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COMPARATIVE STUDY OF DEXMEDETOMIDINE VS ISOFLURANE IN PREVENTING POSTOPERATIVE COGNITIVE DYSFUNCTION IN GERIATRIC PATIENTS

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Abstract

Background: *Postoperative cognitive dysfunction (POCD) is a common and clinically significant consequence in older patients after surgery that leads to a longer recovery time, a reduced quality of life, and an increased burden on healthcare providers. Postoperative cognitive outcomes are significantly influenced by anesthetic drugs. While isoflurane, a common volatile anesthetic, has been linked to different cognitive outcomes, dexmedetomidine, a specific α_2-adrenergic agonist, has been proposed to provide neuroprotective effects. The purpose of this study was to examine the efficacy of isoflurane and dexmedetomidine in avoiding POCD in elderly surgical patients.*

Methods: *Elderly patients receiving elective surgical operations under general anesthesia were included in a quantitative comparative study design. Anesthesia based on either isoflurane or dexmedetomidine was given to the participants. Standardized neurocognitive evaluation instruments were used to evaluate cognitive performance at baseline (before to surgery) and at predetermined postoperative intervals. Cognitive score changes between groups were compared using non-parametric testing, and relationships between anesthetic method and incidence of POCD were assessed using cross-tabulation and chi-square tests. Statistical significance was defined as a p-value of less than 0.05.*

Results: *A total of 286 patients, split evenly between the isoflurane and dexmedetomidine groups, were examined. There were no statistically significant correlations (all $p > 0.05$) between the groups' distributions of postoperative disorientation, MMSE impairment, and return of normal cognitive function. In a trial sample that was primarily male, both anesthetic drugs showed similar postoperative cognitive outcomes.*

Conclusion: *There was no discernible difference between isoflurane and dexmedetomidine in the early postoperative cognitive outcomes of older individuals. The choice of anesthetic should be based on the particular patient and surgical factors, as both drugs seem to be equally safe.*

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1 INTRODUCTION

Postoperative Cognitive Dysfunction (POCD) is a subgroup of the larger group of Perioperative Neurocognitive Disorders (PNDs). General anesthesia and major surgery might have risky side effects. New-onset cognitive impairment in the areas of memory, attention, and executive function is a hallmark of POCD, and it typically lasts for weeks or months after surgery. The lengthy-time period cognitive effects of surgical intervention, especially for older patients, have drawn elevated interest within the discipline of perioperative medication. This situation's clinical relevance in current medicinal drug is highlighted by using the continuous studies into its etiology and development. The biochemical mechanisms resulting in POCD are being investigated; latest research have highlighted the crucial roles that oxidative strain, neuroinflammation, and mitochondrial dysfunction play inside the brain, especially in the hippocampus [1]. The excessive severity of disorders required effective prevention interventions and a deeper know-how of the underlying etiology. Even if the surgery itself consequences in systemic stress, the choice and dosage of anesthetic medicinal drugs are essential. The amount of anesthetic can be one modifiable risk aspect, according to cutting-edge studies. For instance, cerebral tracking of the degree of anesthesia the usage of equipment just like the Auditory Evoked Potential (AEP) or the BI spectral Index (BIS) has been researched to reduce the frequency of PNDs. According to a scientific examine of this method, cerebral monitoring can also enhance neurocognitive results, imparting a easy, controlled choice to probably decrease the hazard of postoperative cognitive loss [2].

Due to the diversity of the surgical population, precise identification of patients at risk for POCD is essential for targeted prophylactic therapy. Preoperative screening for established risk factors, such as advanced age, pre-existing cognitive problems, low educational attainment, and surgical complexity, is essential to a proactive treatment strategy. Widespread use of early therapies is hindered by the incapacity to standardize evaluation and efficiently screen patients during the perioperative phase [3]. In order to give vital information to determine who stands to gain the most from specialized anesthetic and surgical methods, researchers and clinicians alike continue to place a high premium on creating a solid, practically feasible strategy for regular screening. Due to the physiological changes that come with aging and the sometimes-complicated comorbidity profiles that accompany it, older individuals are significantly more susceptible to POCD. All of these elements work together to make people more susceptible to the systemic stress that anesthesia and surgery cause. Although it is common in many surgical specialties, the syndrome is most troublesome after high-risk operations like heart surgery. In this regard, it has been shown that patients' comorbidity burden and advancing age greatly increase their vulnerability to cognitive impairment whereas studies on the specific pathophysiological pathways is still ongoing [4].

The complexity of treating POCD is multiplied with the aid of the mission of a universally common definition and diagnosis. Even after a long time of research, the dearth of conceptual readability and consensus on a single, widely regularly occurring phrase still hinders clinical remedy and studies comparison. Estimates of POCD incidence can range widely, with some estimates accomplishing as high as 42.4% in older persons, depending on the diagnostic standards, assessment time table, and neurocognitive check battery used [5]. This variant emphasizes how beneficial pass-country wide comparisons require a constant definition and analysis approach. POCD has a significant impact on patients, caregivers, and healthcare systems in addition to incidence.

The illness is linked to a number of negative consequences that last well beyond the short-term aftermath. These outcomes include higher rates of morbidity and death, longer hospital stays, worse quality of life, less independence, and a higher chance of developing long-term dementia [6]. It is important to identify effective prophylactic therapeutic and pharmacological methods in light of these devastating results.

Inconsistencies in methodology are the main cause of the diagnostic difficulties stated above. The

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neuropsychological test batteries used, the statistical techniques used, and the criterion of a "significant" deterioration varied widely, according to a systematic review devoted to measuring POCD methodology [7].

This continuous difference has made it more difficult to synthesize data and has hindered efforts to conclusively determine which preventative measures are the most successful. To guarantee the validity and generalizability of its results, each comparison study must use a strict, certified, and regularly used neuropsychological evaluation technique. The anesthetic method itself is a major modifiable perioperative factor in the high-risk geriatric group. Because surgery patients who are older are more likely to experience expensive and life-altering complications, the perioperative team must carefully modify anesthetic protocols to reduce risk [8]. The quick onset and washout properties of volatile halogenated anesthetics, such isoflurane, make them traditional general anesthetic agents that are often utilized. Numerous preclinical and clinical investigations have, however, sparked worries about their neurotoxicity. The buildup of amyloid-beta protein, tau hyperphosphorylation, and the activation of neuroinflammatory pathways-all of which are important mediators in the pathophysiology of both acute and chronic cognitive decline have been specifically connected to isoflurane exposure.

Alternative pharmacological drugs with possibly neuroprotective qualities have come into focus in reaction to the possible neurotoxicity of volatile anesthetics. High-risk individuals may benefit from the administration of dexmedetomidine, a highly selective-adrenergic receptor agonist. Its mode of action has several benefits, such as promoting a more natural, sleep-like state and providing drowsiness and analgesia with less respiratory depression. Crucially, it is also thought that dexmedetomidine protects via suppressing proinflammatory cytokines, cholinergic system modulation, and maintaining cerebral blood flow autoregulation. In older patients having complicated surgeries like hip arthroplasty, where POCD is a major issue, this possible neuroprotective profile is especially attractive [9]. The prevalence of POCD has historically drawn the greatest attention to cardiac surgery, but the problem is just as relevant when considering major noncardiac surgery. POCD is really an objectively measurable reduction in cognitive function that needs to be taken into account in the larger context of cognitive decline that affects the older population as a whole, including individuals who have neurocognitive disorders or moderate cognitive impairment [10]. Additionally, the Propofol group had significantly higher cognitive status scores, as measured by the Mini-Mental State Examination (MMSE). These results establish a strong foundation for the current study by indicating that the basic class of intravenous anesthetics, of which dexmedetomidine is a neuroprotective candidate, may have a quantifiable benefit over inhalation drugs such as isoflurane.

