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ORIGINAL ARTICLE

Frequency of vasoplegia after cardiac surgery at tertiary Care Hospital in Karachi

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ABSTRACT… Objective: To determine the frequency of vasoplegia after cardiac surgery at tertiary care hospital in Karachi. **Study Design:** Descriptive Cross Sectional study. **Setting:** NICVD Karachi. **Period:** 30/07/2025 to 30/01/2026. **Methods:** Among 162 patients (18 to 65 years old) undergoing cardiac surgery. Patients with pre-existing vasoplegia, pregnancy, end stage dysfunction of organs or with chronic inflammatory diseases were excluded. Baseline demographic and clinical information were note down and the state of vasoplegia was evaluated with the help of a predetermined definition. The SPSS version 22.0 was used to analyze the data and the associations were compared using chi-square or Fisher exact test ($p \leq 0.05$). **Results:** The mean age was 52.14 ± 11.64 years. Majority of the patients were older than 50 years (135; 64.9%), 163 patients (78.4% males), Patients with vasoplegia were 17 (8.2%). Age, gender, body mass index, comorbidities, residence status or type of surgery did not have significant association with vasplegia. Low mean arterial pressure at 24 hours ($p = 0.002$) and 48 hours ($p = 0.044$) was significantly associated with the formation of vasoplegia in the postoperative conditions. **Conclusion:** Vasoplegia in cardiac surgery affects 8.2% of patients and leads to lower mean arterial pressure after the procedure. Early identification of higher-risk patients via hemodynamic monitoring can enhance postoperative care.

Key words: Cardiac Surgery, Cardiopulmonary Bypass, Mean Arterial Pressure, Vasoplegia.

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INTRODUCTION

Vasodilatory shock that follows cardiopulmonary bypass (CPB) is a potential vasoplegic syndrome (afflicting up to half of all patients who undergo major cardiovascular surgery).[1-6] Pathophysiology Villa Vasoplegic syndrome resembles sepsis. Many patients need vasopressors during the post operation period in order to ensure that there is enough tissue perfusion. There is increased morbidity and mortality that is associated with the need to further increase vasopressors.

Vasoplegia is characterized as normal cardiac output or upper cardiac output with low systemic vascular resistance (SVR) which causes organ hypoperfusion. The exact definition has varied but typically is considered when shock occurs within 24 h of CPB in the setting of a cardiac index (CI) is greater than 2.2 L/kg/m2 and SVR less than 800 dyne s/cm5. Such criteria are not very specific and present in other disease conditions that include sepsis, adrenal insufficiency, and hepatic failure among others, the difference being the etiology of the shock (infection in case of sepsis and exposure to extracorporeal circulation in case of vasoplegia).[7] Management of this syndrome is normally restricted to the administration of vasopressors to ensure sufficient perfusion pressures through the setting of a specific target mean arterial pressure (MAP). Since vasoplegic syndrome and sepsis are similar and there is a lack of information to support the results, most of the treatment procedures applied in septic shock have been extended to applicability in vasoplegic syndrome.

Less than 5 percent of all circulatory shock is that of vasoplegic syndrome after cardiovascular surgery.[8] However, high morbidity and mortality rates of vasoplegic syndrome are possible in 5-50 percent of patients receiving cardiac surgery.[9-10] It is more common among the patients who possess antecedent risk factors like the use of antihypertensive drugs, various comorbid conditions, core temperature during bypass is

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warmer and long periods of bypass.[10] A study by Marikie E et al showed that A total of (29%) patients developed vasoplegia after heart failure surgery.[11]

The occurrence of vasoplegia in cardiac surgery is explored in this paper, in an attempt to comprehend its clinical implication and impact on the patient outcome. Vasoplegia is a life threatening complication, as it involves severe hypotension, a reduction in systemic vascular resistance outcome to a lack of sufficient tissue perfusion, organ dysfunction, and increased morbidity and mortality. Understanding of its prevalence will help in improved ICU resource planning and management of healthcare costs. The proposed study will help in refining the clinical guidelines, better training in early detection and treatment and give up to date information in future studies.

