

Magnitude of emergence delirium and associated factors among old-age patients who underwent elective surgery in the Teaching Hospitals of Ethiopia at post anesthesia care unit, Ethiopia, 2021. A multi-center prospective observational study

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Abstract

Background

Emergence Delirium is a common and serious post-operative complication in surgical patients, especially in the old-age. It occurs at any time in the peri-operative period, during or immediately following emergence from general anesthesia. Unfortunately, it was highly associated with post-operative complications such as decrease in functional capacity, prolonged hospital stay, an increase in healthcare costs and morbidity and mortality. The goal of this study was to determine the magnitude of emergence delirium and associated factors among old-age patients who underwent elective surgery in the Teaching Hospitals of Ethiopia at post anesthesia care unit, 2021.

Methods

A multi-center prospective observational study was conducted at Post-anesthesia Care Unit in four Teaching Hospitals of Ethiopia. Old-age surgical patients admitted to Post-anesthesia Care Unit who underwent elective surgery in the four Teaching Hospitals of Ethiopia were selected by using simple random sampling. Pretested structured questionnaire was used to collect data. Data were entered in to Epidata (version 4.6) and exported to the SPSS (version 25.0). Binary logistic regression was used to identify factors independently associated to emergence delirium.

Results

Out of 384 old-age patients included in the study with 100% response rate, the magnitude of emergence delirium was 27.6%. Preoperative low hemoglobin levels (AOR: 2.0, 95%CI; 1.77–3.46), opioids (AOR: 8.0, 95%CI; 3.22–27.8) and anti-cholinergic premedications (AOR: 8.5, 95%CI; 6.85–17.35), and post-operative pain (AOR: 3.10, 95CI; 2.07–9.84) at PACU were independently associated with emergence delirium.

Conclusion

The magnitude of emergence delirium was high. Old-age patients who were premedicated with anti-cholinergic and opioids, those patients who had low pre-operative hemoglobin and post-operative pain were independently associated with emergence delirium. Adequate pre-operative optimization and post-operative analgesia may reduce the magnitude of emergence delirium.

Introduction

Emergence delirium is an acute agitation and confusional state manifested by changes in mental state, loss of attention, and disorganized thinking(1, 2).

Emergence delirium is manifested by acute deterioration in attention and cognition, which may include change in levels of consciousness and thinking (3, 4). It could occur in the Operation room or PACU at any time in the perioperative period, during or immediately following emergence from general anesthesia(1–3).

It remains a common complication in surgical patients during early post-operative period, complicating up to 87% of critically ill patients; 10–24% of general adult medical patients; 37–46% of general surgical patients receiving anesthesia, and in up to 50% of old-age surgical patients during early emergence at PACU(4–6). Hence, the prevalence of delirium varies significantly depending on the type of procedure and age of the patients; being old-age is the most susceptible age groups(2, 5, 6) .

Its magnitude varies depending on the patient population, type and urgency of surgery, and the type and sensitivity of assessment tools. Hence, it has been increasingly recognized as a major adverse event occurring post-operatively in old-age surgical patients as it initiate considerable distress to patients, families, and health professionals(4, 8–11).

This distressing and serious complication possess a serious risk for the patient and PACU staff like violent behavior leading injury, disrupting wound dressing, increased pain, hemorrhage, self-removal medical devices (like endotracheal tubes, catheters, and drainage tubes) with increased health care expenditure, and post-operative mortality placing difficulties in giving patient care(5, 7, 11).

The use certain pre-operative medications like anticholinergics and benzodiazepines, and history of chronic smoking and alcohol abuse has been independently associated with the occurrence of emergence delirium(12–14).

It is a common peri-operative problem in old-age patient that we encounter after anesthesia and surgery post-operatively in the PACU, particularly surgical teams, including anesthetists, surgeon, nurses, residents, interns and PACU nurses were encountering delirium in old-age patients. As long as additional burden on man power is considered, there exist the needs of increasing health professionals numbers caring delirious patient. Specially, PACU staffs must always stay patient side. However, while nurses, medical interns or other professionals are attending delirious patient, non-delirious patients might be less closely monitored, thereby reducing their care and perhaps increasing their anxiety. Therefore, noticed magnitude of emergence delirium and identifying associated factors to avoid these challenges discussed is vital to the anesthetist. So, we aimed to determine the magnitude of emergence delirium and associated factors among old-age patients who underwent elective surgery in the Teaching Hospitals of Ethiopia at PACU.

Methods And Materials

Study Area, Study design, Study Period and Population

A multi-center prospective observational study design was conducted in the four Teaching Hospitals of Ethiopia from February 05 to March 30, 2021 at Post Anesthesia Care Unit. These Teaching Hospitals were a center of teaching for the medical students and bears different clinical care delivery and also

...serving as an academic upgrading or specialty. Patients aged 60 years and above who underwent operation on elective setting during the study period were included in the study. However, patients with pre-existing complicated comorbid diseases and or psychiatric problems like dementia, and Unconscious patient at PACU were excluded from the study.

Operational definition

With the Confusion Assessment Method – Intensive Care Unit (CAM - ICU) both feature 1 and 2 and either of feature 3 or 4 with in the first one hour was considered as emergence delirium (Table – 1). Because it is easy to administer, quick with good specificity and sensitivity for diagnosis of emergence delirium in old-age patients who were awake, not critical ill and mechanically ventilated, as well it enables assessment of the cognitive function(15–19).

Post-operative sedation status (consciousness) and agitation was assessed by Richmond Agitation Sedation Scale (RASS), a 10 point scale which scores from +4 to -5(18,20,21).