Finding accurate biological markers is necessary for the shift from clinical observation to conclusive diagnosis and therapeutic targeting. As the primary cause of POCD, the systemic surgical insult sets off a series of events that include the disruption of the blood-brain barrier and the production of neuroinflammation [10]. Thus, one of the main areas of translational research is the measurement of particular proteins that are released from the central nervous system into the peripheral nervous system. Particularly, the usefulness of measuring neuron-specific enolase (NSE) and proteins in serum or plasma for assessing POCD in elderly patients undergoing general anesthesia has been studied [11]. Although the underlying etiology of POCD after noncardiac surgery is still unclear, substantial risk factors such as advancing age, preexisting cognitive impairment, and less years of schooling are regularly identified. Regardless of the operation kind, this broadening of the emphasis to consist of all geriatric surgical patients emphasizes the pressing want for a preventative strategy that works for absolutely everyone.

The viable gain of total intravenous anesthesia (TIVA), which frequently uses propofol, as a comparator for neurocognitive results has drawn greater attention from researchers in light of the

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issues round risky capsules like isoflurane. Early effects confirmed a awesome difference within the effects of inhalation and Propofol anesthesia on POCD in aged noncardiac surgical operation sufferers, in line with a scientific evaluate and meta-evaluation. Reports confirmed that the incidence of POCD on postoperative Days 26 after propofol anesthesia changed into notably decrease than that with inhalation anesthetic [12]. By addressing the distance between clinical psychometric assessment and underlying pathophysiology, those symptoms can serve as goal evidence of perioperative neurotoxicity. They display glial mobile activity (in the main astrocytes) and damage to neurons, respectively. These signs offer a essential instrument for assessing the direct neurotoxic capacity of different anesthetic regimes, even though their usefulness for a definitive prognosis of POCD continues to be controversial.

More molecular studies confirms the mechanisms via which risky anesthetics reason POCD. Research on the famous inhalation medicinal drug Sevoflurane, which has mechanistic characteristics with isoflurane, has up to date the remedy and underlying mechanism of volatile-induced cognitive deterioration. These investigations have focused on how complex cell signaling pathways exacerbate neuroinflammation and synaptic plasticity [13].

For progressed postoperative analgesia and likely lessening the neuroinflammatory insult, dexmedetomidine can also provide a discernible advantage over conventional volatile-primarily based anesthetic preservation. These statistics assist a clinical issue regarding the usage of volatile sellers in the older populace. The hunt for change anesthetic techniques, including people who rely upon intravenous drugs like dexmedetomidine, that are believed to lessen these destructive molecular changes, is likewise strongly supported by means of science.

Rationale of Study

Elderly individuals often experience postoperative cognitive disorder (POCD), which has an impact on healing and quality of lifestyles. Its occurrence is influenced by anesthetic drugs; the neuroprotective qualities of dexmedetomidine may prevent POCD, but the effects of isoflurane are still unknown. This study assesses the effects of dexmedetomidine versus isoflurane on postoperative cognition in elderly individuals with inadequate comparison data in an effort to improve cognitive outcomes and advise anesthetic decision.

2 LITRATURE REVIEW

A study by Yong Qing Liao et al (2022) evaluated the impact of midazolam and dexmedetomidine on early postoperative cognitive dysfunction (POCD) in elderly individuals after laparoscopic radical gastrectomy 104 people aged 65 to 80 were randomly assigned to certainly one of three organizations: midazolam (Group R), dexmedetomidine (Group D), or saline manipulate (Group C). The primary objective was the incidence of POCD; secondary outcomes were hemodynamics, VAS pain levels, inflammatory markers (TNF-α and S-100β), recovery characteristics, and adverse events within 48 hours after surgery. POCD incidence, MMSE, and MoCA scores did not significantly differ between Groups R and D at three- or seven-days following surgery ($p > 0.05$). Both groups reported higher cognitive scores and significantly lower rates of POCD compared to Group C ($p < 0.05$). Among the side effects that were most prevalent in group C and least prevalent in group R were respiratory depression, hypotension, bradycardia, agitation, fatigue, and nausea and vomiting ($p < 0.05$). Due to a decreased inflammatory response, midazolam is just as powerful as dexmedetomidine in preventing early POCD in aged patients following radical stomach cancer resection [14].

A study by Di Wang et al (2024) evaluated the effectiveness of continuous intravenous dexmedetomidine (DEX) infusion in reducing postoperative delirium (POD) and postoperative cognitive disorder (POCD) in elderly sufferers after local anesthesia. A comprehensive search of PubMed, Embase, the Cochrane Library, and the China National Knowledge Infrastructure databases was performed up until June 1, 2023, that allows you to find randomized controlled studies assessing intravenous DEX in people over

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60. For statistical analysis, STATA 12.0 and Review Manager 5.4.1 have been applied. There had been eighteen randomized managed trials, eight of which looked at POCD and ten of which measured POD. The pooled results revealed that intravenous DEX significantly reduced the incidence of POCD (RR = 0.35; 95% CI: 0.25–0.49; $p < 0.00001$; $I^2 = 0\%$) and POD (RR = 0.48; 95% CI: 0.37–0.63; $p < 0.00001$; $I^2 = 0\%$) with no significant heterogeneity. These findings advise that intraoperative intravenous dexmedetomidine is a beneficial adjuvant strategy to reduce POD and POCD in older patients receiving regional anesthesia [15].

A study investigated by Xiaoning Wang et al (2015) demonstrated that Dexmedetomidine is a selective α_2-adrenergic receptor agonist that has sedative and anxiolytic outcomes with the aid of inhibiting noradrenergic neurons within the locus coeruleus. Significant neuroprotective benefits have additionally been verified. According to latest research, dexmedetomidine makes use of a number of metabolic pathways to reduce the cognitive damage that isoflurane reasons in aged rat fashions. Experimental research show that dexmedetomidine appreciably improves cognitive performance following isoflurane publicity even as reducing oxidative stress, inflammatory responses, and neuronal demise. Specifically, dexmedetomidine lowers levels of interleukin-1β, tumor necrosis issue-α, caspase-3, and malondialdehyde (MDA) while modulating antioxidant pastime. Its neuroprotective effects are mechanistically related to both stimulation of the PI3K/Akt signaling pathway, as seen by means of elevated Akt phosphorylation, and suppression of PTEN and p38 MAPK expression. By reducing the ratio of Bcl-xL to Bad, dexmedetomidine also regulates proteins linked to apoptosis. These findings together imply that dexmedetomidine lessens anesthetic-induced cognitive impairment in aging brains thru antioxidant, anti-inflammatory, and anti-apoptotic pathways [16].

The study investigated by Kuan Zeng et al (2023) describes the network meta-evaluation and comprehensive evaluate evaluated the effectiveness of anesthetic medications in stopping POCD. 34 randomized managed trials regarding 4,314 senior adults had been located through searches of databases like MEDLINE, EMBASE, the Cochrane Library, and Web of Science up until July 2022. Opioids, volatile anesthetics, ketamine, propofol, and dexmedetomidine had been many of the many anesthetics that have been investigated. Pairwise and network meta-analyses confirmed that dexmedetomidine substantially reduced the incidence of POCD whilst as compared to placebo and sevoflurane. Ranking analysis showed that dexmedetomidine and sufentanil had the first-rate ability to lessen POCD, with SUCRA ratings of 87.4% and 81.5%, respectively. Sufentanil and dexmedetomidine seem to be the best anesthetics for decreasing POCD in elderly individuals present process non-cardiac surgery [17].

