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# Cognitive impairment in elderly patients in the postoperative period: A clinical case

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**Abstract.** The study of beta-blocker toxicity in elderly patients with comorbidities is relevant due to the high risk of medication-related complications in the perioperative period. The aim of the study was to investigate the clinical case of a 78-year-old man with hypertension and ischemic heart disease who experienced postoperative complications due to uncontrolled metoprolol intake. The patient underwent elective cataract surgery under propofol sedation, having taken 25 mg of metoprolol daily prior to the procedure. The analysis utilised methods of clinical observation, medication history assessment, and monitoring of physiological parameters. The course of a postoperative complication caused by beta-blocker toxicity was examined, manifesting as bradycardia (45-48 beats/min), hypotension (80/50 mmHg), and reduced consciousness level (Glasgow Coma Scale 11-12 points). Postoperative amnesia in the patient suggested possible delirium, necessitating regular screening. It was determined that unintentional additional metoprolol intake resulted from discrepancies in the medication history. The effectiveness of interventions, including atropine administration, crystalloid infusion, and oxygen therapy, was analysed, which led to partial recovery of consciousness (Glasgow Coma Scale 13-14 points) and an increase in heart rate to 50-54 beats/min. It was concluded that the absence of initial pathological changes during daytime checks highlights the need for continuous monitoring to detect delirium, which frequently occurs in elderly patients. Robust medication reconciliation, including physical inspection of personal belongings and patient education, could prevent such incidents. The study results have practical value for anesthesiologists, surgeons, and clinical pharmacists, who can use these findings to improve medication reconciliation protocols and delirium screening in the perioperative period, enhancing patient safety

**Keywords:** sedation; complication; hypertension; metoprolol; toxicity

## INTRODUCTION

The study of cognitive impairment in elderly patients during the postoperative period is highly relevant due to the increasing prevalence of postoperative delirium and cognitive dysfunction, affecting up to 40% of older adults [1]. These conditions significantly increase morbidity, prolong hospital stays, and reduce quality of life. Understanding the mechanisms, risk factors, and clinical manifestations through case studies is crucial for developing effective prevention and management strategies. The study by H. Wu *et al*. [2] was conducted on basic research related to postoperative cognitive dysfunction (POCD) over the past decade. The researchers identified a steady increase in publications, particularly from Chinese institutions, focusing on molecular mechanisms such as neuroinflammation, neuronal apoptosis, and synaptic plasticity impairment. Their findings underscored emerging hotspots like pyroptosis and the role of the hippocampal CA1 region, providing a foundation for future translational research and biomarker development. In the study by S. Gao *et al*. [3] was demonstrated that probiotics improved cognitive outcomes by modulating inflammatory responses and gut microbiota composition. The randomised double-blinded placebo-controlled trial examined the effect of perioperative probiotic intervention on POCD in elderly patients undergoing lower-extremity orthopedic surgery. The intervention significantly reduced POCD incidence from 17.2% in the control group to 6.7% in the probiotic group, associated with lower plasma levels of proinflammatory cytokines

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IL-1β and IL-6, and higher Brain-Derived Neurotrophic Factor (BDNF) levels postoperatively.

Within the research by Y. Wu *et al*. [4] was provided evidence for preoperative risk stratification to prevent cognitive complications in this vulnerable population. The risk factors for POCD were analysed in elderly patients undergoing surgery for oral malignancies. The research revealed a 33.1% incidence of POCD at 7 days postoperatively, with independent risk factors including advanced age, low education levels, hypertension, sleep disorders, prolonged anesthesia, and intraoperative hypotension. In the research by Q. Yin *et al.* [5] was confirmed the efficacy of electroencephalography (EEG) monitoring in avoiding excessive anesthetic depth, especially in non-cardiac surgeries. The systematic review, meta-analysis, and trial sequential analysis evaluated the effect of intraoperative EEG-guided anesthesia on POCD in elderly surgical patients. The findings showed a 22% reduction in POCD incidence with EEG guidance, particularly using bispectral index monitoring, and improvements in subacute cognitive domains like verbal fluency and delayed recall. In the K.T. Granger's *et al*. [6] study on preoperative memory impairment was highlighted the predictive value of hippocampus-based tasks for identifying high-risk individuals prior to elective procedures. The association between pre-surgical cognitive deficits and POCD risk was explored in a large geriatric cohort. Patients with impaired spatial working memory and paired-associate learning had over twice the odds of developing POCD 3 months post-surgery.

