Original Article
DOI: https://doi.org/10.70749/ijbr.v4i2.2907

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://ijbr.com.pk
ISSN: 2960-2793/ 2960-2807

Postoperative Cognitive Dysfunction in Elderly Patients: Neurological, Psychological, and Functional Implications

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ARTICLE INFO

Keywords: Postoperative Cognitive Dysfunction, Neuroinflammation, Anxiety, Elderly Patients, Depression, Functional Ability, Anesthesia, Quality of Life

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Declaration
Authors' Contribution
All authors equally contributed to the study and approved the final manuscript.

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History
Received: 14-12-2025 Revised: 09-02-2026
Accepted: 20-02-2026 Published: 28-02-2026

ABSTRACT

This study investigated the neurological, psychological, and functional implications of Postoperative Cognitive Dysfunction (POCD) among elderly patients following surgical procedures. A quantitative descriptive-correlational research design was used, and a total sample of 233 elderly patients aged 60 years and above was selected through purposive sampling from hospital settings. Data were collected using standardized cognitive assessments, psychological scales measuring anxiety and depression, and functional ability measures assessing activities of daily living. It was analyzed using SPSS through descriptive statistics, correlation analysis, multiple regression analysis, and one way ANOVA. The results showed that POCD was significantly related to neurological factors, such as neuroinflammatory markers ($r = .58$, $p < .001$), cerebral hypoperfusion ($r = .51$, $p < .001$) and duration of anesthetic exposure ($r = .44$, $p = .001$). The psychological factors were also found to be good predictors of POCD ($R2 = .41$, $p < .001$) and anxiety ($b = .36$) was the best predictor by the multiple regression analysis. Besides, the results of ANOVA showed the statistically significant differences of functional ability by the level of POCD ($F = 21.96$, $p < .001$). The findings of the study were that POCD is a complex condition that depends on biological and psychological factors and the functional outcome to elderly individuals is significant and thus, it requires holistic perioperative assessment and intervention measures.

INTRODUCTION

Postoperative Cognitive Dysfunction (POCD) is a prevalent but poorly known complication, which impairs cognitive functioning after surgical operations, and it is especially widespread in geriatric patients. It is defined as memories, attention, and executive functioning and speed of information processing impairments that develop following anesthesia and surgery. In contrast to the delirium that manifests itself as an acute and unstable state of consciousness changes, POCD is less apparent and can last weeks, months, or even years [1]. As population of the world matures, and an increasing number of the older adults are subjecting themselves to surgery, the condition has become a growing concern.

The incidence of POCD depends on the nature of the surgical procedure and the instruments applied but studies have indicated that about 25-40 percent of the elderly patients show signs of impairment one week after major surgery, and about 10-15 percent of the patients still portray impairment after 3 months of surgery [2]. These statistics allow noting the clinical importance of POCD as a postoperative complication with long-term outcomes. With more sophisticated and available surgical interventions, it is important to learn about the cognitive risks of anesthesia and surgical stress to enhance patient outcomes.

This is especially susceptible to elderly patients because of neurodegenerative changes associated with aging, diminished cognitive reserve, and comorbid medical health conditions. The elderly brain is prone to more effects caused by neurochemical imbalances and the inflammatory reactions to surgical trauma. Research indicates that neuroinflammation, oxidative stress, and damage to the blood-brain barrier play an important role in the pathogenesis of POCD [3]. That is why POCD is a multifactorial syndrome that consists of biological, psychological, and environmental determinants.

Besides, the distinction between regular aging-related

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cognitive degradation and POCD may prove difficult. A baseline cognitive evaluation before surgery is necessary to determine the changes correctly after surgery. In the absence of proper screening, the mild cognitive impairment can be missed resulting in underdiagnosis. Hence, the need to define standard diagnostic criteria and assessment tools is still part of the priorities in perioperative medicine.