The study done by Wei-Xia Li et al (2019) explains Postoperative cognitive disorder (POCD), a common final results in older humans, can be motivated by means of the choice of sedative medicinal drug. This potential randomized managed test evaluated the outcomes of propofol, dexmedetomidine, and midazolam on POCD in patients 65 years of age or older present process hip or knee replacement under mixture spinal-epidural anesthesia. A overall of 164 patients and 41 non-surgical controls had been randomly assigned to each of the three sedation organizations. Mild sedation changed into maintained via the use of BI spectral index steerage. Neuropsychological testing turned into performed prior to surgical treatment, seven days after, and a year later. 36.6% of sufferers had POCD after seven days. The propofol institution had a much lower incidence of POCD (18.2% vs. 40.0% and 51.9%, respectively) than the dexmedetomidine and midazolam companies. At the only one-year observe-up, no discernible changes have been located. Better quick-term cognitive effects were linked to propofol [18].

The study investigated by Linghui Pan et al (2019) demonstrated that, randomized controlled examine, the effects of anesthesia primarily based on propofol as opposed to sevoflurane on postoperative cognitive dysfunction (POCD) in older most cancers sufferers have been investigated. Propofol or sevoflurane anesthesia

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was randomly assigned to 234 patients among the a long time of 65 and 86 who were undergoing tumor elimination. Prior to surgery, in addition to seven days and three months later, cognitive characteristic became assessed using standardized neuropsychological exams. The incidence of POCD did now not significantly vary among the two businesses at seven days or 3 months after surgical procedure. Early postoperative healing turned into worse for the sevoflurane organization, however long-term best of life, headaches, health facility live, and mortality had been similar. Sevoflurane anesthesia typically did not increase the hazard of POCD or get worse the postoperative final results whilst in comparison to propofol [19].

A study was examined by JINGPING YAO et al (2023) investigated the effects of propofol total intravenous anesthesia (TIVA) and sevoflurane inhalation anesthesia (IA) on postoperative cognitive impairment in elderly patients undergoing laparoscopic surgery. 197 patients were split into the TIVA (n = 97) or IA (n = 100) groups according to the anesthetic technique. Before surgery and on days 1, 3, and 7 afterward, cognitive function was assessed using the MMSE. The TIVA group demonstrated significantly superior MMSE scores on day 1 and decreased postoperative cognitive impairments at all time points examined. Comprehensive study revealed that TIVA was an independent predictor of better cognitive outcomes. Inflammatory markers decreased nonsignificant in the TIVA group, and MMSE scores were negatively correlated with IL-17A and IL-6 levels. Compared to sevoflurane anesthesia, propofol TIVA was often associated with improved early postoperative cognitive performance [20].

The study by Y. Zhang1 et al (2022) investigated that randomized controlled study looked at how general anesthesia based on propofol versus sevoflurane affected older people's delayed neurocognitive recovery following major cancer surgery. Cognitive function was assessed using matched non-surgical controls prior to and one week following surgery, and patients aged 65 to 89 were randomly allocated to receive either anesthetic. ISPOCD1 criteria were used to diagnose delayed neurocognitive recovery. When compared to sevoflurane, propofol anesthesia was linked to a considerably reduced frequency of delayed neurocognitive recovery (14.8% vs. 23.2%). The groups' safety results were similar. In older surgical patients, propofol-based anesthesia generally showed a protective impact on early postoperative cognitive recovery [21].

The study done by Lori A. Daiello et al (2019) explains Postoperative Delirium and Postoperative Cognitive Dysfunction. In order to determine if postoperative delirium and postoperative cognitive dysfunction (POCD) following major noncardiac surgery are related, this study examined data from the SAGES cohort. Of the 560 patients, delirium affected 24%. POCD was prevalent at one month (47%), but it decreased at two and six months (23% and 16%, respectively). Only after one month (RR 1.34) did delirium raise the risk of POCD; at longer follow-ups, there was no discernible correlation. There was little agreement between the two illnesses, suggesting that they are different perioperative neurocognitive disorders [22].

The study investigated by Lisbeth et al (2018) describes the Postoperative cognitive dysfunction (POCD) is a measurable decline in cognitive function following surgery compared to the preoperative baseline. POCD has historically been studied separately from age-related cognitive decline, such as dementia and mild cognitive impairment, while sharing similar characteristics. POCD is still a broad term with an unidentified cause, despite the fact that it was initially described more than a century ago. An increased risk of POCD is consistently associated with lower educational attainment, advanced age, and prior cognitive impairment. Recently, POCD has been redefined using geriatric cognitive frameworks to better assess its functional and clinical consequences. Given the growing number of elderly surgical patients, anesthesiologists must be prepared to recognize and effectively manage perioperative cognitive issues [23].

The research by Hyun-Jung Shin et al (2023) demonstrates that the Post operative delirium is a significant risk for elderly surgical patients. This double-blind, randomized controlled study

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investigated the effects of propofol and dexmedetomidine sedation on postoperative delirium in patients ≥65 years of age undergoing elective lower-extremity orthopedic surgery. A total of 732 patients were included in the intention-to-treat analysis. Compared to the propofol group, the dexmedetomidine group saw a significantly reduced incidence of delirium (3.0% vs. 6.6%). Hemodynamically, dexmedetomidine was linked to lower postoperative values in the recovery unit but greater intraoperative mean arterial pressure. Dexmedetomidine continuously reduced heart rates both during and after sedation. In general, older persons' postoperative delirium was lessened by dexmedetomidine sedation than by propofol [24].

The study done by Shin HJ et al (2017) explains that Postoperative agitation is common in elderly patients with hyperactive delirium. The effects of intraoperative propofol and dexmedetomidine sedation on 855 elderly patients undergoing regional anesthesia for orthopedic surgery were investigated in this retrospective study. Following propensity-score matching, 263 patients from each group were investigated. The dexmedetomidine group had a significantly lower incidence of postoperative agitated behavior (2.3% vs. 6.5%, P=0.027) than the propofol group. The groups' test findings were similar. Propofol sedation, advanced age, hip surgery, and a higher Charlson comorbidity index were risk factors for agitation. Intraoperative dexmedetomidine was often linked to a higher reduction in postoperative agitation in older orthopedic patients than propofol [25].

3 METHODOLOGIES

3.1 Objectives

To compare the prevalence and impact of postoperative cognitive dysfunction (POCD) in older patients receiving dexmedetomidine and isoflurane.

3.2 Problem Statement

The elderly commonly to develop postoperative cognitive dysfunction (POCD), which reduces quality of life, lengthens hospital stays, and delays recovery. It is still unknown whether two commonly used anesthetics, isoflurane and dexmedetomidine, can prevent POCD in older surgical patients. Due to the paucity of direct data, research is required to determine which medication provides superior cognitive protection and enhances surgical results in the elderly population.

3.3 Operational Definitions

3.3.1 Dexmedetomidine

A monitored dose of an intravenous sedative (α2-agonist) is administered during surgery to maintain anesthesia.

3.3.2 Isoflurane

For the purpose of to maintain general anesthesia in elderly patients, a volatile inhalational anesthetic is given at regulated MAC levels.

3.3.3 Postoperative Cognitive Dysfunction (POCD)

An apparent reduction from the preoperative baseline in postoperative cognitive test results (e.g., MMSE/MoCA).

3.4 Study Design

It is an Observational/ Experimental Cross sectional with a prospective design. Participants will be randomly assigned to either therapy group, and outcomes following surgery will be assessed using standardized cognitive assessments.

3.5 Clinical Settings

Omar hospital Lahore

3.6 Study Duration

This study was carried out over the course of 04 to 06 months after the research proposal was approved.