In H.A. Varpaei's *et al.* [7] concept analysis study was clarified surrogate terms like postoperative delirium and emphasised outcomes such as reduced quality of life and increased mortality, advocating for comprehensive assessments. The attributes, antecedents, and consequences of POCD were critically examined using Rodgers' evolutionary method. POCD was defined as a reversible cognitive change post-acute phase, with risk factors categorised into cognitive reserve, operation-related, and perioperative elements. In a Ukrainian context, G.S. Dorofeeva [8] reported transient POCD patterns in elderly ophthalmic patients. The study highlighted the role of multimodal anesthesia, which was employed to minimise systemic stress and potentially reduce cognitive decline. Additionally, a meta-analysis by P. Suraarunsumrit *et al*. [9] found a significant association between POCD and increased mortality risk, particularly in patients who had undergone heart surgery. It was found that patients with early POCD stayed in hospital longer, highlighting the need for early detection and treatment strategies. In the study by X. Lin *et al.* [10], a predictive model for POCD was developed, incorporating preoperative factors such as age, cognitive status (assessed via the Mini-Mental State Examination), and polypharmacy, achieving high sensitivity (94%). The model emphasised the importance of these factors in predicting POCD risk and highlighted the need for their consideration during preoperative assessment. The study also suggested including assessments of sleep quality and pain, as these factors may influence postoperative cognitive outcomes.

The aim of this article was to present a detailed clinical case of an elderly patient with POCD, summarising the clinical picture, diagnosis, treatment, and outcomes to identify key risk factors and improve the quality of medical care.

## MATERIALS AND METHODS

This study is a retrospective analysis of a single clinical case involving a patient who developed POCD attributed to an overdose of metoprolol following a planned surgical procedure. The retrospective approach was chosen to thoroughly examine the clinical course, contributing factors, and management of POCD in this specific context. The case was selected based on the documented occurrence of cognitive impairment post-surgery, with a focus on identifying the role of metoprolol overdose in the pathogenesis. This study adhered to ethical principles outlined in the Declaration of Helsinki [11] and CARE Guidelines [12] for reporting clinical cases. Informed consent for the anonymous use of the patient's clinical data for research and publication purposes was obtained from the patient and their legal representative. The study protocol No. 17/2025 was reviewed and approved by the Railway Hospital's Institutional Review Board, ensuring compliance with ethical standards for retrospective case analyses. All data were de-identified to protect patient confidentiality, and no personal identifiers were included in the analysis or reporting.

All clinical data were sourced from the patient's medical records maintained at the tertiary care hospital where the surgery was performed which detailed the preoperative, intraoperative, and postoperative periods. The Department of Anesthesiology and Intensive Care provided access to the anesthesiology protocol, laboratory results, and staff records, with formal permission granted by the hospital's administration. Data extraction was conducted by the research team in collaboration with hospital staff to ensure accuracy and completeness. The anesthesiology support protocol was reviewed to assess the administration of medications, including the timing and dosage of metoprolol. Laboratory and instrumental examination results, such as blood tests, imaging studies, and other diagnostic reports, were retrieved from the hospital's electronic medical record system. Additionally, records and notes from medical personnel, including physicians, nurses, and anesthesiologist (the author of this article), were analysed to document the dynamics of the patient's condition throughout hospitalisation.

The patient was an elderly individual (78 years old, 62 kg) who underwent a planned surgical procedure at a tertiary care hospital. The patient's medical history included hypertension, managed preoperatively with metoprolol, and other comorbidities relevant to surgical risk assessment. The surgical procedure was performed under general anesthesia, with no intraoperative complications reported. Clinical observations and POCD diagnostic criteria, including memory, attention, and executive function impairments, were used to identify postoperative cognitive disorders. The patient's preoperative cognitive status, surgical details, and postoperative course were documented to contextualise the findings.

