Original article

Revista de Enfermagem do Centro-Oeste Mineiro
2026; 16/5803
www.ufsj.edu.br/recom

RECOM
Revista de Enfermagem
do Centro-Oeste Mineiro

Incidence of acute kidney injury in women and men undergoing cardiac surgery: a longitudinal study

Incidência da injúria renal aguda em mulheres e homens submetidos a cirurgia cardíaca: estudo longitudinal

Incidencia de lesión renal aguda en mujeres y hombres sometidos a cirugía cardíaca: un estudio longitudinal

ABSTRACT
Objective: To identify the incidence of acute kidney injury in the immediate postoperative period in women and men undergoing cardiac surgery. **Method:** Observational, longitudinal, and quantitative study, conducted in a teaching hospital with adult patients admitted for elective cardiac surgery. Data collection occurred at three time points: preoperative, intraoperative, and immediate postoperative, using a structured questionnaire. Statistical analysis was performed. **Results:** 109 patients participated in the study, the majority being male, with a median age of 65 years. A statistically significant association was found between alcoholism and sex. An association was also identified between age group and the occurrence of acute kidney injury. **Final considerations:** The incidence of acute kidney injury was 39.4% among the patients evaluated, and no statistically significant association was found between this complication and the sex of individuals undergoing cardiac surgery.
Descriptors: Postoperative complications; Acute kidney injury; Thoracic surgery; Nursing.

RESUMO
Objective: Identificar a incidência da injúria renal aguda no pós-operatório imediato em mulheres e homens submetidos a cirurgia cardíaca. **Método:** Estudo observacional, longitudinal e quantitativo, realizado em hospital escola com pacientes adultos internados para cirurgia cardíaca eletiva. A coleta de dados ocorreu em três momentos: pré-operatório, intraoperatório e pós-operatório imediato, por meio de questionário estruturado. Foi realizada análise estatística. **Resultados:** Participaram do estudo 109 pacientes, a maioria foi do sexo masculino, com idade mediana de 65 anos. Verificou-se associação estatisticamente significativa entre o etilismo e o sexo. Também foi identificada associação entre a faixa etária e a ocorrência da injúria renal aguda. **Considerações finais:** A incidência da injúria renal aguda foi de 39,4% entre os pacientes avaliados, não sendo constatada associação estatisticamente significativa entre essa complicação e o sexo dos indivíduos submetidos a cirurgia cardíaca.
Descritores: Complicações pós-operatórias; Injúria renal aguda; Cirurgia torácica; Enfermagem.

RESUMEN
Objetivo: Identificar la incidencia de lesión renal aguda en el período postoperatorio inmediato en mujeres y hombres sometidos a cirugía cardíaca. **Método:** Este estudio observacional, longitudinal y cuantitativo se realizó en un hospital docente con pacientes adultos ingresados para cirugía cardíaca electiva. Los datos se recolectaron en tres puntos de tiempo: preoperatorio, intraoperatorio y postoperatorio inmediato, mediante un cuestionario estructurado. Se realizó un análisis estadístico. **Resultados:** Un total de 109 pacientes participaron en el estudio, la mayoría de los cuales eran hombres, con una edad media de 65 años. Se encontró una asociación estadísticamente significativa entre el consumo de alcohol y el género. También se identificó una asociación entre el grupo de edad y la ocurrencia de lesión renal aguda. **Consideraciones finales:** La incidencia de lesión renal aguda fue del 39,4% entre los pacientes evaluados y no se encontró asociación estadísticamente significativa entre esta complicación y el género de los individuos sometidos a cirugía cardíaca.
Descriptores: Complicaciones postoperatorias; Lesión renal aguda; Cirugía torácica; Enfermería.

Mariana Beltrami[1]
0009-0006-7211-2935

Carol Andrade Bolzani[1]
0009-0009-8426-6570

Julia Scalco Marcolina[1]
0009-0006-2872-2779

Juliana Baldissera Dors[2]
0000-0003-4862-2258

Marcelo Walker[1]
0009-0002-6965-9674

Thaís Dresch Eberhardt[3]
0000-0003-0138-2066

[1]University of Passo Fundo, Passo Fundo, Rio Grande do Sul, Brazil.

[2]Hospital de Clínicas de Passo Fundo, Passo Fundo, Rio Grande do Sul, Brazil.

