Section: Cardiothoracic Surgery

Original Research Article

INCIDENCE AND PREVALENCE OF POSTOPERATIVE COGNITIVE DYSFUNCTION AFTER CARDIAC SURGERIES-AN INSTITUTIONAL STUDY

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ABSTRACT

Background: Post-Operative Cognitive Dysfunction (POCD) is a serious yet under recognized complication following major surgeries, particularly open cardiac procedures. POCD manifests as impairments in memory, attention, learning, executive function, and psychomotor dexterity, sometimes accompanied by behavioural changes. Despite numerous global studies, a standardized diagnostic test remains elusive. **Aim:** To establish the incidence of POCD and devise a reliable methodical test for its diagnosis using available resources at the Department of Cardiothoracic Surgery, Government Stanley Medical College Hospital.

Materials and Methods: This retrospective study included 100 patients who underwent elective open cardiac surgeries between 2020 and 2023. Patients with previous cognitive disorders, psychiatric illnesses, or pre-existing cerebral, pulmonary, or renal insufficiency were excluded. Montreal Cognitive Assessment (MoCA) was used as a screening test for preoperative cognitive assessment, while both MoCA and Wisconsin Card Sorting Test (WCST) were used as confirmatory tests postoperatively at 3 days, 6 weeks, and 6 months after surgery. A decline of more than one standard deviation between preoperative and postoperative scores was considered significant.

Results: The overall incidence of POCD was 46% at discharge, 29% at six weeks, and 18% at six months postoperatively. The incidence increased with advancing age, with 75% of patients over 71 years exhibiting POCD at discharge compared to only 20% in those under 20 years. CABG surgeries showed the highest POCD incidence (52.9%), followed by aortic valve replacement (50%), mitral valve replacement (44.6%), double valve replacement (42.8%), and congenital heart disease surgeries (25%).

Conclusions: POCD represents a significant complication following cardiac surgery, with highest incidence at discharge that gradually decreases over time. MoCA and WCST proved to be reliable and practical cognitive assessment tools within our institutional setting.

Keywords: Open heart surgery, POCD, Cognition, MoCA, WCST.

INTRODUCTION

Open cardiac surgeries are associated with significant cognitive decline in postoperative patients. Post-Operative Cognitive Dysfunction (POCD) presents an iceberg phenomenon where only a subset of patients are symptomatic and clinically diagnosed, leaving the majority undetected. POCD has been linked to various adverse outcomes including increased mortality within one year after surgery, earlier retirement, and premature need for financial and psychological assistance.

Cardiac surgeries, being highly skilled and demanding procedures, carry substantial risks of compromising cerebral blood flow and require extended duration of general anesthesia. Consequently, a significant fraction of patients develop psychological and neurological disturbances, particularly during the early postoperative period. POCD, one of the most

common yet under-explored entities, was first documented by Bedford in 1955.[1] It represents a well-defined clinical phenomenon with multifactorial origins, characterized by a decline in cognitive function lasting from 1-12 months after surgery or longer.

POCD can be sub classified into short-term and long-term variants. Short-term POCD is defined as cognitive decline lasting up to 6 weeks after surgery, whereas long-term POCD persists up to 6 months postoperatively. The risk factors for POCD include advancing age, preoperative mild cognitive impairment, cerebral/cardiac/vascular insufficiency, and low educational status, and alcohol abuse, longer duration of surgery, intraoperative or postoperative complications, secondary surgery, and long-acting anaesthetics. Among these, advancing age appears to be the most significant factor, with POCD incidence increasing substantially in older patients with a history of alcohol abuse.[2,3]

The pathogenesis of POCD remains incompletely understood, though possible mechanisms include inflammatory cascades involving NF-kB signaling leading to cytokine release that impairs the blood-brain barrier. Long-acting anesthetics appear to increase POCD incidence, though definitive clinical evidence is lacking. In cardiac surgeries specifically, hypoperfusion, emboli, and inflammation associated with cardiopulmonary bypass (CPB) have demonstrated connections to POCD. According to literature, worldwide incidence of POCD after cardiac surgery is approximately 53% at discharge, 36% after six weeks, and 24% after six months postoperatively.

