

Postoperative Delirium and Its Risk Factors in Elderly Patients Undergoing Heart Valve Surgery

Waqas Hamid, Barira Ahmad and Muhammad Ali Khan

ABSTRACT

Objective: To investigate the incidence rate and risk factors of postoperative delirium in elder patients who were undergoing heart valve surgery.

Study Design: This observational prospective study

Place and Duration of Study: This study was conducted at the Chaudhary Pervaiz Elahi Institute of Cardiology, Multan from December 2022 to May 2023.

Methods: Patients of age above 18 years and admitted for elective valvular surgery were included in the study. The CAM-ICU was used as the diagnostic tool to evaluate delirium after surgery, applicable to both mechanically ventilated and extubated patients. This assessment tool involves four steps: (1) identifying fluctuating mental state, (2) reduced attention level (3) assessing for disoriented thinking, and (4) detecting altered mental condition.

Results: Among 230, 52 patients (22.6%) developed delirium, while 178 patients (77.4%) did not. The mean cardiopulmonary bypass (CPB) time was prolonged in patients with delirium (116.42 ± 8.99 minutes) compared to the non-delirium group (97.03 ± 8.24 minutes) ($p < 0.001$). Conversely, the mean aortic clamp time was shorter in the delirium group (61.62 ± 4.51 minutes) compared to the non-delirium group (86.54 ± 8.92 minutes) ($p < 0.001$). Additionally, the mean ventilator time was significantly longer in the delirium group (3.54 ± 0.64 days) compared to the non-delirium group (1.56 ± 0.54 days) ($p < 0.001$).

Conclusion: Delirium in post-operative period was found in 22.6% patients after open heart valvular surgery with elderly patients were identified as non-modifiable risk factor and modifiable risk factors include ventilation time and cardiopulmonary bypass time.

Key Words: Post-operative delirium, Heart valve surgery, Risk factors, Cardiopulmonary bypass time, Clamp time

Citation of article: Hamid W, Ahmad B, Khan MA. Postoperative Delirium and Its Risk Factors in Elderly Patients Undergoing Heart Valve Surgery. *Med Forum* 2024;35(11):169-172.doi:10.60110/medforum.351136.

INTRODUCTION

Neurological complications following cardiac surgery present a complex issue, with delirium being a notable neuropsychiatric syndrome observed since the advent of cardiopulmonary bypass (CPB), historically termed postcardiotomy delirium¹. In recent time neurological complications from cardiac surgery has been categorized into Types of injuries I and II, with delirium often representing the most common symptom of Type-II injuries². However, the distinction between delirium and the earlier nomenclature of postcardiotomy delirium remains unclear³.

Department of Cardiac Surgery, Chaudhary Pervaiz Elahi Institute of Cardiology, Multan.

Correspondence: Dr. Waqas Hamid, Assistant professor of Cardiac Surgery, Chaudhary Pervaiz Elahi Institute of Cardiology, Multan

Contact No: 03336173553

Email: drwaqashamid@yahoo.com

Received: March, 2024

Reviewed: April-May, 2024

Accepted: September, 2024

In 5th edition of DSM-5 (Diagnostic and Statistical Manual of Mental Disorders) published by Association of American Psychiatrist, is marked and defined by five key features: a disturbance in awareness and attention, typically lasting from a few hours to a few days; representing a deviation from the individual's average level of attention and awareness, often with fluctuations in severity throughout the day; and it may also include cognitive disturbances, such as memory deficits, disorientation, language difficulties, or challenges with visuospatial abilities and perception^{4,5}.

Post-surgical delirium, which is not attributable to pre-existing or emerging neurocognitive disorders, severely reduced arousal states like coma, substance intoxication, poison exposure, withdrawal are more common⁶. Delirium may have associated with increased risk of morbidity and mortality, hospital stay prolongation, and extended cognitive impairment⁷. Delirium can be diagnosed with criteria of DSM-5, but in intensive care setting it is quite difficult to address. In ICU numerous diagnostic tools have been employed for critically ill patients⁸. Confusion Assessment method is a useful tool for ICU patients which more extensively studied and recommended by many researchers^{9,10}.