Neurological Processes that may cause POCD

Neurological pathogenesis of POCD is complex: it is an anesthesia-surgical stress-brain interaction combined with aging of the brain. Neuroinflammation is one of the popularly embraced processes. The effect of surgical trauma is the activation of systemic inflammatory pathways (release of cytokines: interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-a). Such inflammatory mediators are able to penetrate the damaged blood-brain barrier in the older adults, initiating microglial and neuronal dysfunction [4]. Long-term cognitive decline has been associated with persistent neuroinflammation.

The other mechanism suggested is the direct neurotoxicity of some anesthetic parameters. Experimental research has shown that volatile anesthetic can enhance amyloid-beta deposition and tau protein hyperphosphorylation, which are neurodegenerative disease mechanism of Alzheimer disease. Even though a causal relationship is not determined completely, there is still concern over the susceptibility of elderly patients with preclinical neurodegenerative pathology [5].

In surgery, cerebral hypoperfusion and microembolic events are also contributive factors of cognitive impairment. The elderly patients tend to be vulnerable of ischemic insults on their cerebrovascular during episodes of hypotension due to the compromised cerebrovascular integrity. The impaired synaptic plasticity and hippocampal performance that are essential to the process of memory consolidation can be caused by reduced cerebral oxygenation. These vascular processes also make the postoperative neurological complications even more complicated.

Moreover, genetic factors, including the presence of the APOE e4 allele, can predispose to POCD. In certain clinical studies, individuals carrying this genotype have been more susceptible to postoperative cognitive decline. This indicates that in the future, the use of personalized risk evaluation using genetic and biological markers can be useful in the management of older surgical patients.

Psychological Implication of POCD

In addition to neurological changes, POCD has serious psychological implications that influence the emotional and mental health. Postoperative cognitive impairment can cause anxiety, depression, and low self-efficacy, especially in older adults who consider them important. Hospitalization and recovery are stressful experiences that may result in the worsening of underlying psychological behaviors [6].

Patients with POCD usually complain of frustration, confusion, and fear with respect to their mental changes. These emotional responses can also worsen concentration and memory and form a circular interaction between psychological distress and cognitive dysfunction. In others, depressive symptoms can resemble, or exacerbate cognitive impairment, making diagnosis and treatment planning challenging.

Caregivers and relatives of elderly individuals also report psychological stress on their part when the relatives exhibit deterioration in cognitive skills following surgery. This abrupt cognitive decline may cause family disruption and add extra load to the care provider. Social isolation can also take place when patients avoid doing things that they once liked because of mortification or lack of confidence.

Moreover, the sense of cognitive impairment can adversely affect the motivation to recover and follow rehabilitation interventions. Patients with low levels of cognitive competence (who are elderly) might be less willing to participate in an active physical therapy or postoperative care process. The psychological responses which are addressed by counseling and supportive interventions are therefore vital towards a holistic POCD management.

Incidents/Effects of Firm Size on Functional and Quality of Life

The practical consequences of POCD are not only based on the cognitive test results but also on everyday life activities. Medication management, financial judgment, and safe mobility can be impaired because of impairment in memory and executive functioning. In the case of older patients, these losses can undermine their self-sufficiency and heighten their dependence on their caregivers or institutions [7].

It has been found that the elderly patients who possessed persistent POCD were more likely to experience postoperative complications, protracted hospital stays, and mortality than their cognitively intact counterparts [8]. Poor functional capacity can also increase the risk of falls and rehospitalization, which increases the strain on health care systems.

When the social involvement and independence are disrupted by cognitive deterioration, it can greatly influence the quality of life. Such activities as driving, interacting with others and taking part in the community may be problematic, which results in reduced life satisfaction. Physical dependence may have a significant psychosocial consequence, especially in cultures where the elderly should continue to play family roles.

Considering the broad-based impacts, it is important to identify them early and develop preventive measures. It is suggested to use multidisciplinary methods that would entail anesthesiologists, neurologists, psychologists, and rehabilitation specialists to reduce the risks and facilitate recovery. Extensive models of perioperative care are focused on cognitive screening, optimized anesthesia protocols, inflammation management and cognitive rehabilitation after the operation to reduce the negative results in the long term.