[3]Federal University of the Southern Border, Passo Fundo, Rio Grande do Sul,Brazil.

Corresponding author:
Thaís Dresch Eberhardt
thais.eberhardt@uffs.edu.br

INTRODUCTION

Cardiovascular diseases showed an increase in the absolute number of deaths and years of life lost due to disability in Portuguese-speaking countries, including Brazil, from 1990 to 2019[1]. According to the National Health Survey, in 2019, there were 12,946,932 individuals with cardiovascular disease in Brazil, 51% of whom were men, a figure explained by greater exposure to behavioral risk factors such as obesity[2].

In this context, cardiac surgery is a highly complex procedure that causes significant organic repercussions, altering patients' physiological mechanisms in various ways. These changes may lead to a critical postoperative (PO) state, requiring intensive care to ensure adequate recovery. Despite such care, complications may arise during this period[3], as well as the need for readmission to the Intensive Care Unit[4], which may even result in patient death[5].

The main risk factors for the development of postoperative complications in cardiac surgeries are related to advanced age, followed by hypertension and smoking[6]. In this context, it is noteworthy that acute kidney injury (AKI) is an important complication associated with cardiac surgery, with complex clinical repercussions capable of negatively impacting patients' prognosis[7]. AKI is defined as an abrupt decrease in renal function, which can lead to alterations in fluid, electrolyte, acid-base, and hormonal regulation[8].

Although some studies indicate that the incidence of AKI is higher in men[9,10], it has been observed that in cardiac surgery, mortality among patients who develop this condition is similar between sexes[11]. Another study pointed out that women present with greater severity of the condition, making sex an independent risk factor for the occurrence of AKI[12]. From this perspective, a better understanding of the factors associated with this disorder may help to more accurately identify high-risk patients, thereby justifying the present study[9].

Therefore, research investigating the incidence of AKI in the immediate postoperative period (IPO) of cardiac surgery is essential to verify differences between sexes. Understanding these differences can help improve predictive models and tailor prevention and treatment strategies, resulting in better clinical outcomes for both groups. Thus, the aim of this study is to identify the incidence of AKI in the IPO among women and men undergoing cardiac surgery.

METHOD

This is an observational, longitudinal, and quantitative study, guided and structured according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) initiative. The research was conducted in a large philanthropic hospital, registered as a teaching hospital and located in the municipality of Passo Fundo, in the northern region of the state of Rio Grande do Sul, Brazil. The institution is a reference center for high-complexity care, including hemodynamics, and holds Level 3 Hospital Accreditation—Accredited with Excellence—by the National Accreditation Organization (NAO).

Patients aged 18 years or older and hospitalized during the preoperative period for elective cardiac surgery were included. Exclusion criteria were pregnant women or those suspected of pregnancy, individuals with impaired verbal communication without a companion, or with an

altered level of consciousness without a companion.

For the sample size calculation, the Epi Info™ software, version 7.2.5.0, was used. The parameters considered were a statistical power of 80%, a significance level of 95% (< 0.05), a population size of 202 patients (number of patients who underwent cardiac surgery at the study site from August 2022 to August 2023), an expected complication rate of 58.0% (13), and a margin of error of 5 percentage points, resulting in a required sample of 89 patients. To this number, 30% was added to account for possible losses, leading 116 patients.

The data collection team consisted of eight cardiology nurse residents. Prior to data collection, all collectors received 10 hours of theoretical and practical training. Before the start of data collection, a pilot test of the questionnaire was conducted, and no modifications were required. Data collection for the main project began in March and ended in November 2024.

Patients were recruited daily through access to the elective surgery scheduling system. All patients scheduled for elective cardiac surgeries were assessed for eligibility criteria and invited to participate in the study. Those who met the criteria and agreed to participate signed the Informed Consent Form (ICF) during the preoperative period, prior to the beginning of data collection.

For data collection, a printed questionnaire developed by the authors themselves was used, structured in three stages: preoperative (anamnesis to identify comorbidities, clinical history, and risk factors), intraoperative (procedure data, complications, cardiopulmonary bypass [CPB] time, and aortic clamping time), and immediate postoperative (IPO) – up to 24 hours after the surgical procedure (physical examination assessing cardiovascular conditions within 24 hours after surgery). It is noteworthy that participants were prospectively followed from the preoperative period to the IPO. The intraoperative data were collected from the patient's medical record and institutional forms completed by the multidisciplinary team during the surgical procedure.