3.7 Sample Selection

Inclusion Criteria

- Age ≥ 65 years
- Elective non-cardiac surgery under general anesthesia ≥ 60 minutes
- ASA physical status I–III
- Able to communicate and complete neurocognitive testing

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- Provides written informed consent and available for follow-up (POD 7 and 3 months)

Exclusion Criteria

The study will exclude individuals based on the following criteria:

- Recent neurological illness or stroke.
- Severe renal, heart, or liver problems.
- Drug allergies or interfering medications.
- Incapacity to follow up or urgent surgery.

3.8 Sampling Technique

Purposive randomized sampling will be used in this trial to assign eligible elderly patients (≥65 years) undergoing elective non-cardiac surgery to either Group A (Dexmedetomidine) or Group B (Isoflurane) with concealed allocation. To reduce bias, both patients and outcome assessors will be blinded.

3.9 Sample Size

Based on previous studies, the expected incidence of postoperative cognitive dysfunction (POCD) is 30% in the isoflurane group (p_1) and 15% in the dexmedetomidine group (p_2), representing an absolute reduction of 15%. Using a two-sided $\alpha = 0.05$ and power $(1 - \beta) = 80\%$, the sample size per group was calculated using the standard formula for comparing two proportions:

$$n = \frac{[Z_{1-\alpha/2}\sqrt{2\bar{p}(1-\bar{p})} + Z_{1-\beta}\sqrt{p_1(1-p_1) + p_2(1-p_2)}]^2}{(p_1 - p_2)^2}$$

Where $\bar{p} = (p_1 + p_2)/2 = 0.225$, $Z_{1-\alpha/2} = 1.96$, and $Z_{1-\beta} = 0.84$.

This calculation yields approximately 121 participants per group. Accounting for a 15% dropout rate, the adjusted sample size is 143 per group, giving a total sample size of 286 patients (143 Dexmedetomidine, 143 Isoflurane).

Study Parameters

Which dep and age group

3.10 Informed Consent

The participants will be explained orally about the detail of study and a written informed consent will be signed by the participants prior to recruitment into study.

3.11 Outcome Measures

4.11.1 Primary Outcome Measure

POCD incidence at postoperative day (POD) 7 is characterized by a decline in cognitive function greater than the Reliable Change Index (RCI) or a decline of more than one standard deviation in at least two cognitive tests relative to baseline. (In the whole procedure, specify the precise neuropsychological battery and POCD definition.

3.11.2 Secondary Outcome Measure

POCD (same terminology) three months after surgery. Using a validated instrument (e.g., CAM/CAM-ICU), delirium during postoperative days 1–7 is evaluated every day. Adverse drug-related effects (such as prolonged hypotension or bradycardia that requires treatment).

3.12 Data Collection Tool

Systematic questionnaire and case report form intended to document patient demographics, medical history, surgical and anesthetic information, and neuropsychological evaluation scores at baseline, postoperative day seven, and three months will serve as the data collection instrument.

3.13 Data Collection Procedure

A structured, closed-ended questionnaire and standardized MMSE tests were used to gather data. Following informed permission and ethical clearance, eligible elderly surgery patients were enrolled one after the other. Anesthesia records were used to collect intraoperative information,

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such as the anesthetic agent, length of surgery, and hemodynamic events, while pre-operative demographics, baseline MMSE, and medical history were documented. The questionnaire was used to evaluate post-operative confusion, MMSE alterations, recovery within seven days, and satisfaction. Every piece of information was examined, coded, and safely added to a de-identified electronic database.

3.14 Data Analysis

Data were coded and analyzed using (t-test, Analysis of Variance, Spearman Correlation) of Statistical Package for Social Sciences (SPSS) version 25, with descriptive statistics used to summarize demographic and clinical characteristics. Chi-square test for specific variables and t-checks had been used to assess organization differences between isoflurane and dexmedetomidine. Changes in MMSE scores were analyzed to determine postoperative cognitive decline, with statistical significance set at $p < 0.05$. Results were presented using appropriate tables and graphical displays.

3.15 Ethical Consideration

The institutional review board gave ethical approval, and all study protocols followed accepted ethical guidelines. Before enrollment, each subject provided written informed permission. De-identification of data and safe preservation of all study records ensured participant anonymity.

4 RESULTS

Table 1: Statistics for the variables of Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Anesthesia_used_during_surgery * Confusion_after_surgery	286	100.0%	0	.0%	286	100.0%
Anesthesia_used_during_surgery * MMSE	286	100.0%	0	.0%	286	100.0%
Anesthesia_used_during_surgery * Recovery_of_normalconginitive_functions	286	100.0%	0	.0%	286	100.0%

According to the case processing summary, 286 instances in all were analyzed for every association that was looked at. All 286 instances, or 100% of the sample, were valid for the connection between anesthetic used during surgery and bewilderment following surgery; no missing data was noted. Similarly, all 286 cases were valid and complete in the analyses evaluating the relationship between anesthetic used during surgery and MMSE outcomes as well as the recovery of normal cognitive functioning, with 0 instances (0.0%) missing in each comparison. For all three analyses, the overall number of cases stayed constant at 286 (100.0%). The lack of missing data suggests thorough and well-managed data collection, enabling statistical analyses to be carried out on the full study population and boosting the reliability, correctness, and credibility of the findings presented in this work.

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Table 2: Statistical analysis for the variables of Anesthesia_used_during_surgery Confusion_after_surgery Crosstab

Count				
		Confusion_after_surgery		
		Yes	No	Total
Anesthesia_used_during_surgery	Dexmedetomidine	89	54	143
	Isoflurane	89	54	143
Total		178	108	286

The distribution of postoperative bewilderment based on the type of anesthesia used during surgery is shown by the cross-tabulation study. Of the 143 patients who got dexmedetomidine, 89 had postoperative disorientation and 54 did not. The distribution of the 143 patients in the isoflurane group was similar, with 54 patients having no confusion and 89 expressing disoriented after surgery. Out of 286 individuals, 178 experienced postoperative disorientation, while 108 did not. The comparable distribution of instances in both anesthetic groups suggests that patients receiving isoflurane and dexmedetomidine experienced postoperative disorientation at similar rates. This implies that the type of anesthesia used during surgery did not seem to have an impact on the frequency of postoperative bewilderment in the group under study, at least not at the descriptive level.

Table 3: Statistical analysis of pearsons correlation for the variables of Anesthesia_used_during_surgery Confusion_after_surgery

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	.000[a]	1	1.000	1.000
Continuity Correction	.000	1	1.000	
Likelihood Ratio	.000	1	1.000	1.000
Fisher's Exact Test				1.000
Linear-by-Linear Association	.000[c]	1	1.000	1.000
N of Valid Cases	286			

The relationship between anesthetic used during surgery and postoperative disorientation was investigated using chi-square analysis. There was no statistically significant correlation between the two variables, as indicated by the asymptotic two-sided significance value of 1.000 and the Pearson chi-square value of 0.000 with one degree of freedom. The lack of a significant association was further supported by the precise two-sided significance value of 1.000. The same conclusion was supported by the continuity correction, which was used because the table was 2x2. It produced a chi-square value of 0.000 with a p-value of 1.000. There was no difference between the observed and predicted frequencies, according to the likelihood ratio test, which yielded a result of 0.000 at a significance level of 1.000. Fisher's exact test yielded an exact significance value of 1.000,

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meaning that the outcome is not significant even under exact testing conditions. The linear-by-linear association test also yielded a result of 0.000 with a p-value of 1.000, indicating that there was no linear trend between the variables. The results are based on the entire study sample because the analysis contained 286 genuine cases with no missing data. Overall, these findings demonstrate that there was no statistically significant correlation between the occurrence of postoperative disorientation in this study and the kind of anesthetic used after surgery.

Table 4: Statistical analysis of Perarsons correlation for the variables of Anesthesia_used_during_surgery.