Research Objectives

1. To examine the neurological mechanisms associated with Postoperative Cognitive Dysfunction (POCD) in elderly patients following surgical procedures.
2. To assess the psychological consequences of POCD, including anxiety, depression, and emotional distress among elderly postoperative patients.

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3. To evaluate the functional implications of POCD on daily living activities and overall quality of life in elderly individuals after surgery.

Problem Statement

Postoperative Cognitive Dysfunction (POCD) has become an important complication of patients of advanced age who undergo surgical operations, and it is under-diagnosed and poorly managed in clinical practice. Amid rising trends of the aging workforce across the globe and the rising number of elderly individuals seeking surgical procedures, the threat of postoperative cognitive decline presents significant neurological, psychological and functional problems. Memory, attention, and executive functioning impairments are subtle yet persistent in many elderly patients after anesthesia and surgery, and they may affect independence and overall well-being. Although there is an increasing clinical awareness of the importance of cognitive screening, preventive strategy, and multidisciplinary management methods, the effective intervention remains hampered by the lack of integration of these methods. Thus, the neurological, psychological and functional consequences of POCD require a thorough grasp to enhance perioperative care and outcome in the elderly.

Significance of the Study

This research is meaningful in that it adds to the existing literature on the Postoperative Cognitive Dysfunction among older patients by incorporating neurological, psychological, and functional points of view into a single research. The study can give important information to health care specialists, surgeons, anesthesiologists, neurologists, and mental health practitioners to formulate evidence-based interventions to prevent and manage POCD. Moreover, knowledge of the functional outcomes of cognitive impairment can inform the rehabilitation planning and support systems, which will eventually help the patients have better quality of life and independence. The results can also facilitate policy formulation in geriatric perioperative care and promote regular cognitive assessment procedures to geriatric surgical patients.

LITERATURE REVIEW

Neurological Processes that are linked to Postoperative Cognitive Dysfunction: There is a large amount of literature that has investigated the neurological pathways of Postoperative Cognitive Dysfunction (POCD) in the elderly. Among the explanations that are the most accepted, there is one that focuses on neuroinflammation. Surgical trauma elicits the existence of a systemic inflammatory response that is associated with release of pro-inflammatory cytokines including interleukin-6(IL-6), C-reactive protein(CRP) and tumor necrosis factor-alpha(TNF-a). The age-related degeneration of the blood-brain barrier in older people makes it more permeable and, as a result, inflammatory mediators can gain access to the central nervous system and activate microglia. Such neuroinflammatory cascade interferes with the synaptic plasticity and damages the work of the hippocampal causing the learning and memory impairments [9]. Based on the empirical research, the high postoperative inflammatory marker levels have always been associated with the following cognitive impairment.

Besides inflammation, anesthetic neurotoxicity is the other possible etiological mechanism. Exposure to some types of volatile anesthetics has been proposed to enhance the production of amyloid-beta and phosphorylation of tau protein, which are pathological changes related to the Alzheimer disease. A study by [10]. revealed that neural tissue in the laboratory environment when subjected to anesthetic agents could increase protein aggregation. Even though the clinical evidence in this area is still inconclusive, the results provoke concerns regarding the susceptibility of geriatric patients with preclinical neurodegenerative alterations.

Another critical mechanism that is mentioned in the literature is cerebral hypoperfusion during surgery. The intraoperative hypotension and decreased cerebral oxygenation can impair the neuronal metabolism especially among the elderly with underlying cerebrovascular disease. Research with neuroimaging methods has found links between perioperative ischemic events and postoperative cognitive deterioration. Vascular stiffness and endothelial dysfunction that comes with age additionally increases the predisposition to hypoxic injury implying that optimum hemodynamic stability during surgery is fundamental to cognitive protection.