In this study, the outcome analyzed was the incidence of acute kidney injury (AKI) in the IPO, defined according to the Kidney Disease Improving Global Outcomes (KDIGO) guidelines as follows: AKI is a subcategory of acute kidney disease, characterized by oliguria > 6 hours, an increase in serum creatinine > 0.3 mg/dL in two days, or > 50% within one week[14].

The data collected were double-entered independently into Microsoft Office Excel®. In this study, no variable with missing data was included. For data analysis, the Statistical Package for the Social Sciences (SPSS), version 25, was used. The data were initially analyzed using simple descriptive statistics. Quantitative variables were described using measures of central tendency (mean or median) and dispersion (standard deviation or interquartile range), according to the coefficient of variation; categorical variables were described using absolute (n) and relative (%) frequencies.

For data analysis, age was categorized into two groups: adults up to 59 years old and older adults aged 60 years and above. Surgical time was categorized using a cutoff point of 4.5 hours (up to 4.5 hours, greater than 4.5 hours). Regarding cardiopulmonary bypass (CPB) time, a cutoff point of 70 minutes was used, as

CPB time ≥ 70 minutes triggers systemic inflammatory processes, while this phenomenon is significantly reduced when the time is below 70 minutes[15]. Additionally, for aortic clamping time, the cutoff point used for categorization was 55 minutes.

For Body Mass Index (BMI) assessment, the following categories were adopted: normal weight (18.5–24.9), overweight (25–29.9), obesity grade I (30–34.9), obesity grade II (35–39.9), and obesity grade III (above 40).

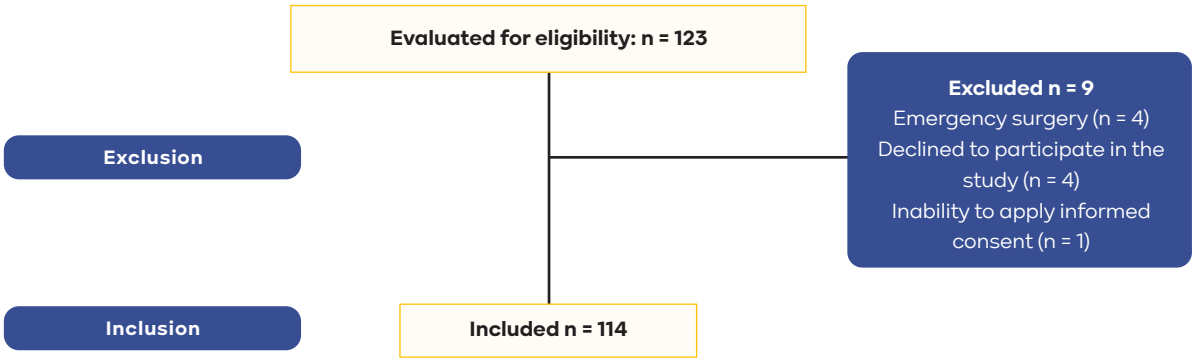
Then, an inferential statistical analysis was performed to evaluate the association between the independent variables and sex (female and male) and AKI, using the Chi-square Test or Fisher's Exact Test (expected value less than 5 in at least one cell). A significance level of 5% (p-value < 0.05) was considered for all analyses.

The Research Ethics Committee under Opinion No. 6.744.804 and Certificate of Presentation approved the matrix research project entitled Immediate postoperative complications in adult and older patients undergoing cardiac surgery" for Ethical Consideration (CAAE) 77952224.7.0000.5342. The study followed the ethical guidelines established by Resolution number. 466/2012 of the National Health Council.