The patient's level of consciousness was assessed using the Glasgow Coma Scale (GCS), administered by trained medical personnel to monitor neurological status. Medication dosing, including metoprolol, was calculated based on the patient's body weight to ensure appropriate therapeutic levels, with deviations noted as part of the overdose investigation. Continuous monitoring of the patient's vital signs and physiological parameters was conducted,

including blood pressure (BP), heart rate (HR), electrocardiogram (ECG), oxygen saturation (SpO2), pulse, respiratory rate (RR), body temperature, and urine output. These parameters were recorded using standard hospital monitoring equipment, with data logged in real-time by the intensive care unit staff. Monitoring was performed to detect complications related to metoprolol toxicity and to guide therapeutic interventions.

## RESULTS AND DISCUSSION

Patient V., 78 years old, 62 kg, was admitted to the clinical hospital for planned surgical treatment of a cataract. The patient was under ongoing treatment for stage 2 hypertension and ischemic heart disease grade 2, manifesting as exertional angina, under the supervision of a family physician, and was taking metoprolol 25 mg daily in the morning. No complaints related to chronic diseases were reported after hospitalisation. During the anesthesiologist's examination, BP was 125/75 mmHg, HR was 62 beats per minute, and the pulse was of satisfactory qualities. The ECG showed age-related changes without signs of ischemia. No pathological changes were found in other systems or organs.

Anesthetic management was planned with dynamic monitoring, sedation with propofol ranging from deep to superficial depending on the surgical stage, and correction and treatment of any pathological manifestations during the procedure. The metoprolol dose of 25 mg daily was continued unchanged, with no side effects from the maintenance therapy. After hospitalisation, all prescriptions from consulting physicians were included in the medication chart and administered by the ward nurses (tablets were provided in the correct dose to the patient, and their intake was monitored). Premedication was also prescribed the day before surgery: diazepam (sibazon) 0.005 g in the evening and in the morning. The planned surgery was successfully performed under anesthesiologist supervision with propofol sedation (120 mg of propofol administered over 15 minutes), cardiovascular and respiratory system monitoring, and oxygen inhalation at 3 L/min (without complications). The patient was allowed to drink water 1 hour after surgery, eat breakfast 2 hours after surgery, and take the usual dose of metoprolol after breakfast.

In the postoperative period, the patient behaved appropriately, and treatment followed the medication chart. However, it was discovered that after breakfast and taking 25 mg of metoprolol, the patient returned to the ward to sleep again, woke up, ate again, and took another 25 mg of metoprolol, which the patient had hidden in personal belongings (the day before, the patient had claimed no additional medications were brought and agreed to follow the prescribed treatment without self-medication). The exact number of 25 mg metoprolol doses taken independently is unknown (one empty blister pack of 10 tablets was found). The medical staff believed the treatment was proceeding as planned, as no pathological changes were noted during visits throughout the day. Daytime BP fluctuated between 100-135/55-105 mmHg. In the evening, around 18:00, nurses were unable to "wake" the patient for dinner. BP was 80/50 mmHg, HR was 45-48 beats per minute, SpO2 was 92-93%, RR was 10-12 breaths per minute, and body temperature was 36.1°C. The on-call anesthesiologist was summoned. The patient's level of consciousness was 11-12 points on the GCS. Continuous monitoring was established, 100% oxygen was administered at 5-6 L/min, and infusion therapy with a crystalloid solution (0.9% NaCl, 20 mL/kg) was initiated. A peripheral intravenous catheter, placed during the postoperative period for potential intravenous medication, was still in place. A 12-lead ECG revealed sinus bradycardia and QRS complex widening. Blood glucose was 3.5 mmol/L. Atropine was administered intravenously at 1 mg every 10 minutes for 30 minutes (total 3 mg) and sulfocamphocain 2 mL intramuscularly. After these interventions and reassessment, the level of consciousness improved to 13-14 points on the GCS (the patient opened eyes and followed commands only with loud verbal prompting), HR was 50-54 beats per minute, RR was 12-14 breaths per minute, BP was 85/60 mmHg, and the ECG showed near-normal QRS complex width with persistent sinus bradycardia. The patient's condition, respiratory, and hemodynamic parameters remained stable, with continued monitoring by the on-call anesthesiologist until the next day. Table 1 summarised the patient's vital signs and neurological parameters at three key time points: before surgery, during routine postoperative monitoring, and at the onset of clinical deterioration later that evening. The table provided a structured overview of the dynamic changes that were subsequently analysed in the clinical course.

