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# Postoperative Cognitive Impairment after Coronary Artery Bypass Grafting and Percutaneous Coronary Intervention: Clinical Characteristics and Risk Factors

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**Abstract**. Cardiovascular diseases remain the leading cause of mortality worldwide, accounting for more than 20 million deaths annually, and coronary artery disease (CAD) constitutes the largest proportion of these cases. Surgical and interventional myocardial revascularization procedures, including coronary artery bypass grafting (CABG) and percutaneous coronary intervention (PCI) with stent implantation, significantly improve survival and quality of life. However, postoperative cognitive impairment (POCI) has emerged as a frequent and clinically relevant complication. The present study aimed to evaluate the frequency, severity, and risk factors of cognitive impairment in patients undergoing CABG or PCI. A prospective observational study was conducted at the Central Clinical Hospital of "Temir Yo'l Ijtimoiy Xizmatlar" LLC between 2025 and 2028. Sixty patients who underwent CABG or PCI were examined and compared with 30 age- and sex-matched controls. Neuropsychological, clinical, and laboratory assessments were performed. Cognitive impairment was identified in 38.3% of patients, with higher prevalence in the CABG group. Advanced age, diabetes mellitus, prolonged cardiopulmonary bypass time, and perioperative hypotension were significant predictors. Early identification of cognitive decline may improve long-term neurological and cardiovascular outcomes.

**Key words:** Coronary Artery Bypass Grafting, Percutaneous Coronary Intervention, Cognitive Impairment, Postoperative Complications, Risk Factors, Neuropsychological Assessment

## Introduction

The 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 [12, 37, 64]. Even PCI, previously considered neurologically safer, has been associated with subtle but clinically meaningful cognitive changes [8, 29]. Mechanisms proposed include microembolic events, cerebral hypoperfusion, systemic inflammation, oxidative stress, and endothelial dysfunction [15, 48].

Several authors have emphasized the role of cardiopulmonary bypass duration and intraoperative hemodynamic instability as key determinants of postoperative cognitive decline [21, 52]. Other studies highlight advanced age, diabetes mellitus, arterial hypertension, and atherosclerotic burden as independent predictors [34, 71]. Neuroinflammation and blood–brain barrier disruption have also been implicated in persistent cognitive deficits [18, 56].

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**

This prospective observational study was conducted at the Neurology and Cardiology Departments of the Central Clinical Hospital of "Temir Yo'l Ijtimoiy Xizmatlar" LLC during 2025–2028.

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 |

## 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.

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