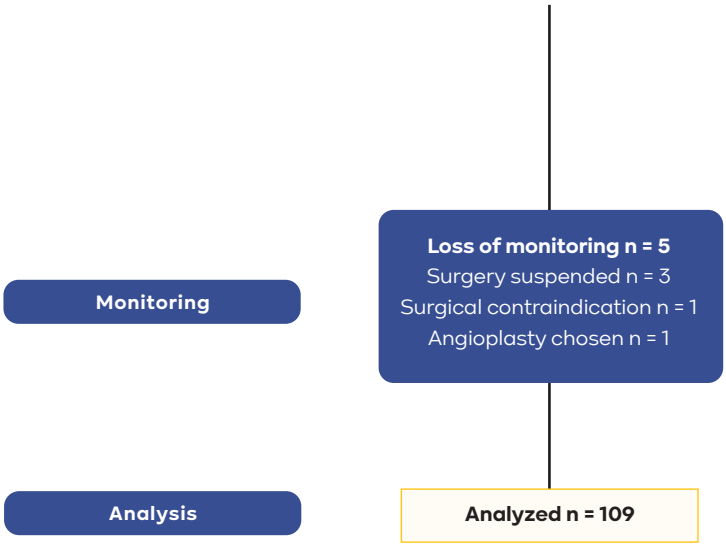
RESULTS

One hundred and twenty-three (123) patients were assessed for eligibility during the data collection period, of which 109 were analyzed, according to the participant selection flowchart presented in Figure 1. The majority of participants were male (n = 72; 66.1%) with a median age of 65.0 years, ranging from 28 to 83 years. The most frequently performed surgery was valve replacement (n = 56; 51.4%), with a median duration of 4.5 hours, cardiopulmonary bypass time of (81.7±28.0) minutes, and aortic clamping time of (57.6±56.0) minutes, as shown in Table 1.

Figure 1 - Flowchart of participant selection for the study. Rio Grande do Sul, Brazil, 2025



Continue



Source: Prepared by the authors.

Table 1 - Distribution of sociodemographic and clinical variables of patients undergoing elective cardiac surgery. Rio Grande do Sul, Brazil, 2024. n = 109

Variables	n%
Sex	
Female	37 (33,9%)
Male	72 (66,1%)
Type of surgery	
CABG*	53 (48,4%)
Aortic dissection repair	1 (0,9%)
Aortic aneurysm repair	7 (6,4%)
ASD repair†	4 (3,7%)
PFO repair‡	2 (1,8%)
Valve repair	2 (1,8%)
Valve replacement	56 (51,4%)
Variables	**Mean ± SD § (min.‖-max.)**
BMI (Kg/m²)**	27,6±4,6 (18,8-41,2)
Surgery duration (minutes)	4,4±0,7 (2,2-7,0
Variables	**Median ± IQR ††(min.-max.)**
Age	65,0±17,0 (28,0-83,0)
Cardiopulmonary bypass (CPB) time (minutes)	81,7±28,0 (0,0-180,0)
Aortic clamping time (minutes)	57,6±56,0 (0,0-160,0)

*CABG: Coronary artery bypass grafting. †ASD: Atrial septal defect. ‡PFO: Patent foramen ovale. §SD: Standard deviation. ‖Min.: minimum. Max.: maximum.
**BMI: Body Mass Index. ††IQR: Interquartile range. ‡‡CPB: Cardiopulmonary bypass.
Source: Prepared by the authors.

A statistically significant association was found between alcoholism (p-value 0.001) and sex; 23.6% of the alcohol-consuming participants were male – Table 2. Regarding the analysis of complications evaluated in this study, an incidence of acute kidney injury (AKI) of 39.4% was identified (n = 43).

Table 2 -Association of categorical variables and sex of adult and older patients undergoing elective cardiac surgery. Rio Grande do Sul, Brazil, 2024. n = 109

Variables	n	Sex		p-value*
		Female n%	Male n%	
Color or race				0,059
White	96	29 (78,4%)	67 (93,1%)	
Brown	7	3 (8,1%)	4 (5,6%)	
Black	5	4 (10,8%)	1 (0,9%)	
Yellow	1	1 (0,9%)	- (0,0%)	
Smoking				0,098
Yes	38	9 (24,3%)	29 (40,3%)	
No	71	28 (75,7%)	43 (59,7%)	
Alcoholism				0,001
Yes	17	- (0,0%)	8 (23,6%)	
No	92	37 (100,0%)	55 (76,4%)	
Sedentary lifestyle				0,487
Yes	87	29 (78,4%)	58 (80,6%)	
No	22	8 (21,6%)	14 (19,4%)	
High blood pressure				0,390
Yes	82	26 (70,3%)	56 (77,8%)	
No	27	11 (29,7%)	16 (22,2%)	
Diabetes mellitus				0,613
Yes	32	12 (32,4%)	20 (27,8%)	
No	77	25 (67,6%)	52 (72,2%)	
Dyslipidemia				0,457
Yes	39	15 (40,5%)	24 (33,3%)	
No	70	22 (59,5%)	48 (66,7%)	
Age group				0,601
Adult	39	12 (32,4%)	27 (37,5%)	
Older adult	70	25 (67,6%)	45 (62,5%)	
Weight classification				0,508
Normal weight	31	12 (32,4%)	19 (26,4%)	
Overweight (≥ 25 kg/m²)	78	25 (67,6%)	53 (76,3%)	