METHODS

The study design was a cross-sectional one conducted at the Department of Cardiac Surgery, National Institute of Cardiovascular Diseases (NICVD), Karachi, Pakistan and done over a six-month period upon the approval from institutional review board (REF#: IRB-69/2025) dated July 30,2025.

The inclusion criteria were that of patients aged 18 to 65 years both genders who had undergone elective cardiac surgery or emergency cardiac surgery which could be a coronary artery bypass grafting (CABG), valve replacement or repair, aortic aneurysm repair, congenital heart defect repair, cardiac transplantation and any other cardiothoracic surgery. The WHO sample size calculator was used estimating the sample (n=162) with a 95 percent interval and a 7 percent margin of error and a prevalence rate of 29 of vasoplegia. The non-probability consecutive sampling method was applied in recruiting patients.

Inclusion and Exclusion Criteria

Inclusion criteria: Patients age 18-65, either gender that were undergoing cardiac surgery at the time of study and signed written informed consent.

Exclusion criteria: Patients with previously documented history of vasoplegia or in preoperative/ vasoplegia were excluded to avoid confounding, pregnant, patients with advanced hepatic/ renal dysfunction, chronic inflammatory/ autoimmune disorders and patients under immunosuppressive therapy were also excluded.

The principal investigator identified and recruited eligible patients. Informed consent was also procured in writing before the enrollment. A predesigned proforma was used to collect baseline demographic and clinical information, including age, gender, comorbidities, surgical and perioperative variables. Standard hospital protocols were followed in all the cardiac procedures. The measurement of vasoplegia was done based on the operational definition as pre-specified in the study protocol. A consultant cardiac surgeon that had a minimum of five years of post-fellowship experience supervised data collection.

The SPSS version 22.0 was used to analyze the data. Quantitative variables (age, height, weight, body mass index, mean arterial pressure) were written as the mean with standard deviation or the median with the range of the interquartile in accordance with Normality test by Shapiro-Wilk. The qualitative variables (gender, residence, comorbidities, type of surgery, vasoplegia) were stated in the form of frequencies and percentages. Through stratification, effect modifiers were controlled. Chi-square or Fisher exact tests as appropriate were done to make post-stratification comparisons. The level of significance to be considered statistically significant was considered 0.05 and below.

RESULTS

Research was conducted on 208 patients undergoing cardiac surgery. The mean age was 52.14 ± 11.64 years. Most of the patients were over 50 years (135; 64.9%), 35-50 years (55; 26.4%), and 18 (8.65%) were below 35 years (Table-I).

The mean height was 164.47 ± 9.85 cm, mean weight was 68.30 ± 13.86 kg and mean body mass index (BMI) was 25.32 ±5.19 kg/m2. The mean arterial pressure (MAP) was 75.91. ± 9.37 mmHg and 76.78 ± 8.98 mmHg at 24 and 48 hours after surgery, respectively (Table-II).

Among the population that participated in the study, 163 patients (78.4% males). Most of them were urban residents (188; 90.4%). In 83 patients (39.9%), there was family history of cardiovascular disease. The most frequent surgical procedure was coronary artery bypass grafting (154; 74.0%), then came valve replacement or repair (48; 23.1). There were 144 patients with hypertension (69.2%), and 83 patients with diabetes mellitus (39.9% (Table-III).

The vasoplegia was also observed in 17 patients with a frequency of 8.2% and 191 patients (91.8) did not develop vasoplegia after cardiac surgery (Table-IV).

The effect of vasoplegia and age group (p = 0.854), gender (p = 0.537), and BMI category (p = 0.124) were not statistically significant. In the same way, there was no significant relationship between residence status (p = 0.215), family history of cardiovascular disease (p = 0.685), and hypertension (p = 0.129) and vasoplegia (Table-V).

It was also not significantly associated with vasoplegia and diabetes mellitus (p = 0.252) or type of cardiac surgery (p = 0.908). But MAP <70 mmHg at 24 hours had a significant relationship with vasoplegia (p = 0.002). The same was also found with MAP when less than 70 mmHg at 48 hours (p = 0.044) (Table-VI).

TABLE-I

Distribution of age (n = 208).