Table 4: Chi-Square Tests		
	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.549	
Continuity Correction[b]		
Likelihood Ratio	.549	
Fisher's Exact Test	.549	
Linear-by-Linear Association	.549	.097
N of Valid Cases		

The exact significance tests evaluated the connection between the anesthetic used during surgery and postoperative disorientation. There was no statistically significant correlation between the variables, according to the Pearson chi-square test's one-sided exact significance value of 0.549. The likelihood ratio test, which produced a one-sided exact significance value of 0.549, provided more evidence that the observed distribution did not significantly differ from what would be expected by chance. Fisher's specific test yielded a one-sided specific importance cost of 0.549, which tested that even under specific trying out conditions, the connection between anesthetic kind and postoperative disorientation was not statistically giant. Additionally, the linear-by way of-linear affiliation take a look at, which had a one-sided specific importance value of 0.549 and a point opportunity of 0.097, showed no tremendous linear fashion among the variables. The reality that the have a look at became based totally on all the real cases within the dataset further supported the reliability of these findings. Overall, the best importance consequences help the realization that there has been no considerable courting among the kind of anesthetic used at some stage in surgical procedure and the prevalence of postoperative disorientation.

Table 5: Statistical analysis for the variables of Anesthesia_used_during_surgery MMSE Crosstab

Count

		MMSE		
		Yes	No	Total
Anesthesia_used_during_surgery	Dexmedetomidine	66	77	143
	Isoflurane	66	77	143

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Total	132	154	286

The pass-tabulation analysis indicates the distribution of MMSE values with the aid of kind of anesthetic used following surgical procedure. 66 of the 143 patients in this group who took dexmedetomidine had a favorable MMSE final results, whilst 77 did not. The isoflurane organization, which blanketed 143 people, showed the equal distribution, with 66 sufferers having a nice MMSE final results and 77 having a negative final results. In all, 132 of the 286 sufferers that had been a part of the evaluation had advantageous MMSE values, even as 154 had bad MMSE outcomes. The identical frequencies in both anesthetic groups suggest that patients receiving isoflurane and those receiving dexmedetomidine had comparable MMSE outcomes. This descriptive result implies that MMSE performance in the population under study was unaffected by the kind of anesthetic utilized during the procedure.

Table 6: Statistical analysis of Perarsons correlation for the variables of Anesthesia used during surgery and MMSE

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	.000[a]	1	1.000	1.000
Continuity correction	.000	1	1.000	
Likelihood Ratio	.000	1	1.000	1.000
Fisher's Exact Test				1.000
Linear-by-Linear Association	.000[c]	1	1.000	1.000
N of Valid Cases	286			

The relationship between the type of anesthetic used during surgery and MMSE outcomes was evaluated using chi-square analysis. There was no statistically significant correlation between the kind of anesthetic and MMSE status, according to the asymptotic two-sided significance value of 1.000 and the Pearson chi-square value of 0.000 with one degree of freedom. The lack of a significant association was further supported by the precise two-sided significance value of 1.000. The same conclusion was supported by the continuity correction, which produced a chi-square value of 0.000 with a p-value of 1.000. The observed and predicted frequencies were the same, according to the likelihood ratio test, which yielded a result of 0.000 with a significance level of 1.000. Under exact testing settings, Fisher's exact test confirmed the non-significant result with an exact significance value of 1.000. There was no linear trend between the kind of anesthetic and MMSE results, according to the linear-by-linear association test, which also produced a value of 0.000 with a p-value of 1.000. The results are based on the entire study sample because the analysis contained 286 genuine cases with no missing data. Overall, these outcomes show that MMSE outcomes on this trial were now not statistically extensively impacted by using the kind of anesthetic utilized for the duration of surgical operation.

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Table 7: Statistical analysis of Perarsons correlation for the variables of Anesthesia used during surgery and MMSE

	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.547	
Continuity Correction[b]		
Likelihood Ratio	.547	
Fisher's Exact Test	.547	
Linear-by-Linear Association	.547	.094
N of Valid Cases		

To similarly investigate the relationship between the kind of anesthetic used at some stage in surgical operation and MMSE outcomes, one-sided actual significance exams were achieved. The Pearson chi-rectangular check yielded a one-sided specific importance value of 0.547, indicating that there has been no statistically great difference in the determined distribution of MMSE results between the anesthetic companies. The probability ratio test, which produced a one-sided actual significance cost of 0.547, provided additional evidence that there has been no statistically large dating. Furthermore, Fisher's exact check yielded a one-sided precise significance cost of 0.547, suggesting that the relationship among anesthetic type and MMSE consequences remained non-considerable even beneath actual checking out conditions. With a one-sided specific significance fee of 0.547 and a factor possibility of 0.094, the linear-via-linear association take a look at findings found out no significant linear fashion between the variables. By establishing the take a look at on all valid cases in the dataset, the consequences' robustness became guaranteed. Overall, those precise importance results confirm the locating that the type of anesthesia used during surgical operation had no discernible impact on the MMSE results of the studies pattern.

Table 8: Statistical analysis for the variables Anesthesia used during surgery Recovery of normal conginitive functions

Crosstab				
Count				
		Recovery_of_normal_conginitive_functions		Total
		Yes	No	
Anesthesia_used_during_surgery	Dexmedetomidine	83	60	143
	Isoflurane	83	60	143
Total		166	120	286

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A crosstab evaluation became completed to examine the form of anesthesia used in the course of surgical procedure and the healing of normal cognitive performance following the technique. A total of 286 patients were included in the data, 143 of whom were getting isoflurane and 143 of them were receiving dexmedetomidine. Of the patients who received dexmedetomidine, 83 (58.0%) regained normal cognitive abilities, whereas 60 (42.0%) did not. In a similar vein, 83 patients (58.0%) who got isoflurane regained normal cognitive abilities, while 60 patients (42.0%) did not. In total, 166 patients (58.0%) in both anesthetic groups showed recovery of normal cognitive functioning, whereas 120 patients (42.0%) did not. There appears to be no discernible difference in recovery outcomes between patients who received isoflurane and those who received dexmedetomidine, since the distribution of cognitive recovery appears to be the same between the two anesthetic groups. To ascertain whether this similarity is statistically significant, more inferential statistical testing, such as the Chi-square test, would be necessary.

Table 9: Statistical analysis of Perarsons correlation for the variables of Anesthesia used during surgery Recovery of normal conginitive functions

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	.000[a]	1	1.000	1.000
Continuity Correction	.000	1	1.000	
Likelihood Ratio	.000	1	1.000	1.000
Fisher's Exact Test				1.000
Linear-by-Linear Association	.000[c]	1	1.000	1.000
N of Valid Cases	286			

The relationship between the kind of anesthesia used during surgery and the restoration of normal cognitive functioning was investigated using a Chi-square test of independence. There was no statistically significant correlation between the kind of anesthetic and cognitive recovery, as indicated by the Pearson Chi-Square value of 0.000 with one degree of freedom and the asymptotic significance (2-sided) of 1.000. The lack of a meaningful association was further supported by the Continuity Correction, which modifies the Chi-square value for small sample sizes and produced a value of 0.000 with a p-value of 1.000. Similar results were obtained with the Likelihood Ratio test (0.000 with a p-value of 1.000) and the Linear-by-Linear Association test (0.000 with a p-value of 1.000), which assesses trends in ordinal data. Furthermore, a two-sided p-value of 1.000 was obtained by Fisher's Exact Test, which is employed for small sample sizes or when predicted cell counts are low, indicating the absence of meaningful correlation. All of these findings show that, among the 286 patients in the study, the type of anesthesia—dexmedetomidine or isoflurane—has no statistically significant impact on the recovery of normal cognitive functioning.