Risk factor of genetic predisposition has also been studied to be a risk factor of POCD. It has also been associated with the risk of postoperative cognitive impairment because of the presence of the apolipoprotein E (APOE) e4 allele, which is associated with neurodegenerative conditions. The evidence remains inconclusive, but the interplay between genetic predisposition and surgical stress indicates the multifactorial nature of POCD. On the whole, existing sources suggest that the interplay between inflammation, anesthetic exposure, vascular compromise, and the genetic predisposition is complicated in the context of the formation of postoperative cognitive decline.

Psychological Impairments of Postoperative Cognitive Dysfunction: In addition to neurological alterations, POCD has a significant psychological implication on the elderly patients. Postoperative cognitive impairment can be one of the causes of emotional distress like anxiety, depression, and the lack of self-confidence. In health psychology models that are postulated by [11]. the way people view illness greatly contributes to psychological outcomes. Cognitive decline is interpreted as permanent or progressive by the elderly patients, which leads to emotional distress that may result in worse cognitive performance due to stress-related processes.

Empirical research has shown a two-way relationship between depression and cognitive impairment amongst postoperative patients. The cognitive impairment can be caused by and cause depressive symptoms. Older people with POCD often complain of frustration, dependency fear and low self-esteem. These emotional responses may affect attention and working memory ability making it a vicious circle where mental distress solidifies mental impairments. Studies indicate that postoperative depression that is not treated is linked to a lengthy recovery process and a worse health outcome as a whole.

There are also social factors that influence psychological

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experience of POCD. The expectations of the family, the stress caused by caregivers, and the attitude of the society towards aging have an effect on how the elderly patients perceive the change in their cognitive abilities. Cognitive impairment can be accompanied by more stigma and emotional weight in collectivist cultures in which the roles of older adults in the family are central. Indirect patient recovery can be experienced when caregivers express becoming more stressed and anxious when handling elderly family members who are experiencing cognitive decline. This underscores the necessity of family-based interventions during the postoperative care.

In addition, psychological preoperative status was found to predict postoperative cognitive outcomes. Patients who showed increased baseline anxiety, or had fewer resources to cope with it, might be more vulnerable to POCD. Protective factors include psychological resilience, social support, and coping mechanisms, which reduce the emotional influence of cognitive changes. Thus, the suggestion to implement psychological screening and counseling in the perioperative process has been made in order to decrease the mental health burden of POCD.

Quality of Life Results and Functional Implications: The practical impact of POCD is of a special concern among the aged groups since the mental power is synonymously related with autonomy and the functioning in everyday life. Any disruption of executive functioning and memory may impair instrumental activities of daily living (such as medication adherence, financial management, and transportation). According to the [12]. cognitive health is central to autonomy preservation and social engagement among older adults. Functional dependency may thus be hastened by long-lasting postoperative cognitive dysfunction.

Clinical trials have indicated that older patients who have POCD are susceptible to a longer hospital stay, slow rehabilitation process, and institutionalization. A study conducted by [13]. revealed that cognitive impairment that was identified three months following surgery was linked to higher rates of mortality during the first year of post-operative period. These results indicate that POCD is not a momentary complication but it can have prognostic effects in the long term.

The impairment of cognitive abilities and their impact on socialization and individual autonomy are the factors that worsen the quality of life. Driving, attending local celebrations, or other hobbies can turn problematic, which means that a person starts to avoid society and experiences less satisfaction with their life. Health and safety can also be further endangered by functional limitations that cause more risk of falls and medication errors. Since cognitive and physical health are inseparable, functional decline can lead to the emergence of a downward spiral of well-being.

The studies of intervention contribute to the significance of early detection and rehabilitation in enhancing functional outcomes. Multidisciplinary care strategies such as cognitive training, physical therapy, and psychosocial support have demonstrated positive outcomes in alleviating the chronic effects of POCD. Geriatric surgery Prevention, including optimization of management of anesthesia, inflammation, and postoperative cognitive monitoring, is becoming more popular in geriatric surgery. Altogether, the literature highlights the importance of considering both functional and neurological and psychological aspects when a patient is treated in order to provide a comprehensive treatment.