Distribution of Age

Age	Frequency	Percent
< 35 Years	18	8.65%
35 – 50 Years	55	26.44
> 50 Years	135	64.9%
Total	208	100.0
Mean and SD	52.14 ± 11.64	

TABLE-II

Mean & SD of height & weight. (n = 143)

Variables	Mean	Standard Deviation
Height (cm)	164.47	9.85
Weight (kg)	68.30	13.86
BMI	25.32	5.19
MAP at 24hours	75.91	9.37
MAP at 48hours	76.78	8.98

TABLE-III

Distribution of Gender, residence, FHCVD, Type of cardiac surgery, HTN & DM. (n = 208)

Variables		Frequency	Percent
Gender	Male	163	78.4
	Female	45	21.6
Residence	Urban	188	90.4
	Rural	20	9.6
Family history of cardiovascular disease	No	125	60.1
	Yes	83	39.9
Type of Cardiac Surgery	Coronary Artery Bypass Grafting	154	74.0
	Valve Replacement Or Repair	48	23.1
	Aortic Aneurysm Repair	4	1.9
	Congenital Heart Defect Repair	2	1.0
Hypertension	No	64	30.8
	Yes	144	69.2
Diabetes	No	125	60.1
	Yes	83	39.9
	Total	208	100.0

TABLE-IV

Frequency of vasoplegia after cardiac surgery. (n = 208).

Vasoplegia	Frequency	Percent
No	191	91.8
Yes	17	8.2
Total	208	100.0

DISCUSSION

Vasoplegia was observed at a frequency of 8.2 percent in this group of patients undergoing cardiac surgery, which is in line with the existing literature which records vasoplegic syndrome as a fairly common postoperative occurrence. Postoperative cardiopulmonary bypass (CPB) vasoplegia is defined as an incidence of systemic hypotension and low systemic vascular resistance that is unresponsive to fluid resuscitation and vasopressor.[12-13] Past reviews state that there is great variation in incidence which is generally 5%-44% based on definitions and surgical population.[12]

TABLE-V

Stratification of Vasoplegia with age, Gender, BMI, Residence, Family history of CVD & HTN. (n = 208).

Variables No		Vasoplegia No		P-Value
Age	< 35 Years	17	1	0.854
	> 50 Years	123	12	
	35 to 50 Years	51	4	
Gender	Male	148	15	0.537
	Female	43	2	
BMI	Normal Weight (18.5–22.9 kg/m²)	59	1	0.124
	Obesity (≥25.0 kg/m²)	90	11	
	Overweight (23.0–24.9 kg/m²)	25	4	
	Underweight (<18.5 kg/m²)	17	1	
Residence	Urban	174	14	0.215
	Rural	17	3	
Family History of cardiovascular disease	No	114	11	0.685
	Yes	77	6	
Hypertension	No	56	8	0.129
	Yes	135	9	
	Total	191	17	

TABLE-VI

Stratification of Vasoplegia with DM, type of Cardiac surgery, MAP At 24 & 48hours. (n = 208).

Variables No		Vasoplegia No		P - Value
Diabetes	No	117	8	0.252
	Yes	74	9	
Type of Cardiac Surgery	Coronary Artery Bypass Grafting	141	13	0.908
	Valve Replacement Or Repair	44	4	
	Aortic Aneurysm Repair	4	0	
	Congenital Heart Defect Repair	2	0	
MAP at 24hours	< 70	47	10	0.002
	> 70	144	7	
MAP at 48hours	< 70	47	8	0.044
	> 70	144	9	
Total		191	17	208

The age, gender, and the BMI were not significantly associated with vasoplegia in the current cohort. These results are in line with the recent studies that have shown that basic demographic factors are not reliable predictors of vasoplegic syndromes after cardiac surgery.[12-13] In a similar manner, the common comorbidities such as hypertension and diabetes did not have a significant independent relationship with vasoplegia in our study, which is in line with the heterogeneous nature of an association with vasoplegia in the literature and that vasoplegia is a multifactorial phenomenon.[12-13,22]

The nature of cardiac surgery (e.g. CABG vs valve procedures) was not significantly linked to vasoplegia. Although other retrospective cohorts have found

both longer CPB and more complicated surgeries to be correlated with vasoplegia, procedural category has not always predicted its occurrence.[12,18] Another meta-analysis also emphasized the fact that perioperative variables such as CPB duration, not mere simple classification of the procedure, are more closely correlated with vasoplegia.[18]