Since the day of delirium was diagnosed in cardiac surgery patients no pharmacological intervention was found effective, identifying its risk factors is more important in patients of cardiac surgery. Consequently, this study was planned to determine the frequency and risk factors of delirium in patents admitted for valvular surgery, these findings helps medical professionals to adopt proper and practical strategies in preoperative period.

METHODS

This observational prospective study was conducted at Chaudhary Pervaiz Elahi Institute of Cardiology, Multan from December 2022 to May 2023. Patients of age above 18 years and admitted for elective valvular surgery were included in the study. Any comorbid condition that prevent assessment of CAM-ICU like deafness and dementia, history of previous stroke, and taking medications for treatment of psychiatric disorder were excluded from the study. All patients received standard care, which included a pre-surgery examination conducted one day before their procedure to assess their previous history of cognitive function, mental and physical condition.

General anesthesia was administered to all patients, with induction achieved using rocuronium, fentanyl, etomidate, and midazolam. Maintenance of anesthesia was achieved with inhalational anesthetics (sevoflurane) and propofol. Prophylactic antibiotic (ceftriaxone) and tranexamic acid (Transamin) was given. Procedure was heparinized to avoid risk clotting and its effect was reversed by using protamine sulphate after completion of CPB.

Pump flow rate was maintained between 2.4-2.8 L/min/m², mean blood pressure was controlled between 60-90 mmHg and hypothermia was induced between 33-35°C. after completion of surgery patient was shifted to recovery room and sedated by using midazolam and combination with fentanyl. Following all criteria extubation was performed.

The CAM-ICU guidelines was used to evaluate and label delirium after surgery, applicable to both mechanically ventilated and extubated patients. This assessment tool involves four steps: (1) identifying fluctuating mental state, (2) reduced attention level (3) assessing for disoriented thinking, and (4) detecting altered mental condition. Delirium was assessed by and qualified psychiatrist at 1st post-operative day and after that at day 2, 3 and 4. SPSS version 27 was used for data analysis. After test of significance p value below 0.05 was taken as significant.

RESULTS

A total of 230 patients were enrolled in our study. Among these, 52 patients (22.6%) developed delirium, while 178 patients (77.4%) did not. Average of patient's age with delirium was 58.58±10.23 years,

compared to 56.11±8.63 years in those without delirium, a difference that was not statistically significant (p=0.241). Although there were more males than females in both groups, (p=0.314). The majority of patients in both groups were classified as ASA II, between groups p=0.363.

The mean cardiopulmonary bypass (CPB) time was prolong in patients with delirium (116.42±8.99 minutes) compared to the non-delirium group (97.03±8.24 minutes) (p<0.001). Conversely, the mean aortic clamp time was shorter in the delirium group (61.62±4.51 minutes) compared to the non-delirium group (86.54±8.92 minutes) (p<0.001). Additionally, the mean ventilator time was significantly longer in the delirium group (3.54±0.64 days) compared to the non-delirium group (1.56±0.54 days) (p<0.001).

Table No. 1: Demographic and perioperative profile among delirium and non-delirium patients

Variable	Delirium		p-value
	Yes 52 (22.6%)	No 178 (77.4%)	
Age (years)	58.58±10.23	56.11±8.63	0.241
Gender			
Male	33 (63.5)	99 (55.6)	0.314
Female	19 (36.5)	79 (44.4)	
ASA status			
I	22 (42.3)	63 (35.4)	0.363
II	30 (57.7)	115 (64.6)	
CPB time (minutes)	116.42±8.99	97.03±8.24	<0.001
Aortic clamp time (minutes)	61.62±4.51	86.54±8.92	<0.001
Ventilator time (days)	3.54±0.64	1.56±0.54	<0.001
N (%), Mean ± S.D			