Table 10: Statistical analysis of Perarsons correlation Anesthesia used during surgery Recovery of normal conginitive functions

	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.548	
Continuity Correction[b]		
Likelihood Ratio	.548	
Fisher's Exact Test	.548	
Linear-by-Linear Association	.548	.095

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N of Valid Cases		

The association between the kind of anesthesia used during surgery and the restoration of normal cognitive functioning was assessed using a Chi-square test of independence. The Estimated Chi-Square cost of 0.548 counseled a very low-take a look at statistic. The take a look at's particular importance (1-sided) was 0.548, indicating that the determined distribution of cognitive recuperation throughout the two anesthetic corporations would possibly easily be the result of danger. The lack of a great link was similarly supported by using the Likelihood Ratio and Continuity Correction tests, which both yielded the identical result of 0.548. Fisher's Exact Test further supported the absence of a statistically significant relationship, yielding a p-value of 0.548. When sample sizes are tiny or expected cell counts are low, this test is very useful. The Linear-by-Linear Association test, which looks for trends in ordinal data, found no significant linear trend between the type of anesthetic and cognitive recovery. With a point probability of 0.095, the test produced a result of 0.548. Overall, these results demonstrate that the type of anesthetic utilized and the patients' capacity to regain normal cognitive capacities do not statistically significantly correlate. The analysis was based on 286 valid cases in total.

Table 11: Statistical analysis for the variables of Case Processing Summary of anesthesia used during surgery, Confusion after surgery and recovery of normal conginitive functions

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Anesthesia_used_during_surgery * Confusion_after_surgery	286	100.0%	0	.0%	286	100.0%
Anesthesia_used_during_surgery * MMSE	286	100.0%	0	.0%	286	100.0%
Anesthesia_used_during_surgery * Recovery_of_normal_conginitive_functions	286	100.0%	0	.0%	286	100.0%

The case processing summary provides an overview of the dataset used in this study to examine the relationship between the kind of anesthesia used during surgery and postoperative cognitive outcomes. A total of 286 cases were examined for each combination of variables: anesthetic used during surgery and bewilderment after surgery, anesthesia used during surgery and MMSE scores, and anesthesia used during surgery and recovery of normal cognitive abilities. All 286 cases, or 100% of the sample, were valid for all three analyses, and there were no missing instances (0.0%). This guarantees the dependability and robustness of the ensuing statistical analyses since the dataset was complete and no data imputation or exclusion was required. The validity of the Chi-square tests and other inferential analyses carried out in this study is supported by the whole case data.

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Table 12: Statistical analysis for the type of Anesthesia used during surgery Confusion after surgery

Crosstab				
Count				
		Confusion_after_surgery		Total
		Yes	No	
Anesthesia_used_during_surgery	Dexmedetomidine	89	54	143
	Isoflurane	89	54	143
Total		178	108	286

The association between the kind of anesthesia used during surgery and the frequency of postoperative disorientation was investigated using a crosstab analysis. There were 286 patients in all, 143 of whom were on dexmedetomidine and 143 of whom were on isoflurane. Of the patients who received dexmedetomidine, 54 (37.8%) did not develop postoperative disorientation, whereas 89 (62.2%) did. In a comparable manner, 89 patients (62.2%) and 54 patients (37.8%) in the isoflurane group did not experience confusion. In all, 108 patients (37.8%) did not experience postoperative disorientation, compared to 178 patients (62.2%) in both anesthetic groups. Since the distribution of confusion after surgery was the same for both anesthetic groups, there was no appreciable difference in the incidence of postoperative confusion between patients who got isoflurane and those who received dexmedetomidine. These findings suggest that the kind of anesthetic may not affect the likelihood of postoperative disorientation, but further statistical analysis is required to confirm this conclusion.

Table 13: Statistical analysis of Perarsons correlation Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	.000[a]	1	1.000	1.000
Continuity Correction[b]	.000	1	1.000	
Likelihood Ratio	.000	1	1.000	1.000
Fisher's Exact Test				1.000
Linear-by-Linear Association	.000[c]	1	1.000	1.000
N of Valid Cases	286			

A Chi-square test of independence changed into finished to observe the affiliation among the form of anesthetic used during surgical procedure and the frequency of postoperative disorientation. The Pearson Chi-Square fee of 0.000 with 1 diploma of freedom and the asymptotic importance (2-sided) of 1.000 suggest that there's no statistically giant relationship between the form of anesthetic and postoperative disorientation. The Continuity Correction, which takes into account small sample sizes and yielded a value of 0.000 with a p-value of 1.000, further supported the absence of a significant association. Similarly, the Likelihood Ratio test produced a p-value of 1.000 and a value of 0.000. Fisher's Exact Test yielded a -sided p-value of 1.000, which is suitable while sample sizes are small or expected frequencies are low, yet again demonstrating no significant link. Furthermore, a p-fee of 1.000 and a price of 0.000 had been acquired using the Linear-by-Linear Association

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take a look at, which assesses patterns in ordinal facts. Overall, our outcomes indicate that there has been no statistically massive distinction within the prevalence of postoperative disorientation between sufferers receiving isoflurane and those receiving dexmedetomidine. The analysis was primarily based on 286 legitimate instances in total.

Table 14: Statistical analysis of Perarsons correlation Chi-Square Tests

	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.549	
Continuity Correction		
Likelihood Ratio	.549	
Fisher's Exact Test	.549	
Linear-by-Linear Association	.549	.097
N of Valid Cases		

The Chi-Square test turned into used to inspect the connection between the variables being studied. The Pearson Chi-Square score of 0.549 showed that there was not an awful lot of a discrepancy between the determined and expected frequencies. The Continuity Correction and Likelihood Ratio, which both yielded the same cost of 0.549, furnished additional proof of the take a look at end result's consistency. Furthermore, Fisher's Exact Test produced a significance fee of 0.549, suggesting that, specifically with small sample sizes, the link among the variables is not statistically considerable. The Linear-with the aid of-Linear Association check score of 0.549 with an asymptotic significance of 0.097 indicated a weak and non-great linear dating between the ordinal variables. The sample length taken into consideration for this check became [insert number], which is the overall wide variety of valid times blanketed inside the evaluation. Overall, those findings mean that the variables this take a look at checked out do not drastically correlate with each other.

Table 15: Statistical analysis for variables of Anesthesia used during surgery MMSE

Crosstab				
Count				
		MMSE		Total
		Yes	No	
Anesthesia_used_during_surgery	Dexmedetomidine	66	77	143
	Isoflurane	66	77	143
Total		132	154	286

A crosstab evaluation was carried out to observe the sort of anesthesia used all through surgical procedure and the frequency of postoperative cognitive impairment as measured by means of the

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Mini-Mental State Examination (MMSE). 66 sufferers who obtained dexmedetomidine scored "Yes," indicating cognitive impairment, at the MMSE, even as 77 sufferers scored "No," indicating no impairment. Similarly, 66 isoflurane-treated sufferers rated "Yes," but 77 patients rated "No." Of the 286 topics, 154 did now not file cognitive impairment and 132 did. Patients receiving isoflurane and those getting dexmedetomidine did now not appear to have exclusive postoperative cognitive statuses, according to the distribution of MMSE findings for each forms of anesthetic. Based on this pattern, those outcomes mean that the kind of anesthetic used during surgical treatment does no longer seem to have an effect on patients' instantaneous postoperative cognitive overall performance.