One of the major results in this study was that there was significant correlation between the reduced postoperative mean arterial pressure (MAP <70 mmHg) at 24 hours and 48 hours and vasoplegia. Intrinsic hypotension unresponsive to fluids is also a classical sign of vasoplegic syndrome and probably represents excessive systemic inflammatory responses and vascular tone loss in the post-CPB period.[12-13] Though majority of the information on the postoperative hemodynamics and vasoplegia is based on observational cohorts, decreased MAP, and vasopressor dependency following the CPB are often observed in the patients with vasoplegia.[13]

Pathophysiology of vasoplegia is an activated systemic inflammation caused by CPB, dysfunction of the endothelium, excessive nitric oxide production, and relative vasopressin deficiency.[12-13] The effects of these mechanisms include reduced systemic vascular resistance and dysfunctional vasoreactivity which causes the typical low blood pressure condition in the presence of sufficient cardiac output.[12-13,22] Therefore, hemodynamic surveillance, including sustained hypotension, during the postoperative period can assist in earlier detection of patients prone to vasoplegia in the postoperative period.

Even though this study has been useful, with incidence and association data that are very local, there are a number of limitations that should be considered. The single-center design might not be generalizable and such variables like duration of CPB, aortic cross-clamp period and specific vasopressor regimens were not tested but have been described in the literature as possible sources of vasoplegia.[12,18] Future research can consider inclusion of biomarkers of systemic inflammation to shed more light on the underlying mechanisms in this population.

Finally, cardiac surgery led to vasoplegia in 8.2 percent of patients in this tertiary care hospital. No significant relation between baseline demographics and prevalent comorbidities and vasoplegia was observed, but the low postoperative values of MAP were significantly associated with it. These results demonstrate the value of systematic hemodynamic evaluation and can influence perioperative risk prediction and control in patients who are subjected to cardiac surgery.

CONCLUSION

The percentage of patients developing vasoplegia was significant in this tertiary care hospital in Karachi after cardiac surgery. Most demographic and clinical characteristics, including age, sex, body mass index, diabetes, hypertension, type of surgical operation, and family-history of cardiovascular disease were not significantly related to vasoplegia, however, lower mean arterial pressure at 24 and 48 hours after the surgery had a significant correlation. These results indicate the role of early postoperative hemodynamic surveillance, especially MAP curves, in the prompt detection of patients who are at risk of vasoplegia. Greater multicenter investigations in larger cohorts are necessary to confirm this as well as investigate preventive and therapeutic measures that can be used in high-risk patients within such facilities.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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REFERENCES

1. Ltaief Z, Ben-Hamouda N, Rancati V, Gunga Z, Marcucci C, Kirsch M, et al. **Vasoplegic syndrome after cardiopulmonary bypass in cardiovascular surgery: Pathophysiology and management in critical care.** Journal of Clinical Medicine. 2022 Oct 29; 11(21):6407.
2. Omar S, Zedan A, Nugent K. **Cardiac vasoplegia syndrome: Pathophysiology, risk factors and treatment.** The American Journal of the Medical Sciences. 2015 Jan 1; 349(1):80-8.

