CHRONIC RENAL FAILURE AS A RISK FACTOR FOR CARDIAC ARREST IN THE INTENSIVE CARE UNIT (ICU)

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ABSTRACT

Chronic renal failure is a global problem, and there is a reciprocal relationship with cardiovascular disease. Cardiac arrest is one of the complications that can occur in patients with chronic renal failure. The study will look at whether chronic renal failure is a risk factor for cardiac arrest with chronic renal failure in patients in the ICU. This study used a cross-sectional analytical observational study design. The data taken was in the form of medical record data of patients with chronic renal failure in the ICU of PKU Muhammadiyah Gamping Hospital who experienced cardiac arrest without seeing the comorbidities of the disease. Total subjects amounted to 168 patients. To determine chronic renal failure as a risk factor for cardiac arrest, the data obtained were carried out bivariate regression test with a meaning of <0.05. Bivariate test results showed a p>0.05 value, meaning chronic renal failure is not significantly a risk factor for cardiac arrest. Subjects with chronic renal failure had a relative risk (RR) of 1.27, which means they had a 1.27 times higher risk of cardiac arrest than patients without chronic renal failure. Chronic renal failure is not significantly a risk factor for cardiac arrest, but it has a greater risk of cardiac arrest than without chronic renal failure. Further research is needed, taking into account the underlying comorbid disease.

Keywords: Chronic Renal Failure, Risk Factors, Cardiac Arrest, Intensive Care Unit (ICU)

INTRODUCTION

Chronic kidney disease is a progressive condition in >10% of the general population worldwide or about >800 million individuals. The disease occurs mainly in older individuals, women, people with diabetes mellitus and hypertension (Kovesdy, 2022). Chronic renal failure affects more than 20 million people in the United States, or about 13% of the population, and 485,000 patients have end-stage renal disease (ESRD) requiring renal replacement therapy (Bikbov et al., 2020). COVID-19 patients with chronic kidney disease had a higher chance of death (Alas-Pineda et al., 2024; Gaillet et al., 2023). The prevalence of chronic renal failure (CRF) in Indonesia, based on Basic Health Research (2018), is 0.38 percent of the 252,124,458 population in Indonesia, so there are 713,783 CRF sufferers in Indonesia (Kemenkes RI, 2018)

Patients with chronic kidney disease (CKD) are more prone to worsening renal failure suddenly, so many are admitted to the intensive care unit (ICU) (De Rosa et al., 2017). Recent research has shown the role of a homodimer protein called activin A in chronic kidney disease and mineral and bone metabolism disorders (CKD-MBD). This condition may exist in vascular calcification and osteolytic processes (Yonata et al., 2020).

There is a significant interrelationship between chronic kidney disease (CKD) and cardiovascular disease (CVD). Chronic kidney disease (CKD) is an essential co-morbidity in patients with heart failure (HF) and has a higher mortality rate than those without CKD (Minhas et al., 2023; Warrens et al., 2022). CKD is a considerable risk factor for the development and worsening of cardiovascular disease. Conversely, cardiovascular disease is a leading cause of morbidity and mortality in patients with chronic kidney disease. Several factors contribute to this association, including risk factors such as hypertension, diabetes, and dyslipidemia, as well as other risk factors such as inflammation, oxidative stress, and mineral disorders associated with impaired kidney function (Vallianou et al., 2018). Chronic kidney disease (CKD) patients with coronary artery disease (CAD) in the intensive care unit (ICU) have higher hospital deaths and poorer prognosis than patients with any of the single conditions (Ye et al., 2023).

Cardiac arrest is a phenomenon of cardiovascular disease due to the cessation of cardiac activity (García Fierros et al., 2021). Chronic kidney disease (CKD) and left ventricular (LV) dysfunction are risk factors for cardiac arrest (Ravi et al., 2023). CKD patients have an increased risk of sudden cardiac arrest, which often has a poor prognosis. Recent research has found that chronic kidney disease (CKD) has high mortality, risk of sudden cardiac arrest in ICU patients, and low CPR success (Sharma et al., 2022). Research by Benjamin et al., (2023) shows that patients with CKD are more at risk of myocardial infarction resulting in cardiac arrest. The study will look at whether chronic renal failure is a risk factor for cardiac arrest in the ICU.

TINJAUAN PUSTAKA

Chronic Kidney Failure (CKF) is a progressive and irreversible kidney function disorder, where the body is unable to maintain metabolism and fails to maintain fluid and electrolyte balance which results in increased urea (Sumah, 2020).

The causes of CKD undergoing hemodialysis in Indonesia according to Penefri in 2003 are Glomerulonephritis 46.39%, Diabetes Mellitus 18.65%, Obstruction and infection 12.85%, Hypertension 8.46%, and other causes 13.65%. Other causes include infection, inflammatory disease, hypersensitive vascular disease, connective tissue disorders, congenital and hereditary disorders, metabolic disorders, toxic nephropathy, obstructive nephropathy and drug intoxication (Priyanto, 2019).

There are several risk factors for chronic kidney disease such as hypertension, diabetes mellitus, increasing age, family history of chronic kidney disease, obesity, cardiovascular disease, low birth weight, autoimmune diseases such as systemic lupus erythematosus, drug poisoning, systemic infections, urinary tract infections, urinary tract stones and congenital kidney

disease. In addition, lifestyles such as smoking, alcohol consumption, and low physical activity are also dominant factors associated with chronic kidney failure (Wijaya, 2024).