* Chi-square or Fisher's exact test. p-value significant at a significance level of 5%.
Source: Prepared by the authors.

Table 3 presents the factors associated with the incidence of AKI in the postoperative period (POI) in patients undergoing elective cardiac surgery. A statistically significant association was identified between age group – older adult (p-value = 0.009), alcoholism (p-value = 0.020) and AKI in the POI. It is noteworthy that no statistically significant association was identified between sex and the occurrence of AKI in the POI.

Table 3 - Factors associated with the incidence of Acute Kidney Injury (AKI) in patients undergoing elective cardiac surgery. Rio Grande do Sul, Brazil, 2024

Variables	n	Acute Kidney Injury		p-value*
		Yes n%	No n%	
Sex				0,805
Female	37	14 (32,6%)	23 (34,8%)	
Male	72	29 (67,4%)	43 (65,2%)	
Race				0,108
White	96	34 (79,1%)	62(93,9%)	
Brown	7	5 (11,6%)	2 (3,0%)	
Black	5	3 (7,0%)	2 (3,0%)	
Yellow	1	1 (0,9%)	- (0,0%)	
Smoking				0,684
Yes	14	14 (32,6%)	24 (36,4%)	
No	71	29 (67,4%)	42 (63,6%)	
Alcoholism				0,020
Yes	17	11 (25,6%)	6 (9,1%)	
No	92	32 (74,4%)	60 (90,9%)	
Sedentary lifestyle				0,875
Yes	87	34 (79,1%)	53 (80,3%)	
No	22	9 (20,9%)	13 (19,7%)	
High blood pressure				0,097
Yes	82	36 (83,7%)	46 (69,7%)	
No	27	7 (16,3%)	20 (30,3%)	
Diabetes mellitus				0,060
Yes	32	17 (39,5%)	15 (22,7%)	
No	77	26 (60,5%)	51 (77,3%)	
Dyslipidemia				0,329
Yes	39	13 (30,2%)	26 (39,4%)	
No	70	30 (69,8%)	40 (60,6%)	
Use of norepinephrine				0,523
Yes	80	33 (76,7%)	47 (71,2%)	
No	29	10 (23,3%)	19 (28,8%)	
Age group				0,009
Adult	39	9 (20,9%)	30 (45,5%)	
Older adult	70	34 (79,1%)	36 (54,5%)	
Weight classification				0,333
Normal weight	31	10 (23,3%)	21 (31,8%)	
Overweight (≥ 25 kg/m²)	78	33 (767%)	45 (68,2%)	
Surgery time: Up to 4.5 hours				0,921
More than 4.5 hours	45	18 (41,9%)	27 (40,9%)	
Surgery time: Up to 4.5 hours	64	25 (58,1%)	39 (59,1%)	
ECC Time†				0,072
Up to 70 min	22	5 (11,6%)	17 (25,8%)	
Over 70 min	87	38 (88,4%)	49 (74,2%)	
Clamping time				0,077
Up to 55 minutes	52	16 (37,2%)	36 (54,5%)	
Greater than 55 minutes	57	27 (62,8%)	30 (45,5%)	

*Chi-square test or Fisher's exact test. p-value significant at a significance level of 5%. †ECC: Extracorporeal circulation. Source: Prepared by the authors.

DISCUSSION

The incidence of AKI in men and women during the postoperative period (POI) of cardiac surgery was 39.4%, with no difference between sexes. A statistically significant association was identified between male sex and alcohol consumption, as 100.0% of participants who consumed alcohol were men. Regarding factors associated with AKI, a statistically significant association was found with age group (older adult) and alcohol consumption.