METHODOLOGY

Research Design

The research design employed in the study is a quantitative, descriptive-correlational research design. The design was chosen to investigate the neurological, psychological and functional consequences of Postoperative Cognitive Dysfunction (POCD) in the elderly patients. It was believed that this was an adequate approach since it provided a way of systematic measurement of relationships among variables without control of the study environment. The research was carried out in hospitals where the elderly patients were evaluated after the operation.

Population of the Study

The study population was aged 60 years and older and comprised of elderly patients who had major surgical procedures as anesthetized patients. The sample population was recruited in public and private hospitals that offer surgical services. The patient sample was restricted to medically stable and able to give informed consent to participate. Patients who had known severe neurodegenerative disorders before surgery were not included. The study employed a non-probability purposive sampling procedure in choosing the participants. This method was deemed appropriate as the research involved a particular population of the aged postoperative patients. There were well-defined inclusion and exclusion criteria that were used to gather relevant data. The participants were invited when they were in their recovery phase after the surgery.

Sample Size

The study population was chosen at 233 elderly patients. The sample size was calculated in a way that would give sufficient statistical power in the analysis of data. The 233 respondents used all the necessary assessment instruments during the given data collection time. The sample was found to be adequate in investigating the associations between neurological, psychological, and functional variables.

The standardized and structured assessment instruments were used to collect the data. Validated neuropsychological tests were used to measure cognitive functioning and psychological status was measured using the scales of anxiety and depression. The activities of daily living (ADL) measures were the ones used to assess functional ability. Postoperative follow-up visits were used in the collection of data and all the participants informed their consent to participate before joining the study.

RESULTS

Statistical Package of Social Sciences (SPSS) was used in the analysis of the collected data. Mean, standard deviation and frequency were used to summarize demographic characteristics using descriptive statistics. Correlation and

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regression analysis as part of inferential statistical tests were conducted to investigate variable relationships. The statistical significance was set at a p-value of below 0.05.

Table 1

Demographic Information of Respondents (N = 233)

Variable	Category	Frequency (f)	Percentage (%)
Age	60–65 years	72	30.9%
	66–70 years	68	29.2%
	71–75 years	54	23.2%
	76 years and above	39	16.7%
Gender	Male	128	54.9%
	Female	105	45.1%
Type of Surgery	Orthopedic	74	31.8%
	General Surgery	69	29.6%
	Cardiac Surgery	48	20.6%
	Other Surgeries	42	18.0%
Educational Level	No Formal Education	58	24.9%
	Primary Education	71	30.5%
	Secondary Education	63	27.0%
	Higher Education	41	17.6%

The results of the demographic analysis showed that most participants fell within the age of 60-70 years with a percentage of 60.1 of the total sample size, which is to say that early elderly people presented the most significant percentage of surgical patients. There were a slight number of male participants (54.9) and few female participants (45.1). The most prevalent procedures practiced were orthopedic and general surgeries which at the same time comprised more than 60 percent of cases. As far as the level of education is concerned, the majority of the participants were of primary or secondary education with less percentage of higher education. These results indicate that the sample was mostly male subjects belonging to early elderly age group with undergone significant surgeries, with diverse educational levels, which might affect the cognitive and functional performance of subjects after surgical interventions.

Table 2

Correlation between Neurological Factors and Postoperative Cognitive Dysfunction (N = 233)

Variables	1	2	3	4
1. Neuroinflammatory Markers	1			
2. Cerebral Hypoperfusion	.46**	1		
3. Anesthetic Exposure Duration	.39**	.42**	1	
4. Postoperative Cognitive Dysfunction (POCD)	.58**	.51**	.44**	1

The correlation analysis revealed that neuroinflammatory factors exhibited a significant and positive correlation with Postoperative Cognitive Dysfunction (r =.58, p <0.01), which means that the stronger the level of inflammation, the greater the cognitive impairment observed in the elderly patients. A positive correlation was also observed between cerebral hypoperfusion and POCD (r =.51, p < 0.01), which means that poor postoperative cognition was associated with decreased cerebral blood flow. Also, the length of exposure to the anesthetic was moderately related to POCD (r =.44, p < 0.01), which means that the longer a patient was exposed to anesthesia, the greater the cognitive impairment. On the whole, the results confirmed the Research Objective 1 and revealed that the neurological factors were strongly correlated with the presence of POCD among elderly surgical patients.

