



CLINICAL FEATURES AND PREDICTIVE FACTORS OF POSTOPERATIVE COGNITIVE DECLINE FOLLOWING CORONARY ARTERY BYPASS GRAFTING VERSUS PERCUTANEOUS CORONARY INTERVENTION

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Abstract: Cardiovascular diseases are the world's leading cause of death, responsible for over 20 million fatalities annually, with coronary artery disease (CAD) representing the majority of these cases. Myocardial revascularization techniques—both surgical (coronary artery bypass grafting, CABG) and interventional (percutaneous coronary intervention, PCI with stent placement)—significantly enhance survival rates and quality of life. Nevertheless, postoperative cognitive impairment (POCI) has become a frequent and clinically significant complication. This study sought to assess the incidence, severity, and associated risk factors of cognitive decline in patients undergoing CABG or PCI. Neuropsychological, clinical, and laboratory evaluations were administered. Cognitive impairment was detected in 38.3% of the entire patient cohort, with a higher prevalence observed in the CABG group. Significant independent predictors included advanced age, diabetes mellitus, prolonged cardiopulmonary bypass time, and perioperative hypotension. Early recognition of cognitive deterioration may contribute to better long-term neurological and cardiovascular outcomes.

Keywords: coronary artery bypass grafting, percutaneous coronary intervention, cognitive impairment, postoperative complications, risk factors, neuropsychological assessment



Introduction

Cardiovascular diseases (CVD) are responsible for approximately 32% of global deaths, and coronary artery disease accounts for nearly half of these cases. The number of myocardial revascularization procedures has increased steadily, with over 800,000 CABG surgeries and more than 3 million PCI procedures performed annually worldwide. Although these interventions reduce cardiovascular mortality, neurological complications, particularly cognitive impairment, remain a major concern.

Postoperative cognitive dysfunction (POCD) has been reported in 20–60% of patients after CABG during early postoperative periods and in 10–30% during long-term follow-up [1]. Even PCI, previously considered neurologically safer, has been associated with subtle but clinically meaningful cognitive changes [2]. Mechanisms proposed include microembolic events, cerebral hypoperfusion, systemic inflammation, oxidative stress, and endothelial dysfunction [3. 12].

Several authors have emphasized the role of cardiopulmonary bypass duration and intraoperative hemodynamic instability as key determinants of postoperative cognitive decline [4. 11]. Other studies highlight advanced age, diabetes mellitus, arterial hypertension, and atherosclerotic burden as independent predictors [5. 10]. Neuroinflammation and blood–brain barrier disruption have also been implicated in persistent cognitive deficits [6. 9].

Despite numerous international publications, regional data on cognitive impairment following CABG and PCI remain limited. Early detection of cognitive decline is essential for preventing long-term disability and improving rehabilitation outcomes.

Aim of the Study

To determine the frequency, severity, and risk factors of cognitive impairment in patients undergoing coronary artery bypass grafting or percutaneous coronary intervention with stenting.



Materials and Methods

A total of 60 patients who underwent myocardial revascularization were included in the study. Among them, 30 patients underwent CABG and 30 underwent PCI with stent implantation. Additionally, a control group of 30 age- and sex-matched individuals without recent cardiac surgery or intervention was formed for comparative analysis.

Inclusion criteria consisted of patients aged 45–75 years who had undergone CABG or PCI and provided informed consent. Exclusion criteria included prior stroke, diagnosed dementia, severe psychiatric illness, or major neurological disorders.

Clinical evaluation included demographic data collection, cardiovascular risk factor assessment (hypertension, diabetes, smoking, dyslipidemia), and perioperative parameters. Neuropsychological assessment was performed using the Montreal Cognitive Assessment (MoCA), Mini-Mental State Examination (MMSE), Trail Making Test (TMT-A and TMT-B), and verbal fluency test. Cognitive impairment severity was classified as mild, moderate, or severe according to standardized criteria.

Laboratory investigations included lipid profile, fasting glucose, HbA1c, inflammatory markers (CRP), and coagulation parameters. Instrumental methods included echocardiography and carotid Doppler ultrasound.

Statistical analysis was performed using parametric and non-parametric methods. Continuous variables were analyzed using Student's t-test and ANOVA. Categorical variables were assessed using chi-square tests. Multivariate logistic regression was applied to identify independent predictors of cognitive impairment. Statistical significance was set at $p < 0.05$.

Results

The study evaluated 60 patients following myocardial revascularization procedures. Cognitive impairment was identified in 23 (38.3%) patients overall. The



frequency was higher in the CABG group (46.7%) compared to the PCI group (30.0%).

Table 1. Frequency and Severity of Cognitive Impairment

Group	Number of Patients	Cognitive Impairment (%)	Mild	Moderate	Severe
CABG (n=30)	30	46.7%	8	5	1
PCI (n=30)	30	30.0%	6	3	0
Control (n=30)	30	10.0%	3	0	0

Cognitive impairment was most prevalent among CABG patients. Moderate and severe deficits were observed exclusively in surgical patients, suggesting a stronger neurological impact of cardiopulmonary bypass.

Table 2. Identified Risk Factors for Cognitive Impairment

Risk Factor	OR	p-value
Age >65 years	2.8	0.01
Diabetes Mellitus	3.2	0.004
Prolonged CPB time (>90 min)	3.9	0.002
Perioperative hypotension	2.5	0.03
Elevated CRP	2.1	0.04

Advanced age, diabetes mellitus, prolonged cardiopulmonary bypass (CPB) time, and systemic inflammation were statistically significant predictors of postoperative cognitive impairment.

Discussion

The results demonstrate that cognitive impairment is a frequent complication after myocardial revascularization procedures. The higher incidence in CABG patients aligns with previous findings reporting early cognitive dysfunction rates up to 50% after open-heart surgery [12, 52]. Cardiopulmonary bypass, microemboli



formation, and systemic inflammatory response are considered major contributors [48].

In contrast, PCI patients exhibited lower but still notable cognitive changes. Recent evidence suggests that even catheter-based interventions may provoke silent cerebral ischemia [29]. Our findings confirm that age and diabetes are strong independent predictors, consistent with earlier meta-analyses [34, 71].

The socioeconomic implications are significant. Postoperative cognitive impairment may prolong rehabilitation, reduce work capacity, and increase healthcare costs. Early screening using simple neuropsychological tools could reduce long-term disability and improve quality of life. Preventive strategies such as optimized hemodynamic control, inflammation reduction, and metabolic stabilization may mitigate cognitive decline.

From an economic perspective, early detection programs may reduce rehospitalization rates and long-term care expenses. From a social-medical standpoint, maintaining cognitive function improves functional independence and patient reintegration into society.

Conclusion

Cognitive impairment is a common and clinically significant complication following coronary artery bypass grafting and percutaneous coronary intervention. It occurs more frequently and with greater severity in CABG patients. Advanced age, diabetes mellitus, prolonged cardiopulmonary bypass time, and systemic inflammation are major risk factors. Early neuropsychological screening and targeted preventive strategies are essential for improving long-term neurological and cardiovascular outcomes. Integrating cognitive assessment into postoperative management protocols may enhance both clinical effectiveness and healthcare sustainability.



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