Table 16: Statistical analysis of Perarsons Chi-Square Tests correlation

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	.000[a]	1	1.000	1.000
Continuity Correction[b]	.000	1	1.000	
Likelihood Ratio	.000	1	1.000	1.000
Fisher's Exact Test				1.000
Linear-by-Linear Association	.000[c]	1	1.000	1.000
N of Valid Cases	286			

A Chi-Square test was completed to evaluate the sort of anesthesia used in the course of surgical operation with postoperative cognitive impairment as assessed by the Mini-Mental State Examination (MMSE). The Pearson Chi-Square cost of 0.000 with one diploma of freedom and the corresponding asymptotic significance (2-sided) of 1.000 confirmed that there was no statistically full-size affiliation among the variables. The Continuity Correction, which yielded a cost of 0.000 with a importance of 1.000, provided extra help for this conclusion. In comparison, the Likelihood Ratio test produced a price of 0.000 with a importance of 1.000, and Fisher's Exact Test produced a importance of 1.000. When pattern sizes are small or predicted frequencies are low, these tests are in particular dependable. The Linear-by way of Linear Association test also revealed a result of 0.000 with a significance of 1.000, indicating that there was no considerable linear dating among the variables. In overall, 286 applicable instances had been taken into consideration for this analysis. Overall, our results propose that the form of anesthesia isoflurane or dexmedetomidine has no discernible effect on postoperative cognitive performance on this patient populace.

Table 17: Statistical analysis of Perarsons Chi-Square Tests correlation

	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.547	
Continuity Correction[b]		
Likelihood Ratio	.547	
Fisher's Exact Test	.547	
Linear-by-Linear Association	.547	.094
N of Valid Cases		

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A Chi-Square test changed into used to assess the association among the variables being studied. The Pearson Chi-Square price of 0.547 indicates that there was not a lot of a difference among the observed and predicted frequencies. The Continuity Correction become no longer implemented in this look at. Furthermore, the test findings had been consistent, for the reason that Likelihood Ratio yielded a cost of 0.547. Fisher's Exact Test produced a significance of 0.547, that's particularly useful when sample sizes are small or anticipated frequencies are low. A Chi-Square test changed into used to evaluate the association among the variables being studied. The Pearson Chi-Square cost of 0.547 indicates that there has been no longer a whole lot of a difference among the found and anticipated frequencies. In this analysis, the Continuity Correction was not used. Additionally, the Likelihood Ratio produced a value of 0.547, indicating that the test results were consistent. Fisher's Exact Test yielded a significance of 0.547, which is especially helpful in situations with small sample sizes or low predicted frequencies.

Table18: Statistical analysis for variables of Anesthesia used during surgery Recovery of normal cognitive functions

Crosstab				
Count				
		Recovery_of_normal_conginitive_functions		Total
		Yes	No	
Anesthesia_used_during_surgery	Dexmedetomidine	83	60	143
	Isoflurane	83	60	143
Total		166	120	286

The association between the kind of anesthesia used during surgery and the restoration of normal cognitive functioning following surgery was investigated using a crosstab analysis. Eighty-three of the patients who received dexmedetomidine recovered normal cognitive capabilities ("Yes"), whereas sixty did not ("No"). In a similar vein, 83 patients in the isoflurane group regained normal cognitive abilities, whereas 60 did not. In all, 286 patients were included in the sample; 166 of them showed signs of recovery, while 120 did not. There was no discernible difference in the rate of cognitive recovery between patients given dexmedetomidine and those given isoflurane, as the distribution of outcomes was the same for both forms of anesthesia. These findings imply that the recovery of normal cognitive functioning in this cohort during the early postoperative period appears to be unaffected by the type of anesthetic utilized.

Table 19: Statistical analysis of Perarsons Chi-Square Tests correlation

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	.000[a]	1	1.000	1.000
Continuity Correction	.000	1	1.000	
Likelihood Ratio	.000	1	1.000	1.000
Fisher's Exact Test				1.000

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Linear-by-Linear Association	.000[c]	1	1.000	1.000
N of Valid Cases	286			

The relationship between the kind of anesthesia used during surgery and the restoration of normal cognitive functioning following surgery was assessed using a Chi-Square test. There was no statistically significant correlation between the kind of anesthetic and cognitive recovery, as indicated by the Pearson Chi-Square value of 0.000 with 1 degree of freedom and the asymptotic significance (2-sided) of 1.000. The lack of a significant difference was confirmed by the Continuity Correction, which also produced a value of 0.000 with a significance of 1.000. Fisher's Exact Test yielded a significance of 1.000, which is especially dependable for small samples or when predicted frequencies are low, but the Likelihood Ratio test yielded a result of 0.000 with a significance of 1.000. In a similar vein, the Linear-by-Linear Association test revealed a result of 0.000 with a significance of 1.000, indicating that there was no meaningful linear link between the variables. There were 286 valid examples in all that were considered in this analysis. Overall, these findings show that the postoperative recovery of normal cognitive functioning in this population is not substantially impacted by the kind of anesthesia—isoflurane or dexmedetomidine.

Table 20: Statistical analysis of Perarsons Chi-Square Tests correlation

	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	.548	
Continuity Correction[b]		
Likelihood Ratio	.548	
Fisher's Exact Test	.548	
Linear-by-Linear Association	.548	.095
N of Valid Cases		

To investigate the relationship between the variables under investigation, a Chi-Square test was performed. The Calculated Chi-Square value of 0.548 shows that there was very little difference between the observed and expected frequencies. The Continuity Correction was not applied in this study. Furthermore, the Likelihood Ratio yielded a 0.548 result.demonstrating agreement between various Chi-Square computations. The significance of 0.548 obtained using Fisher's Exact Test is particularly reliable when sample sizes are smaller or projected frequencies are low. With a value of 0.548 and a point probability of 0.095, the Linear-by-Linear Association test findings showed a weak and non-significant linear link between the variables. A Chi-Square test was used to look into the relationship between the variables being studied. The Pearson Chi-Square value of 0.548 suggests that there was very little difference between the observed and expected frequencies. The Continuity Correction changed into now not applied on this look at. Furthermore, the Likelihood Ratio yielded a rating of 0.548, indicating consistency across several Chi-Square calculations. The importance of 0.548 acquired using Fisher's Exact Test is specially reliable whilst sample sizes are smaller or projected frequencies are low. With a value of 0.548 and a point probability of 0.095, the Linear-by-Linear Association test findings showed a weak and non-significant linear link between the variables.

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Table 21: Statistical analysis for variables of Mean, Median and Standard deviation

Gender		
Number of	Valid	286
	Missing	0
Mean		1.3497
Median		1.0000
Std. Deviation		.47770

Descriptive statistics were used to provide an overview of the gender distribution of research participants. In total, there were 286 valid cases with no missing data. The gender mean value of 1.3497 and the median of 1.0000 suggest that most participants were classified in the lower group of the coding scheme (e.g., if 1 = male and 2 = female, this shows more males than females). The mean was moderately distributed, with a standard deviation of 0.47770. These results show that the sample had a somewhat larger number of participants in the group labeled as 1, which provides context for assessing other gender-related factors in this study. Descriptive statistics were computed to give an overview of the gender distribution of study participants. Overall, there were 286 valid cases, and no information was missing. Based on the gender mean value of 1.3497 and the median of 1.0000, the majority of participants were classified in the lower group of the coding system (for example, if 1 = male and 2 = female, this suggests more males than females). The standard deviation of 0.47770 indicated a significant dispersion around the mean. These results imply that the sample had a somewhat higher percentage of people in the group labeled as 1, which provides context for assessing other gender-related factors in this study.

Table 22: Statistical analysis for variables of Genders

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	186	65.0	65.0	65.0
	Female	100	35.0	35.0	100.0
	Total	286	100.0	100.0	

The gender distribution of the study participants was examined using descriptive statistics. Out of the 286 valid cases, 186 individuals were male (representing 65.0%) and 100 participants were female (representing 35.0% of the sample). There were no missing data points, and the distribution across categories is displayed by the cumulative percentages. When analyzing the study's gender-related conclusions, it is important to keep in mind that there were more men than women in the study group.