3. Muhammad R, Dharmadjati BB, Mulia EP, Rachmi DA. **Vasoplegia: Mechanism and management following cardiopulmonary bypass.** The Eurasian Journal of Medicine. 2022 Feb 1; 54(1):92.
4. Nash CM. **Vasoplegic syndrome in patients undergoing cardiac surgery: A literature review.** AACN Advanced Critical Care. 2021 Jun 15; 32(2):137-45.
5. Datt V, Wadhhwa R, Sharma V, Virmani S, Minhas HS, Malik S. **Vasoplegic syndrome after cardiovascular surgery: A review of pathophysiology and outcome-oriented therapeutic management.** Journal of Cardiac Surgery. 2021 Oct; 36(10):3749-60.
6. Busse LW, Barker N, Petersen C. **Vasoplegic syndrome following cardiothoracic surgery—review of pathophysiology and update of treatment options.** Critical Care. 2020 Feb 4; 24(1):36.
7. Busse LW, Barker N, Petersen C. **Vasoplegic syndrome following cardiothoracic surgery—review of pathophysiology and update of treatment options.** Critical Care. 2020 Feb 4; 24(1):36.
8. Sánchez MB, Villa CR, de Gopegui Miguelena PR, Ibañes PG, López AC. **Factors associated with vasoplegic shock in the postoperative period of cardiac surgery and influence on morbidity and mortality of the use of arginine vasopressin as rescue therapy.** Medicina Intensiva (English Edition). 2024 Jul 1; 48(7):392-402.
9. Castagna F, Mehra MR, Nabzdyk CG, Givertz MM. **Vasoplegia syndrome after cardiac surgery: Insights into mechanisms and treatment.** Heart Failure. 2025 Jul 1; 13(7):102482.
10. Torrez JP, Otsuki DA, Zeferino SP, Sanchez AF, Auler Jr JO, Zeferino S, et al. **Vasoplegic syndrome following bypass: A comprehensive review of pathophysiology and proposed treatments.** Cureus. 2025 Jan 27; 17(1):e78057.
11. van Vessem ME, Palmen M, Couperus LE, Mertens B, Berendsen RR, Tops LF, et al. **Incidence and predictors of vasoplegia after heart failure surgery.** European Journal of Cardio-Thoracic Surgery. 2017 Mar 1; 51(3):532-8.
12. Busse LW, Barker N, Petersen C. **Vasoplegic syndrome following cardiothoracic surgery review of pathophysiology and update of treatment options.** Critical Care. 2020 Feb 4; 24(1):36.
13. Ltaief Z, Ben-Hamouda N, Rancati V, Gunga Z, Marcucci C, Kirsch M, et al. **Vasoplegic syndrome after cardiopulmonary bypass in cardiovascular surgery: Pathophysiology and management in critical care.** Journal of Clinical Medicine. 2022 Oct 29; 11(21):6407.
14. Bastopcu M, Sargın M, Kuplay H, Erdoğan SB, Yapıcı N, Aka SA. **Risk factors for vasoplegia after coronary artery bypass and valve surgery.** Journal of Cardiac Surgery. 2021 Aug; 36(8):2729-34.
15. Muhammad R, Dharmadjati BB, Mulia EP, Rachmi DA. **Vasoplegia: Mechanism and management following cardiopulmonary bypass.** The Eurasian Journal of Medicine. 2022 Feb 1; 54(1):92.
16. Qin TX, Yao YT, **Evidence in Cardiovascular Anesthesia (EICA) Group. Vasoplegic syndrome in patients undergoing heart transplantation.** Frontiers in Surgery. 2023 Feb 13; 10:1114438.
17. Khan GM, Rashid RP, Ahmed T. **Understanding the pathophysiology of vasoplegia following cardiopulmonary bypass: A comprehensive narrative review: Vasoplegia following cardiopulmonary bypass.** Cardiovascular Journal. 2024 Aug 12; 16(2):92-7.
18. Dayan V, Cal R, Giangrossi F. **Risk factors for vasoplegia after cardiac surgery: A meta-analysis.** Interactive Cardiovascular and Thoracic Surgery. 2019 Jun 1; 28(6):838-44.
19. Vaidyanathan S, Chidambaram K, Mohanraj A. **Vasoplegic syndrome after off pump coronary artery bypass grafting surgery.** Int J Res Med Sci. 2017 Sep; 5(9):4191-4.
20. Torrez JP, Otsuki DA, Zeferino SP, Sanchez AF, Auler Jr JO, Zeferino S, et al. **Vasoplegic syndrome following bypass: A comprehensive review of pathophysiology and proposed treatments.** Cureus. 2025 Jan 27; 17(1):e78057.
21. Heyman HM, Serrano RA. **Vasoplegic syndrome and noncatecholamine therapies.** InStatPearls [Internet] 2024 Jan 11. StatPearls Publishing.

AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Aruba Khan:** Conceptualized the research idea, drafting.
2	**Ali Raza Mangi:** Study design, interpretation of findings.
3	**Abdul Ghayas:** Data analysis.
4	**Fakeha Qureshi:** Data collection.
5	**Osama Bin Sohail:** Data analysis.