By definition, POCD assessment requires both preoperative and postoperative evaluation of cognitive status. Various psychometric tests are available for evaluating cognition, including Montreal Cognitive Assessment (MoCA), Wisconsin Card Sorting Test (WCST), the Rey Auditory Verbal Learning Test, Trail Making Test, Grooved Pegboard Test, Digit Span Test, Stroop Test, Paper and Pencil Memory Test, Letter and Number Replacement Test, Four-Field Test, Erzigkeit's Short Cognitive Performance Test, and Mini Mental Status Examination. Despite this abundance of available tests, no definitive assessment tool has been established as universally efficacious and reliable for POCD diagnosis.[4]

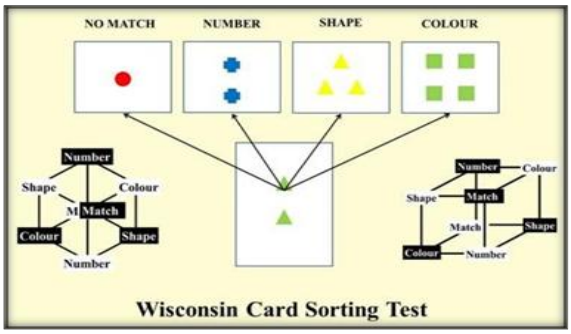
Our study aims to determine the incidence of POCD among patients undergoing cardiac surgery at our institution and to establish a standardized methodology for its assessment using readily available resources.

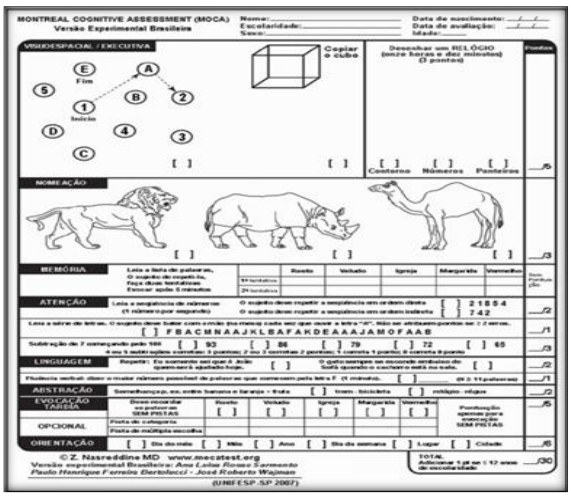
MATERIALS AND METHODS

This retrospective study included 100 patients who underwent cardiac surgeries and were evaluated for cognitive dysfunction both pre- and postoperatively between 2020 and 2023. The Montreal Cognitive Assessment (MoCA) was employed as a screening test for preoperative cognitive assessment, while both MoCA and Wisconsin Card Sorting Test (WCST) were utilized as confirmatory tests to evaluate postoperative cognitive status. A decline of more than one standard deviation (1SD) between preoperative and postoperative scores was deemed significant.

Inclusion criteria encompassed all patients who underwent elective open cardiac surgeries in the Department of Cardiothoracic Surgery at Stanley Medical College. Exclusion criteria comprised patients with previous cognitive disorders, psychiatric illnesses, pre-existing cerebral, pulmonary, or renal insufficiency, and those with education below 7th grade.

A total of 100 consecutive patients undergoing open-heart surgery at Stanley Medical College were included in this retrospective study. The procedures encompassed coronary artery bypass grafting, valve replacement or repair, and various other cardiac interventions. Patients over 16 years of age undergoing elective cardiac surgery with or without cardiopulmonary bypass (CPB) were included. Preoperative cognitive function was assessed using the Montreal Cognitive Assessment test. In cases of CABG surgery, procedures were always assisted by a CPB device. All patients underwent Montreal Cognitive Assessment and Wisconsin Card Sorting Test (as confirmation) postoperatively at 3 days, 6 weeks, and 6 months after surgery. Scores were tabulated, and a difference of 1SD between preoperative and postoperative scores was considered significant for the diagnosis of POCD.





RESULTS

The study analyzed 100 patients who underwent cardiac surgeries at the Department of Cardiothoracic Surgery, Stanley Medical College. The incidence of POCD varied significantly across age groups and types of cardiac procedures.

Age Distribution and POCD Incidence

The age-based analysis revealed a clear correlation between advancing age and POCD incidence (Table 1). In patients under 20 years (n=10), POCD was observed in only 20% at discharge, with complete resolution by 6 weeks. The 21-30 age group (n=13) showed 38.5% incidence at discharge, decreasing to 15.3% at 6 weeks and 7.6% at 6 months.