RESEARCH METHOD

The study has received ethical permission number No. 002/KEP-PKU/I/2023 and uses a cross-sectional analytical observational research design. Data was collected sequentially from medical records and obtained from 168 subjects with a history of chronic renal failure and cardiac arrest without looking at other comorbid diseases in the ICU of PKU Muhammadiyah Gamping Hospital Yogyakarta from 2019 to 2022. To determine whether chronic renal failure is a risk factor for cardiac arrest, the data obtained were carried out bivariate regression test with $p < 0.05$.

RESEARCH RESULTS

Tabel 1. Subject Characteristic

		N	%
Gender	Male	84	50.0%
	Female	84	50.0%
Aged	≥ 60 yo	91	54.2%
	< 60 yo	77	45.8%
Cardiac arrest	Yes	70	41.7%
	No	98	58.3%
Chronic renal failure	Yes	49	29.2%
	No	119	70.8%

This study obtained 168 inpatient subjects in the ICU of PKU Muhammadiyah Gamping Hospital. Male subjects numbered 84 (50.0%), and females numbered 84 (50.0%). The age of subjects >=60 years amounted to 91 (54.2%), and <60 years amounted to 77 (45.8%). Subjects with cardiac arrest numbered 70 (41.7%), and non-cardiac arrest numbered 98 (29.2%). Subjects with chronic renal failure numbered 49 (29.2%) and undiagnosed chronic renal failure numbered 119 (70.8%) (Table 1).

Table 2. Chronic Renal Failure Risk Factor For Cardiac Arrest

		Cardiac arrest						
		Yes		No		p	RR	CI 95%
		n	%	n	%			
CRF	Yes	24	49.0	25	51.0	0.217	1.27	0.88-1.82
	No	46	38.7	73	61.3			

CRF: Chronic Renal Failure

To determine whether chronic renal failure is a risk factor for cardiac arrest, a bivariate regression test with a significance level of $p<0.05$ was performed. The results of the bivariate regression test showed that subjects with chronic renal failure who experienced

cardiac arrest numbered 24 (49%), and those who did not experience cardiac arrest amounted to 25 (51%). Undiagnosed subjects with chronic renal failure who experienced cardiac arrest numbered 46 (38.7%), and non-cardiac arrest numbered 73 (61.3%). The results of the bivariate test showed a level of significance p = 0.217, which means that chronic renal failure is not a risk factor for cardiac arrest, but chronic renal failure has a risk of cardiac arrest 1.27 times greater than without chronic renal failure (RR = 1.27) (Table 2).

DISCUSSIONS

The results showed chronic renal failure is not a risk factor for cardiac arrest (p>0.05). Still, they had a relative risk value (RR) of 1.27, which means chronic renal failure patients have 1.27 times the risk of cardiac arrest than patients without chronic renal failure. The study did not look at other comorbid diseases and stages of kidney failure. Chronic renal failure in the late stages increases cardiovascular risk and is associated with 70% of cardiovascular deaths (Tanaka et al., 2020). Patients with chronic kidney disease (CRF) show an increased cardiovascular risk that manifests as coronary artery disease, heart failure, arrhythmias, and sudden cardiac death (Jankowski et al., 2021).

In CRF patients with a 5-year follow-up, 13% worsened and progressed to end-stage or stage 5 CRF. Hakopian et al. found that CRF patients with a follow-up of 5 years still had higher rates of hospitalization and death related to heart failure compared to CRF patients with a diagnosis period of fewer than five years. The study found that CRF stages 4 and 5 were associated with an increased risk of hospitalization and death in heart failure patients (Hakopian et al., 2019).

The study also did not look at comorbid diabetes mellitus and hypertension. In subjects with type 2 diabetes (T2D) can have complications in the form of CKD. This combination increases the risk of comorbid cardiovascular disease (CVD) and end-stage renal disease (ESKD) (Fried et al., 2023). Hypertension also affects most chronic kidney disease (CRF) patients. Both hypertension and CRF are interconnected because hypertension is a strong determinant of poor renal and cardiovascular outcomes, as well as decreased kidney function that worsens hypertension. This two-way relationship is evidenced by the high prevalence of hypertension across CRF stages and the dual benefit of effective antihypertensive treatment for renal and cardiovascular risk reduction (Burnier & Damianaki, 2023). The risk factors for CRF are diabetes and hypertension (Lee et al., 2022).

Arterial disease has a high prevalence with chronic renal failure (Skalsky et al., 2022). Baber et al.'s study concluded that chronic kidney failure has a higher risk of developing coronary heart disease compared to individuals who are only diagnosed with hypertension, diabetes mellitus, or a smoking lifestyle (Baber et al., 2017). Research by Bagheri et al. (2019) shows creatinine levels in coronary heart disease patients around 1.1 mg /dL or >1 mg / dL. This number indicates the contribution of creatinine to coronary heart disease, so serum creatinine is associated

with coronary heart disease as a risk factor for cardiac arrest (Bagheri et al., 2019). Some GFR figures in medical records show chronic kidney failure patients with cardiac arrest are in the range of CRF stages 4-5. The decrease in stage 4 GFR occurs at a value of 15-29 ml/minute, which means it is significantly decreased, and stage 5 <15 ml/minute or end-stage renal disease (ESRD). This is in line with research showing that there will be an increased risk of coronary heart disease resulting in cardiac arrest in CRF patients stage 4 and 5 (Liu et al., 2014).

CONCLUSION

Chronic kidney failure is not significantly a risk factor for cardiac arrest, but it has a greater risk of cardiac arrest than without chronic renal failure. Cardiac arrest is more common in patients with chronic renal failure with underlying diseases such as cardiovascular disease and diabetes mellitus.

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