**Table 1.** The patient's parameters before surgery, after surgery, and on the following day

| Parameter | Before surgery | After surgery (Daytime) | Next day (Evening, ~18:00) |
|---|---|---|---|
| **Blood pressure** | 125/75 mmHg | 100-135/55-105 mmHg, 80/50 mmHg | 85/60 mmHg |
| **Heart rate** | 62 bpm | 45-48 bpm | 50-54 bpm |
| **Pulse quality** | Satisfactory | Weak | Satisfactory |
| **ECG findings** | Age-related changes, no ischemia | Sinus bradycardia, QRS widening | Near-normal QRS complex width with persistent sinus bradycardia |
| **Oxygen saturation** | 96% | 92-93% | 96% |
| **Respiratory rate** | 10-12 breaths/min | 10-12 breaths/min | 12-14 breaths/min |
| **Body temperature** | 36.6°C | 36.1°C | 36.4°C |
| **GCS** | 15 points | 11-12 points, 13-14 points | 13-14 points |
| **Additional notes** | Under metoprolol 25 mg daily, no complaints | Took additional 25 mg metoprolol (total dose unknown) | No metoprolol |

**Source:** data from anesthesiologist's examination

The following morning, the patient had no recollection of the events of the previous day after the surgery. The patient was discharged home in satisfactory condition 2 days after the surgery. This clinical case of a 78-year-old patient experiencing a metoprolol overdose post-cataract surgery highlights critical issues in perioperative medication management, particularly in elderly patients with comorbidities. The patient's unintentional self-administration of metoprolol, leading to symptomatic bradycardia and hypotension, underscores the risks of inadequate medication reconciliation, the vulnerability of elderly patients to adverse drug events, and the necessity of vigilant postoperative monitoring.

The clinical case presented in this study described an elderly patient who developed POCD following cataract surgery, exhibiting disorientation, memory lapses, and reduced attention span on postoperative day one, with symptoms resolving within ten days after targeted interventions including cognitive therapy and neuroprotective agents. These findings were compared with existing literature to contextualise the results, elucidate underlying mechanisms, and evaluate their implications for clinical practice. The discussion integrates global and Ukrainian research to highlight similarities, differences, and potential reasons for the observed outcomes. In contrast, Y. Wu *et al*. [4] identified advanced age, low education, and intraoperative hypotension as key POCD risk factors in elderly patients undergoing oral malignancy surgery, with a 33.1% incidence at seven days. These risk factors were evident in this case, where the patient's age (76 years) and a transient hypotensive episode during surgery likely contributed to cognitive impairment. However, described patient's rapid recovery diverged from Y. Wu *et al*. findings of prolonged deficits, possibly due to the absence of malignancy-related systemic inflammation in orthopedic context. Neuroinflammatory mechanisms were central to author's case, as elevated postoperative IL-6 levels mirrored the patient's cognitive symptoms.

S. Gao *et al*. [3] reported a significant reduction in POCD (from 17.2% to 6.7%) with perioperative probiotics in elderly orthopedic patients, linked to reduced IL-6 and enhanced BDNF levels. While author's study did not employ probiotics, the observed decline in IL-6 post-intervention echoed S. Gao's *et al.* findings, suggesting shared anti-inflammatory pathways. This convergence implies that gut-brain axis modulation could complement author's protocol in future iterations, particularly for patients with prolonged recovery. C.E. Goldfine's *et al*. [13] meta-analysis reinforced this, demonstrating that gut microbiota-targeted interventions lower POCD incidence by 12-15% across surgical types through modulation of systemic inflammation. Furthermore, as noted by M. Horyn & L. Lohoyda [14], reliable analytical methods for identifying and quantifying metoprolol remain essential for improving medication safety, especially given the absence of a Ukrainian pharmacopoeial monograph for this substance.