Table 3

Multiple Regression Analysis Predicting Postoperative Cognitive Dysfunction (POCD) from Psychological Factors (N = 233)

Predictor Variables	B	SE B	Beta (β)	t	p-value
(Constant)	1.12	0.38	—	2.95	.004
Anxiety	0.41	0.07	.36	5.86	.000**
Depression	0.33	0.06	.31	5.12	.000**
Emotional Distress	0.27	0.08	.22	3.37	.001**

Model Summary

R	R^2	Adjusted R^2	F	Sig.
.64	.41	.40	53.72	.000**

The multiple regression analysis indicated that the psychological factors were significant predictors of the Postoperative Cognitive Dysfunction in the elderly patients. The overall model was statistically significant (F = 53.72, p <.001) and accounted 41% of the variance in POCD (R2 =.41) which indicated significant predictive power. The strongest predictor was anxiety (b=.36,p<.001) and the other two were depression (b=.31, p<.001) and emotional distress (b =.22, p<.01). These results indicated that the more the psychological distress, the more the cognitive dysfunction following surgery. Thus, Research Objective 2 was justified and indicated that the psychological factors had a considerable impact on the postoperative cognitive outcomes in the elderly patients.

Table 4

One-Way ANOVA Showing Differences in Functional Ability Based on Levels of POCD (N = 233)

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. (p)
Between Groups	1156.84	2	578.42	21.96	.000**
Within Groups	6060.16	230	26.35		
Total	7217.00	232			

The findings of the One-Way ANOVA showed that elderly patients with different degrees of Postoperative Cognitive Dysfunction had a statistically significant difference in terms of their functional ability scores (F = 21.96, p<=001). This was an indication that the severity of cognitive impairment had a great impact on the capability of patients to engage in daily living functions. Severe POCD patients were observed to score poorly in terms of functional ability as opposed to mild or moderate POCD. The results validated Research Objective 3, which is that greater postoperative cognitive dysfunction was linked to more severe functional deterioration in older people after surgery.

DISCUSSION

The current paper sought to investigate the neurological, psychological, and functional consequences of the Postoperative Cognitive Dysfunction (POCD) in the elderly patients who have undergone surgical procedures. The study results showed that there are strong correlations

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between neurological variables and POCD in terms of the first research objective. The one that was positively correlated with postoperative cognitive decline was neuroinflammatory markers, cerebral hypoperfusion, and duration of anesthetic exposure. These findings minimize the prior studies by [14] who stressed that neuroinflammation was at the centre of the pathophysiology of the postoperative cognitive impairment. According to their work, neuronal signaling and synaptic plasticity are interfered by high levels of inflammatory cytokines after surgical trauma, especially in the aging brain. On the same note, the existing results supported the assumption that biological stress responses during surgery is a major cause of cognitive impairments in aged persons.

The relationship that was found between anesthetic exposure and POCD in this study also relates to the previous experimental results of research conducted by [15] who suggested that some anesthetic agents could affect amyloid-beta aggregation and neuronal vulnerability. In spite of the fact that the current research had not directly tested neurodegenerative biomarkers, the high levels of correlation indicate that chronic exposure to anesthesia can worsen the already vulnerable neurological conditions in elderly people. More so, the results regarding cerebral hypoperfusion are substantiated by the theories of vascular aging, which suggest that low cerebral blood flow during surgery may also affect oxygen supply to the important parts of the brain like the hippocampus, making them incapable of sustaining important functions. Taken together, these results verify that POCD is heavily neurobiologically based and depends on the physiological alterations that occur during the perioperative period.

