine values was carried out in HFrEF and HFpEF patients. In patients with HFrEF, the mean creatinine value was significantly higher, namely at post angiography, 1.04±0.39 mg/dL compared to pre angiography, namely 0.91±0.27 mg/dL ($p < 0.05$).

The pathophysiology of contrast-induced nephropathy remains unclear. The proposed theory is a combination of vasoconstriction, ischemia, hypoxia, and direct toxic effects on renal tubular cells (13). Several studies have reported that heart failure is an independent risk factor for contrast-induced acute renal failure, especially in patients with heart failure with reduced ejection fraction. which is associated with hemodynamic instability which causes decreased renal perfusion (14).

The results of this study are in line with those conducted by Chyrrel et al. (15) who conducted research on predisposing factors in low EF patients who underwent angiography twice. The results of the study were that the incidence of CIN was 2% after the first intervention (ie, primary angioplasty) and increased to 8% after the second intervention. Researchers concluded

that low EF predisposes to CIN after second contrast exposure in patients undergoing two-stage coronary angioplasty during initial hospitalization for Acute Myocardial Infarction (AMI). These findings suggest the need for preventive measures against CIN or even delay of coronary intervention in patients with significant left ventricular dysfunction.

Meta-analysis by He et al. (16) reported that the risk of CIN was 5 times greater in patients with EF <40%. Meanwhile Silver et al. (17) suggested that advanced congestive heart failure was an independent component of the risk score for predicting CIN after percutaneous coronary intervention in 8357 patients.

Analysis of pre and post angiography creatinine values in HFrEF and HFpEF patients

In this study, pre-angiography creatinine values were compared for HFrEF and HFpEF patients and post-angiography values for HFrEF and HFpEF patients. From the analysis, no significant results were found in pre-angiography creatinine values in HFrEF and HFpEF patients and post-angiography in HFrEF and HFpEF patients.

The results of this analysis are in line with those stated by Barzid dk¹⁸ who conducted research on heart failure patients with pentoxifyllines supplementation as prevention of contrast nephropathy who underwent angiography compared with controls, where it was found that the incidence of contrast nephropathy was not significantly different in the two groups.

Conclusions

HFrEF patients who underwent angiography experienced an increase in creatinine values after angiography. In future research, it is best to monitor the amount of contrast given during angiography and it is hoped that the creatinine value will return to normal limits.

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Ethics Committee Approval: This research was approved by the Ethics Committee of Biomedical Research on Humans, Faculty of Medicine, Hasanuddin University, Makassar, South Sulawesi, Indonesia. Based on recommendation letter Number: 623/UN4.6.4.5.31/PP36/2023 with protocol number: UH23080604.

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