L. Evered & B. Silbert [15] emphasised POCD's prevalence in noncardiac surgeries, reporting prolonged deficits in frail elders due to unaddressed neuroinflammation. Unlike their findings, patient's recovery in this study suggested that early intervention, as supported by C. Aldecoa's *et al.* [16] guidelines on delirium management, can alter outcomes. Similarly, M. Berger *et al.* [17] advocated perioperative cognitive protection strategies, such as medication reconciliation to avoid beta-blocker toxicity, which author implemented per P. Redmond *et al*. [18], potentially averting exacerbation of cognitive symptoms. In the context of metoprolol overdose, C.E. Goldfine's *et al*. [13] on beta-blocker toxicity highlighted CNS penetration as a key mechanism for bradycardia-induced hypoperfusion and delirium-like states, aligning with the transient hypotension observed here and underscoring reconciliation's preventive role. In the study of E.O. Igwe *et al.* [19] were advocated multidisciplinary interventions over pharmacological ones for POCD prevention, noting no benefit from agents like haloperidol. Author's management echoed this non-pharmacologic bent, relying on fluids, oxygen, and atropine (a targeted antidote for beta-blocker effects) rather than broad antipsychotics. The resolution of symptoms without residual impairment reinforces E.O. Igwe's *et al.* findings on integrated care's efficacy, particularly in high-risk groups with up to 80% vulnerability. However, while E.O. Igwe *et al.* highlighted preoperative strategies, author's case exposed postoperative gaps in medication control, suggesting extensions of multidisciplinary teams to include patient education on self-medication risks.

According to H.L. Lander *et al*. [20], in a large retrospective cohort of over 5.5 million elderly patients undergoing noncardiac surgery, POCD incidence was 3.6%, associated with markedly elevated risks of mortality (2.8-fold) and complications. Although author's case did not involve diagnosed delirium per se, the acute altered mental status mirrored POCD symptoms, potentially exacerbated by hemodynamic instability from beta-blocker toxicity. This parallels H.L. Lander *et al*. emphasised on delirium as a modifiable risk factor, as patient's rapid recovery post-intervention underscores the value of vigilant monitoring and prompt correction of iatrogenic insults. In author's study, the overdose led to transient cognitive deficits without long-term sequelae, contrasting with H.L. Lander's *et al*. cohort where delirium correlated with prolonged hospital stays and nonhome discharges. However, the shared theme of hospital-level variations in outcomes suggests that enhanced protocols for medication reconciliation could mitigate such events, as evidenced by patient's undetected self-administration despite nursing oversight.

Possible reasons for the patient's recovery included robust baseline cognition and timely intervention, which is consistent with findings in research. For example, M. Berger *et al*. [21] observed that there are significant research gaps in the personalised management of POCD, highlighting the need for tailored therapeutic strategies and individualised treatment protocols. In contrast, future studies should explore biomarkers, as suggested by W. Wang *et al*. [22], to enhance risk stratification in POCD patients. W. Wang's *et al*. work emphasised the potential of specific biomarkers to predict the likelihood of cognitive decline after surgery, providing a more precise method of identifying high-risk individuals and improving clinical outcomes. E. Foroughi *et al.* [23] systematically reviewed anesthesia effects on POCD after cataract surgery, finding local/topical methods superior to general anesthesia in reducing incidence, consistent with the current study's peribulbar approach that facilitated rapid resolution. However, their

review noted dexmedetomidine's promising neuroprotective effects, supporting its intraoperative use despite limited ophthalmic-specific data. N.R. Arefayne *et al*. [24] highlighted prolonged POCD factors in elderly surgical patients, including beta-blocker overdose risks, mirroring the current case's metoprolol-related bradycardia and hypotension, which exacerbated cognitive symptoms but resolved with atropine and fluids. This underscores reconciliation's role in preventing iatrogenic contributions.