The pathogenesis of Acute Kidney Injury (AKI) associated with cardiac surgery is poorly understood but likely involves an interaction between preoperative comorbidities and perioperative stressors, which may be mainly related to a mismatch between oxygen delivery and renal demand. Factors such as hypoperfusion, atheroembolic events, exposure to nephrotoxic agents, inflammation, oxidative stress, and medication use may contribute to this condition. The combination of these factors makes the kidneys particularly vulnerable to damage, leading to an increased incidence of AKI in the postoperative period[16].

In this study, an AKI incidence of 39.4% was identified, corroborating the existing literature, which reports incidence rates of AKI in cardiac surgeries ranging from 8% to 50%[3,11,12,17–19]. This result reflects the severity of the consequences that may arise in this context. Patients with AKI present a significantly higher risk of mortality, as well as greater hospitalization costs, compared with patients without AKI. Even after discharge, up to 365 days later, patients with AKI continued to show a cost increase of up to 1.35 times, and those requiring acute dialysis continued to exhibit a 2.86-fold increase in mortality. Post–cardiac surgery AKI was associated with a more than fivefold greater likelihood of developing chronic kidney disease[17,18].

Furthermore, the analysis revealed a predominance of male patients undergoing cardiac surgeries, which was also observed in a retrospective study that analyzed the clinical-epidemiological profile, mortality rate, and factors associated with AKI in patients undergoing cardiac surgeries. That study found that 59.7% of patients were men[19].

Although no statistically significant association was identified between sex and the occurrence of AKI in the postoperative period, a significant association was found between alcohol consumption (p-value 0.001) and male sex. It was observed that 100% of the alcohol-consuming participants in the sample were men, which is consistent with data in the literature indicating that alcohol consumption remains higher among men[20].

A study analyzing the temporal trend of the prevalence of excessive alcohol consumption among adults in Brazilian capitals between 2006 and 2019 identified that, although alcohol consumption was more prevalent among men, there was an increase in excessive consumption among women during the analyzed period[20]. These findings raise important concerns and call for attention to specific public health policies.

In addition, a statistically significant association was identified between alcoholism and the development of AKI in the immediate postoperative period (p-value = 0.020). Chronic alcohol consumption has been identified as a possible risk factor for kidney injury, since the toxic metabolites generated during its metabolism, such as acetaldehyde and free

radicals, can induce oxidative stress and renal inflammation. These mechanisms directly affect kidney structure and function, compromising homeostasis and promoting the development of kidney injury, especially in individuals with associated liver dysfunctions[21].

Another factor associated with the occurrence of AKI identified in this study was age group (older adult) (p-value = 0.009). It is known that older patients are more susceptible to an episode of AKI[22]. AKI in the older adult shows a significant association with factors such as physiological renal aging, the presence of multiple comorbidities, the use of nephrotoxic medications, and greater clinical frailty[22,23]. Despite advances in early diagnosis, the management of AKI in this population remains challenging and requires individualized treatment, especially regarding fluid balance control and cautious use of diuretics. Furthermore, it is noteworthy that the need for renal replacement therapy is more common among older patients with severe conditions, although this intervention is associated with higher mortality and morbidity rates[23].

In this context, it is worth emphasizing that nursing plays an important role, especially in the immediate postoperative period. Therefore, it is essential to invest in continuing health education strategies, develop tools to guide patient care in the postoperative period of cardiac surgery, and ensure adequate human resources[24]. Additionally, it is known that older cardiac patients often face barriers to medication adherence[25]. Thus, it is important that nurses monitor these patients after discharge in primary care.

This study presented some limitations: the outcome was collected only after the 24-hour period following cardiac surgery, and the exact time of occurrence was not recorded. Therefore, it was not possible to perform survival analysis. Moreover, the stages of AKI and the prognosis of the study participants were not analyzed.

Future research is suggested to address the issue of AKI in the postoperative period among men and women undergoing elective cardiac surgery. It is important to conduct studies that investigate the effects of alcoholism and age group on the occurrence of AKI, according to the stages of the disease, as well as multiprofessional strategies for prevention and treatment.