Table 1: Age Distribution

Age Group	Total number of patients in the age group	At time	Incidence of POCD the of discharge	
			At 6 weeks	At 6 months
<20	10	20% (2)	0	0
21-30	13	38.5% (5)	15.3% (2)	7.6% (1)
31-40	13	61.5% (8)	23% (3)	15.3% (2)
41-50	24	45.8% (11)	25% (6)	16.6% (4)
51-60	21	57.1% (12)	28.5% (6)	19% (4)
61-70	17	52.9% (9)	35.2% (6)	17.6% (3)
>71	12	75% (9)	50% (6)	33.3% (4)
Overall	100	46%	29%	18%

For patients aged 31-40 (n=13), the initial POCD rate was notably higher at 61.5%, decreasing to 23% at 6 weeks and 15.3% at 6 months. The 41-50 age group (n=24) demonstrated 45.8% POCD at discharge, 25% at 6 weeks, and 16.6% at 6 months.

In the 51-60 age group (n=21), POCD was observed in 57.1% at discharge, 28.5% at 6 weeks, and 19% at 6 months. For patients aged 61-70 (n=17), the incidence was 52.9% at discharge, 35.2% at 6 weeks, and 17.6% at 6 months.

Most significantly, patients over 71 years (n=12) exhibited the highest POCD rates: 75% at discharge, 50% at 6 weeks, and 33.3% at 6 months. The overall incidence across all age groups was 46% at discharge, gradually decreasing to 29% at 6 weeks and 18% at 6 months.

POCD Incidence by Surgical Procedure

The study also analyzed POCD incidence across different cardiac procedures (Table 2). CABG procedures (n=34) showed the highest POCD rate at 52.9% at discharge. Mitral valve replacement, the most common procedure (n=47), had a 44.6% POCD incidence. Aortic valve replacement (n=4) showed a 50% POCD rate, while double valve replacement (n=7) showed 42.8% incidence. Surgeries for congenital heart disease (n=8) demonstrated the lowest POCD rate at 25%.

Table 2: Type of Open-Heart Surgery Done

Type of Surgery	Number of Patients	Incidence of POCD at Discharge
CABG	34	52.9% (18)
Mitral valve replacement	47	44.6% (21)
Aortic valve replacement	4	50% (2)
Double valve replacement	7	42.8% (3)
Surgery for congenital heart disease	8	25% (2)
Overall	100	46%

DISCUSSION

This study provides valuable insights into the demographic and procedural determinants of POCD among cardiac surgery patients at Stanley Medical College, Chennai. Our findings confirm that POCD represents one of the most common complications following cardiac surgeries, with a significant overall incidence of 46% at discharge.[5]

The age-stratified analysis clearly demonstrates that POCD incidence increases substantially with advancing age, with the highest rates observed in patients over 71 years. This correlation can be attributed to age-related atherosclerotic changes that predispose older patients to cerebral vascular complications. Notably, younger patients exhibited lower POCD incidence with more transient manifestations, showing better recovery over time.

The procedure-specific analysis revealed that CABG surgeries carried the highest risk for POCD (52.9%), followed by aortic valve replacement (50%). This finding aligns with current understanding that procedures involving cardiopulmonary bypass and potential manipulation of the ascending aorta pose greater risks for cerebral microemboli and subsequent cognitive effects. The relatively lower incidence observed in surgeries for congenital heart disease (25%) may reflect the younger patient demographic typically undergoing these procedures.[6]

Our study also identified a history of alcohol use as a potential contributing factor to increased POCD incidence and subsequent complications, though

detailed quantification of this relationship was beyond the scope of this initial analysis.

The MoCA and WCST assessment tools proved particularly effective for our patient population, many of whom come from lower socioeconomic backgrounds. These tests offer simplicity and efficacy in evaluating cognitive function in this specific demographic subset.[7]

It is noteworthy that among the eight deaths reported in our study cohort within the first postoperative year, a significant fraction occurred in older patients with POCD, highlighting the potential prognostic significance of postoperative cognitive decline. However, establishing direct causality would require more targeted investigation.[8-10]

While this study provides valuable insights into POCD patterns in our institutional setting, we acknowledge the need for larger-scale, multicentric research with more comprehensive assessment protocols to further delineate the causes, characteristics, and outcomes of POCD following cardiac surgery.

CONCLUSION

POCD represents a significant complication following cardiac surgery, with an overall incidence of 46% at discharge, gradually decreasing to 18% at six months postoperatively. Advanced age and certain procedure types, particularly CABG and aortic valve surgery, are associated with higher POCD risk. The MoCA and WCST proved to be practical and reliable assessment tools within our institutional setting. Our findings underscore the importance of preoperative cognitive screening and postoperative monitoring, particularly in high-risk patients, to enable early intervention and potentially improve long-term outcomes.

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