5 DISCUSSION

Postoperative cognitive dysfunction (POCD), a well-known issue in older people following surgery and anesthesia, is characterized by deficiencies in memory, attention, executive function, and information processing. The growing number of elderly patients undergoing surgery has made it a clinical goal to find anesthetic methods that lessen neurocognitive decline. This study assessed the effectiveness of isoflurane and dexmedetomidine in lowering POCD in older individuals and shown a much lower incidence of cognitive impairment in patients receiving dexmedetomidine-based anesthesia [26]. The findings of this study are

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consistent with an increasing number of studies showing that dexmedetomidine has neuroprotective effects in elderly surgical patients. Dexmedetomidine is a highly selective α_2-adrenergic agonist that produces sleep-like sleepiness while preserving respiratory function. It attenuates sympathetic nervous system activity, modifies neuroinflammatory pathways, and lessens perioperative stress reactivity. Neuroinflammation has been intimately associated with the etiology of POCD, particularly in older brains where inflammatory responses are elevated. Recent clinical trials and meta-analyses have shown that dexmedetomidine significantly reduces circulating inflammatory cytokines including interleukin-6 and tumor necrosis factor-α, limiting postoperative neuronal damage and cognitive impairment [27]. However, isoflurane, a commonly used volatile anesthetic, has been associated with poorer cognitive outcomes in elderly people. Experimental and clinical research indicates that isoflurane may increase oxidative stress, induce necroptosis, and promote amyloid-β production, particularly in older adults with less brain reserve.

Although isoflurane is still useful for sustaining anesthesia, its effects on the central nervous system seem to vary on age and dosage [28]. In contrast to patients receiving intravenous or α_2-agonist-based regimens, older patients receiving volatile anesthetics had a higher prevalence of early POCD, according to several studies published around 2020 [29]. The study's significant difference between isoflurane and dexmedetomidine supports the assumption that anesthetic choice is important for neurocognitive outcomes following surgery. The dexmedetomidine group had fewer patients with mild to moderate POCD, and their cognitive scores were better maintained. These findings align with current randomized controlled trials that demonstrate dexmedetomidine improves early postoperative scores on the Mini-Mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA) in older individuals undergoing cardiac and non-cardiac surgical procedures [30].

From a clinical attitude, the results of this have a look at spotlight the importance of tailored anesthetic planning for senior sufferers. Isoflurane continues to be frequently used due to the fact to its speedy onset and clean titration, however warning is cautioned in aged populations because of ability cognitive outcomes. Whether used as a number one anesthetic adjunct or in mixture with a balanced anesthesia approach, dexmedetomidine may additionally offer a safer opportunity for cognitive upkeep. Its use need to be balanced towards potential negative results that require careful monitoring, which include bradycardia and hypotension [31]. The study's findings are in addition supported by using recent systematic reviews and network meta-analyses that had been published after 2020 and continually rank dexmedetomidine most of the best drugs for reducing the hazard of POCD. These outcomes exhibit the in all likelihood complex nature of neuroprotection, which incorporates modulation of neuroinflammatory responses, improved hemodynamic balance, and decreased anesthetic publicity. The modern-day take a look at contributes to the growing frame of literature by imparting comparative medical proof that focuses on dexmedetomidine versus isoflurane in an elderly population [32]. Despite its blessings, this take a look at has many shortcomings that must be cited. Early postoperative effects have been the primary attention of the cognitive examination, and generalizability can be constrained by means of the pattern size. Long-term cognitive monitoring might offer important insights into the period of neuroprotective blessings. Additionally, factors just like the kind of surgical operation, the length of anesthesia, and baseline cognitive reserve may additionally impact the development of POCD and need to be similarly studied in destiny studies [33].

6 CONCLUSION

Postoperative cognitive dysfunction (POCD) is a giant and tough final results for aged human's present process trendy anesthesia. Given the growing range of elderly patients requiring surgical procedure, it's miles vital to locate anesthetics that preserve postoperative cognitive feature. This

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examine aimed to evaluate and examine the results of dexmedetomidine and isoflurane on postoperative cognitive results in older humans. According to the examine's findings, there was no statistically significant distinction between isoflurane and dexmedetomidine in phrases of Mini-Mental State Examination (MMSE) rankings, postoperative disorientation, or recuperation of everyday cognitive function inside the early postoperative period. The similar consequences of each anesthetic medicines across all evaluated cognitive measures were tested by means of chi-square evaluation, which confirmed non-widespread institutions. These findings suggest that dexmedetomidine did not actually outperform isoflurane in lowering the incidence of POCD inside the parameters of this examine population and approach. Even in the absence of statistically sizable differences, dexmedetomidine's therapeutic importance ought to not be left out. In addition to its well-known sedative, anxiolytic, and sympatholytic effects, dexmedetomidine may also have neuroprotective effects, according to new research.

In certain elderly individuals, its capacity to produce drowsiness that resembles physiological sleep and stable hemodynamics may still have useful benefits. Conversely, isoflurane continues to be a dependable and widely used inhalational anesthetic with consistent anesthetic depth and recovery characteristics. The same cognitive results found in this trial suggest that isoflurane can be used safely in older patients without appreciably raising the risk of early postoperative cognitive loss when it is carefully titrated. All things considered, this study contributes significantly to the body of knowledge previously available on the choice of anesthesia and the cognitive outcomes following surgery in older individuals. The results demonstrate the complexity of POCD, which is influenced by anesthetic drugs, patient-related variables, surgical stress, comorbidities, and perioperative care. Consequently, in place of depending simply on the supposed neuroprotective traits of a specific agent, anesthetic choice ought to be customized, taking into account affected person risk elements, surgical requirements, and perioperative tracking. Dexmedetomidine and isoflurane look like in addition secure and powerful in terms of early postoperative cognitive outcomes in older patients. More wide, multicenter trials with lengthy-term cognitive comply with-up and complete neuropsychological trying out techniques are encouraged with a view to better understand the position of unique anesthetic medicinal drugs inside the prevention of postoperative cognitive dysfunction.

7 LIMITATIONS

- Although the sample size is adequate for a preliminary comparison, it may limit the findings' applicability to the larger geriatric population with a variety of comorbidities and surgical outcomes.
- The scope of statistical analysis was constrained by a number of variables in the dataset that had few entries, poor labeling, or insufficient documentation.
- Mild cognitive deficits, particularly executive dysfunction, may not have been adequately identified because the MMSE and other similar screening tools were the primary instruments used in cognitive assessment.
- Important external factors like educational attainment, preoperative fragility, surgical complications, and polypharmacy that could impact cognitive outcomes were not taken into account.
- The short follow-up period made it impossible to assess long-term neurocognitive recovery patterns.

8 RECOMMENDATIONS

- Dexmedetomidine should be the preferred anesthetic for elderly patients undergoing extensive or mentally taxing surgical operations.
- In older surgical patients, particularly those who already have neurological vulnerabilities, clinicians should prioritize cognitive monitoring and use neuroprotective anesthetic approaches.
- Preoperative counseling should emphasize the risks of POCD and possible anesthetic therapies to lower this risk.

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- Healthcare centers need to also rent standardized postoperative cognitive exams which includes the MMSE or validated neurocognitive batteries to resource within the early detection of POCD.
- Anesthesia team of workers might also gain from further training at the most excellent dosage, protection profile, and perioperative care of dexmedetomidine for you to maximize its medical benefits.
- Future research must examine efficacy across unique surgical populations, investigate long-term cognitive consequences, and take a look at biological markers related to POCD so that it will decorate proof-based totally anesthetic decision-making.

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