FINAL CONSIDERATIONS

Patients undergoing cardiac surgery had an incidence of AKI of 39.4%, with no significant association between sexes. Most patients were male, and all individuals with a history of alcohol use were men. Factors such as advanced age and alcoholism showed a statistically significant association with the occurrence of AKI in the immediate postoperative period. Understanding the pathophysiological mechanisms linking these factors to AKI is important for the implementation of more effective preventive and therapeutic measures.

REFERÊNCIAS

1. Nascimento BR, Brant LCC, Naback ADN, Veloso GA, Polanczyk CA, Ribeiro ALP, Malta DC, Ferreira AVL, Oliveira GMM. Burden of cardiovascular diseases attributable to risk factors in Portuguese-speaking countries: data from the "Global Burden of Disease 2019" study. Arq Bras Cardiol. 2022;118(6):1028-48. DOI: 10.36660/abc.20210680

2. Motta ACSV, Motoki IHL. Prevalen-

ce of ideal cardiovascular health in the Brazilian adult population – National Health Survey 2019. Epidemiol. Serv. Saúde. 2023;32(1):e2022669. DOI: 10.1590/S2237-96222023000300006

3. Covalski D, Pauli E, Echer AK, Nogueira RR, Fortes VLF. Pós-operatório de cirurgias cardíacas: complicações prevalentes em 72 horas. Rev Enferm UFSM. 2021;11:e75. DOI: 10.5902/2179769264147

4. Lv H, Meng Z, Yu C, Chen QH, Wang YL, Xiao Y. Incidence of readmission to the ICU after cardiac surgery: a systematic review and meta-analysis. J Thorac Dis. 2022;14(2):414-22. DOI: 10.21037/jtd-21-1893

5. Milojevic M, Bond C, He C, Shannon FL, Clark M, Theurer PF, Prager RL. Failure to rescue: variation in mortality after cardiac surgery. Interact CardioVasc Thorac Surg. 2021;33:848-56. DOI: 10.1093/icvts/ivab188

6. Hassan AMS, Abd El-Aziz MA, Ahmed NA. Cardiopulmonary bypass: risk factors and complications of patients undergoing open heart surgery. Assiut Sci Nurs J. 2024;12(46):25-32. DOI: 10.21608/asnj.2024.301286.1848

7. Scurt FG, Bose K, Mertens PR, Chatzikyrkou C, Herzog C. Cardiac surgery-associated acute kidney injury. 2024 Jun 1;5(6):909-26. DOI: 10.34067/KID.0000000000000466

8. Kidney Disease: Improving Global Outcomes (KDIGO) Acute Kidney Injury Work Group. KDIGO clinical practice guideline for acute kidney injury. Kidney Int Suppl. 2012;2(1):1-138.

9. Loutradis C, Pickup L, Law JP, Dasgupta I, Townend JN, Cockwell P, Sharif A, Sarafidis P, Ferro CJ. Acute kidney injury is more common in men than women after accounting for socioeconomic status, ethnicity, alcohol intake and smoking history. Biol Sex Differ. 2021;12:30. DOI: 10.1186/s13293-021-00373-4

10. Neugarten J, Golestaneh L. Sex differences in acute kidney injury. Semin Nephrol. 2022;42(2):208-18. DOI: 10.1016/j.semnephrol.2022.04.010

11. Bell J, Sartipy U, Holzmann MJ, Hertzberg D. The association between acute kidney injury and mortality after coronary artery bypass grafting was similar in women and men. J Cardiothorac Vasc Anesth. 2022;36(4):962-70. DOI: 10.1053/j.jvca.2021.11.036

12. Wang Y, Huang X, Xia S, Huang Q, Wang J, Ding M, Mo Y, Yang J. Gender differences and risk factors for acute kidney injury following cardiac surgery: a single-center retrospective cohort study. Heliyon. 2023;9:e22177. DOI: 10.1016/j.heliyon.2023.e22177

13. Soares GMT, Ferreira DCS, Gonçalves MPC, Alves TGS, David FL, Henriques KMC, Riani LR. Prevalência das principais complicações pós-operatórias em cirurgias cardíacas. Rev Bras Cardiol. 2011;24(3):139-46. Disponível em: http://sociedades.cardiol.br/socerj/revista/2011_03/a_2011_v24_n03_01prevalencia.pdf

14. Kidney Disease: Improving Global Outcomes (KDIGO). Clinical practice guideline for acute kidney injury (AKI) and acute kidney disease (AKD) update 2023 [Internet]. 2023 [cited 2024 out 26]. Available from: https://kdigo.org/wp-content/uploads/2023/10/KDIGO-AKI-Guideline_Scope-of-Work_25Oct2023_Final.pdf

15. Whitten CW, Hill GE, Ivy R, Greilich PE, Lipton JM. Does the duration of cardiopulmonary bypass or aortic cross-clamp, in the absence of blood and/or blood product administration, influence the IL-6 response to cardiac surgery? Anesth Analg.