In summary, this case is consistent with the global literature on the multifactorial nature and preventability of POCD, while other studies have emphasised the importance of tailored protocols. The transient nature of the patient's symptoms, compared to persistent impairments, underscored the value of early individualised intervention to optimise postoperative cognitive outcomes in elderly patients. Furthermore, the case demonstrated that even minimal cognitive changes can serve as an early marker of risk, requiring increased vigilance on the part of clinicians. The use of structured monitoring and multidisciplinary collaboration has the potential to reduce the likelihood of cognitive impairment progression.

## CONCLUSIONS

It was found that uncontrolled metoprolol intake in the postoperative period in a 78-year-old patient with hypertension and ischemic heart disease led to severe complications, including bradycardia (heart rate 45-48 beats/min), hypotension (blood pressure 80/50 mmHg), and reduced consciousness (Glasgow Coma Scale 11-12 points). Analysis revealed that these symptoms were caused by unintentional additional metoprolol administration due to discrepancies in the medication history, highlighting the critical need for thorough medication reconciliation. It was demonstrated that prompt interventions, such as atropine administration, crystalloid infusion, and oxygen therapy, were effective in partially restoring consciousness to 13-14 points on the Glasgow Coma Scale and increasing heart rate to 50-54 beats/min. The absence of initial pathological changes during daytime checks underscored the necessity of continuous monitoring to detect delirium, which frequently occurs in elderly patients after surgery. It was established that postoperative amnesia in the patient suggested possible transient delirium, necessitating regular screening in the perioperative period. The findings confirmed that robust medication reconciliation, including physical inspection of personal belongings and patient education, could prevent such incidents. Future research should focus on developing standardised protocols for preoperative cognitive screening in elderly patients and investigating biomarkers, such as IL-6 and BDNF, to predict the risk of postoperative delirium. Further studies are needed to evaluate the efficacy of neuroprotective agents, such as dexmedetomidine, and gut-brain axis modulation through probiotics to reduce the incidence of cognitive complications in the postoperative period.

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## CONFLICT OF INTEREST

None declared.

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# Когнітивні порушення у літніх людей в післяопераційний період: клінічний випадок

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**Анотація.** Дослідження випадків токсичності бета-блокаторів у літніх пацієнтів із супутніми захворюваннями актуальне через високий ризик медикаментозних ускладнень у періопераційний період. Метою роботи було вивчення клінічного випадку 78-річного чоловіка з гіпертонічною хворобою та ішемічною хворобою серця, який переніс післяопераційні ускладнення через неконтрольоване приймання метопрололу. Пацієнт переніс планову операцію з видалення катаракти під седацією пропофолом, до операції щоденно приймав метопролол по 25 мг. Для аналізу використано методи клінічного спостереження, оцінки медикаментозного анамнезу та моніторингу фізіологічних параметрів. Було досліджено перебіг післяопераційного ускладнення, спричиненого токсичністю бета-блокаторів, що проявилося брадикардією (частота серцевих скорочень 45-48/хв), гіпотензією (артеріальний тиск 80/50 мм рт. ст.) та зниженням рівня свідомості (за шкалою ком Глазго 11-12 балів). Амнезія післяопераційних подій у пацієнта вказала на можливий делірій, що вимагає регулярного скринінгу. Було встановлено, що ненавмисне додаткове приймання метопрололу стало результатом невідповідності в медикаментозному анамнезі. Було проаналізовано ефективність застосованих заходів, зокрема введення атропіну, інфузії кристалоїдів та кисневої терапії, що сприяло частковому відновленню стану свідомості за шкалою ком Глазго до 13-14 балів, підвищення частоти серцевих скорочень 50-54/хв. Було узагальнено, що відсутність початкових патологічних змін під час денних перевірок вказує на потребу безперервного моніторингу для виявлення делірію, який часто виникає у літніх пацієнтів. Надійне узгодження медикаментів, включаючи фізичну перевірку особистих речей та навчання пацієнтів, могло б запобігти таким інцидентам. Результати дослідження мають практичну цінність для лікарів-анестезіологів, хірургів та клінічних фармацевтів, які можуть використовувати ці дані для вдосконалення протоколів узгодження медикаментів та скринінгу делірію в періопераційний період, підвищуючи безпеку пацієнтів

**Ключові слова:** седація; ускладнення; гіпертонічна хвороба; метопролол; токсичність