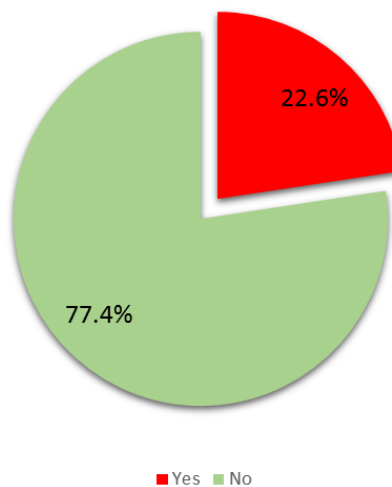


Figure No. 1: Distribution of delirium among the study patients

Table No. 2: Onset time and duration of delirium among delirium patients

	N (%)
Onset time at	
1 st day	29 (55.8)
2 nd day	7 (13.5)
3 rd day	11 (21.2)
4 th day	5 (9.5)
Total	52 (100.0)
Duration at	
1 st day	13 (25.1)
2 nd day	28 (53.8)
3 rd day	9 (17.3)
≥ 4 th day	2 (3.8)
Total	52 (100.0)

Regarding the onset of delirium, 29 patients (55.8%) developed delirium on day 1, 7 patients (13.5%) on day 2, 11 patients (21.2%) on day 3, and 5 patients (9.5%) on day 4. The duration of delirium varied, with 13 patients (25.1%) experiencing delirium for one day, 28 patients (53.8%) for two days, nine patients (17.3%) for three days, and two patients (3.8%) for four or more days.

DISCUSSION

Delirium is a common and frequent complication but not well-reported complication after cardiac surgeries, characterized by acute confusion, fluctuating levels of consciousness, and cognitive disturbances, which can significantly impact patient outcomes, prolong hospital stays, and increase the risk of morbidity and mortality¹¹. Prolong stay of delirium may compromise the patient’s quality of life. This condition is characterized by an altered mental status, accompanied by a wide range of neuropsychiatric signs and symptoms that fluctuate over time, resulting from disruptions in cerebral homeostasis¹².

Incidence of postoperative delirium was 22.6% in present study, which is within the reported range of Asghar et al¹³ and Kirfel et al¹⁴ 4.1% to 54.9% found in the literature for cardiac surgery patients. In our study patients having post-operative delirium were observed with 116.42±8.99 minutes CPB time as compared to normal patients with 97.03±8.24 minutes. Study by Sabol F et al¹⁵ has established an association between aortic clamp time and time duration of CPB and delirium development. Further supporting this, a study by Rudolph et al¹⁶ found that clamp time above 68 minutes was associated with delirium in post-operative time period.

The study by Brown et al¹⁷ indicated that prolong surgical time and cardiopulmonary bypass (CPB) durations were associated with an increased risk of air embolism, particularly in major surgeries like anastomosis of major vessels, and cardiac surgical procedures which also pose a greater risk of blood clot

movement. However, in a 2021 meta-analysis of 14 studies, researcher did not find a link between clamp time and the rate of delirium in post-operative time.

In our study post-operative delirium was occurred at 1st post-operative day. In a study Norkiene et al¹⁸ reported that postoperative delirium most commonly occurs within the first five days after surgery. Kazmierski et al¹⁹ and Tan et al²⁰ concluded that if delirium is diagnosed either during the very 1st day or after the 6th day after surgery, it may not be directly related to the surgery itself. Instead, it could be associated with factors such as urogenital or respiratory infections, the use of acidosis, psychotropic substances, or various changes electrolyte balance.

CONCLUSION

Post-operative delirium was found in 22.6% patients after open heart valvular surgery with elderly patients were identified as non-modifiable risk factor and modifiable risk factors include ventilation time and cardiopulmonary bypass time.

Author’s Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Waqas Hamid, Barira Ahmad
Drafting or Revising Critically:	Barira Ahmad, Muhammad Ali Khan
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

Conflict of Interest: The study has no conflict of interest to declare by any author.

Source of Funding: None

Ethical Approval: No.103 dated 10.08.2021

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