1998;86(1):28-33. DOI: 10.1213/00000539-199801000-00006

16. Cheruku SR, Raphael J, Neyra JA, Fox AA. Acute kidney injury after cardiac surgery: prediction, prevention, and management. Anesthesiology. 2023;139:880-98. DOI: 10.1097/ALN.0000000000004734

17. Lau D, Pannu N, James MT, Hemmelgarn BR, Kieser TM, Meyer SR, Klarenbach S. Costs and consequences of acute kidney injury after cardiac surgery: a cohort study. J Thorac Cardiovasc Surg. 2021;162(3):880-7. DOI: 10.1016/j.jtcvs.2020.01.101

18. Lindhardt RB, Rasmussen SB, Riber LP, Lassen JF, Ravn HB. The impact of acute kidney injury on chronic kidney disease after cardiac surgery: a systematic review and meta-analysis. J Cardiothorac Vasc Anesth. 2024;38(8):1760-8. DOI: 10.1053/j.jvca.2024.03.044

19. Oliveira GS, Briancini AE, Linden DJN, Aguiar GLA, Lodi LM, Almeida RMS-SA. Perfil clínico-epidemiológico e injúria renal aguda em pacientes submetidos a cirurgia cardíaca. REASE. 2023;9(12):1280-94. DOI: 10.51891/rease.v9i12.12860

20. Malta DC, Silva AG, Prates EJS, Alves FTA, Cristo EB, Machado IS. Convergence in alcohol abuse in Brazilian capitals between genders, 2006 to 2019: what population surveys show. Rev Bras Epidemiol. 2021;24(Suppl 1):e210022. DOI: 10.1590/1980-549720210022.supl.1

21. Pati P, Rathore SK. Chronic alcohol intake is a possible risk factor for kidney injury. J Urol Nephrol. 2024;9(3):000260. DOI: 10.23880/oajun-16000260

22. Chang-Panesso M. Acute kidney injury and aging. Pediatr Nephrol. 2021;36(10):2997-3006. DOI: 10.1007/s00467-020-04849-0.

23. Dantas CBA, Lima UPS, Mitidieri AP, Nascimento JEP. Insuficiência renal aguda em idosos: abordagem diagnóstica e terapêutica. REASE. 2024;10(9):2256-65. DOI: 10.51891/rease.v10i9.15762

24. Reisdorfer AP, Leal SMC, Mancia JR. Nursing care for patient in postoperatory heart surgery in the Intensive Care Unit. Rev Bras Enferm. 2021;74(2):e20200163. DOI: 10.1590/0034-7167-2020-0163

25. Reis LC, Soares RAQ, Rosa RF, Cardoso LGS. Adherence to drug treatment in older adu

Author's contribution:
Research conception and design: JBD, MW, TDE
Data acquisition: MB, CAB, JSM, JBD, MW
Data analysis and interpretation: MB, CAB, JSM, JBD, MW, TDE
Funding acquisition:
Manuscript writing: MB, CAB, JSM, JBD, MW, TDE
Critical revision of the manuscript for intellectual content: MB, CAB, JSM, JBD, MW, TDE

Editors in charge:
Patrícia Pinto Braga – Editor-in-Chief
Bruno Araújo da Silva Dantas– Scientific editor

Note:
There was no funding from a development agency.

Received: 31/07/2025
Approved: 02/10/2025

How to cite this article:
Beltrami M, Bolzani CA, Marcolina JS, et al. Incidence of acute kidney injury in women and men undergoing cardiac surgery: a longitudinal study. Revista de Enfermagem do Centro-Oeste Mineiro. 2026;16:e5803. [Access_____]; Available in:_____. DOI: http://doi.org/10.19175/recom.v16i0.5803