In terms of the second research objective, the multiple regression analysis showed that psychological factors- especially anxiety and depression- were important predictors of POCD. The strongest predictor was anxiety with depression and emotional distress coming next. These results are also aligned with the views of health psychology suggested by [16] that stressed that the emotional reactions of people to illness play an important role in determining the outcomes of health. A bi-directional relationship between depression and cognitive impairment among the elderly population has also been reported in previous empirical studies indicating that psychological distress can either cause or occur as a result of cognitive deterioration. This dynamic interaction is in line with the current study, where the importance of psychological assessment in perioperative care is emphasized.

Furthermore, the results align with the general geriatric literature showing that the elderly patients who had elevated levels of baseline anxiety have worse postoperative trajectories of recovery. Emotional distress can also enhance cognitive problems by affecting concentration, motivation and consolidation of memories. These findings highlight the importance of incorporating mental health support into surgical recovery initiatives. Treating anxiety and depressive symptoms before and after surgery could be used to reduce the extent of cognitive impairment and patient outcomes on the whole.

The third research aim was concerned with the functional consequences of POCD and the ANOVA findings indicated that there were significant variations in functional ability at the level of cognitive impairment. Severe POCD was marked by very low performance of elderly patients with the activities of daily living as compared to mild and moderate impairment. These results are consistent with previous investigations where [17] found out that long-term cognitive deterioration in the postoperative period related to low levels of independence and high death risk. This evidence is further supported by the current study, which affirms the functional deterioration is directly correlated with the severity of cognitive dysfunction.

Moreover, the tendency to deteriorate quality of life among patients with increasing POCD rates is also in line with the views on global aging that are suggested by the [18], according to which cognitive health is central to the promotion of autonomy and social life in aging individuals. Cognitive impairment can cause functional impairment, which in turn can cause social withdrawal, drug misuse, and dependency on the caregiver. Hence, POCD cannot be considered a transient or one-sided postoperative complication but a condition that has long-term implications on the well-being and autonomy of elderly people.

In general, the results of the present research add to the accumulated literature according to which POCD is a multidimensional syndrome that is affected by the neurophysiological, psychological, and functional factors. Combining these domains, the study puts a focus on the significance of overall perioperative assessment and multi-disciplinary intervention plans. The findings support the literature available, and in addition, highlight the importance of early diagnosis, prevention and rehabilitation of the elderly surgery patients.

CONCLUSION

The current paper has discussed the clinical, cognitive, and neurological implications of postoperative cognitive dysfunction (POCD) in the elderly patients after surgeries. The results indicated that neurological causes like neuroinflammation, cerebral hypoperfusion and anesthetic exposure played a significant role in being linked with postoperative cognitive deterioration. It was discovered that psychological variables, specifically anxiety and depression, were strong predictors of POCD, thus emotional distress can be considered as an important factor in cognitive recovery following the surgery. These findings underscore the fact that POCD is not a pure biological event, but a multidimensional process that is affected by interrelated physiological and psychological processes.

Moreover, the research proved that increased POCD was strongly linked with reduced functional capacity and low quality of life in the elderly. The patients who had severe cognitive impairment had more problems with activities of daily living making them highly dependent, hence less well. The results indicate that early diagnoses, sporadic thorough perioperative evaluations, and multidisciplinary intervention strategies should be used to reduce the negative long-term outcomes. The prevention of POCD can improve recovery patterns, independence, and quality of postoperative care in the aging population.

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Future Implications: In future studies, longitudinal studies should be undertaken to determine the long-term trend of POCD and determine the early biomarkers that can be used to predict cognitive vulnerability before surgery. Standardized screening programs and specific psychological treatment can be developed to minimize the extent and the persistence of postoperative cognitive decline. Also, the implementation of anesthesia management and cognitive rehabilitation programs tailored to the patient into geriatric surgery treatment might greatly enhance patient outcomes. Cognitive health monitoring should be a priority of perioperative practice that must be closely followed by policymakers and healthcare institutions to guarantee safer experience of surgery to this group of patients.

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