Patients were evaluated for delirium by CAM if they are responsive to verbal commands (RAAS score of other than -4 or -5 (table-2).

Postoperative patient pain was assessed by using numeric rating score, which had an score of 0-10, with 0 - 3= no pain - mild pain, 4 - 6= moderate pain, and 7 – 10 = severe pain as described by (figure-1)

Anemia was defined as a clinical syndrome outlined with low haemoglobin level. Haemoglobin levels <12.0 g/dl in women and haemoglobin levels < 12 g/dl in men(22).

Old-age patients were the patient population who were 60 and above years old(21).

Sample size determination and sampling techniques

Sample size determination

Sample size was calculated by single population proportion formula using 50% proportion of old-age population with emergence delirium, 95%CI and margin of error of 5%.

$$n = (z_{\alpha/2})^2 pq/d^2,$$

Where; n= number of sample size, $Z_{\alpha/2}$ at 95%CI=1.96

p = proportion of emergence delirium, 50%

$q = 1 - p$; for this study, maximum variability is presumed, hence $p = 0.5$; $q = 1 - p = 0.5$

d= level of precision at 95 % confidence level, i.e. 5% of Sample size = 0.05, by incorporating in to the formula; $n = (1.96)^2 (0.5) (0.5) / (0.05)^2 = 384$. Hence, a sample size of 384 was obtained.

Sampling Techniques

Multi-stage sampling techniques were implemented in the Four Teaching Hospitals of Ethiopia including Hawassa University Comprehensive Specialized Hospital, Jimma Medical Center, Tikur Ambessa Teaching and Specialized Hospital and Ambo Referral hospital was randomly selected assuming that 30% of those teaching hospitals were considered as representative and included in this study. The annual PACU admission was obtained at each selected teaching hospital. Then, sample size was proportionally allocated for each selected Teaching Hospital based on each hospital total annual old-age patient PACU admission. Thus, the total calculated sample size was distributed to the annual PACU admission at each specific Teaching Hospital and with this regard the number obtained was taken as the sample size at each selected Teaching Hospital (table-3).

From each of the selected hospital, each morning the daily schedule list were obtained, and old-age patients were selected using simple random sampling. Every patient who was taken as sample and admitted to PACU in the study period was included.

Data collection instruments and Techniques

Data were collected using structured questionnaire. We applied covid-19 prevention strategy. At admission to PACU the patients' socio demographics, pre-operative, intra and post-operative factors were reviewed and recorded. The data collection procedures were included review of patient chart, operation note and anesthesia chart, patient interview, and direct observation of patient's RASS score and CAM score. To ensure data quality pretest was done on 20 patients (5% of sample size) at PACU and possible amendments were made. Regular supervision and follow up were made during data collection.

Data processing and Analysis

Data were entered to Epidata statistical software (version 4.6.0.6) and exported to the SPSS windows statistical software (version 25.0) for data processing and performing other statistical analysis. Bivariable logistic regression was used to select candidate variables for multivariable logistic regression. Variables with a p-value less than 25% in the bivariable logistic regression were a candidate for the multivariable logistic regression. A multivariable logistic regression was fitted to identify factors independently associated to emergence delirium and to control confounders. In the final model AOR and 95% CI was used to measure strength of association and statistical significance respectively.

Ethical Consideration

Ethical clearance letter was obtained from Jimma University Institutional Review Board and Verbal informed consent was obtained from each study participant. Confidentiality of the study participant was maintained. We applied the WHO Covid-19 prevention strategy.

Results

Sociodemographic characteristics

A total of 384 patients were included in the study making a 100% response rate. Greater than half (57.8%) of the study participants were males and the rest, 162(42.2%) were females. Regarding the age of the participants, 170(44.3%) were aged between 65 and 74 years. Majorities, 312(81.3%) of the participants were married. With respect to educational status, greater than one-third (37.2%) of the study participant had no formal education (Table - 4).

Pre-operative Factors

As the distribution of pre-operative factors showed, ASA II held nearly three fourth (74.2%), of the ASA status of old-age patients, while ASA I and ASA III, were 84(21.9%) and 15(3.9%), respectively. Those patients who had a history of comorbid disease were 76(19.8%). Opioids were the frequently given premedication, 120(31.3%), followed by anti-cholinergics, 105(27.3%) and other premedication like diazepam and steroids, 95(24.7%). Regarding pre-operative hemoglobin levels, more than three-fourth (81.0%) of the old-age patients had normal hemoglobin levels, and the rest, 19.0% had low hemoglobin levels (anemic) (Table - 5).

Intra-operative and post-operative factors

Nearly greater than half (54.2%) of old-age patients were taken General Anesthesia. Among these 85(39.9%) of patients were induced with ketofol and the majority, (86.4%) were maintained with inhalational anesthetics in which nearly two-third (67.9%) of the patients were maintained by isoflurane. Regarding the duration of surgery, most procedures were longer than two hours, 314(81.8 %) (Table - 6).

Among the types of surgery old-age patients underwent, general surgeries were more frequently performed procedures relative to the other specialties, 98(25.5%) as described by the bar chart (Figure - 2).

Regarding the PACU sedation score, two-third (66.7) of old-age patients were calm and the rest were agitated, 36(9.4%), restless, 33(8.6%), combative, 32(8.3%) and very agitated, 27(7.0%) respectively, (Figure-3)

Magnitude of emergence delirium

The magnitude of emergence delirium in old-age patients who underwent elective surgery at Teaching Hospitals of Ethiopia was 106 (27.6%).

Factors Associated with Emergence Delirium among old-age patients who underwent elective surgery at PACU

Bivariable and multivariable logistic regression of factors associated with emergence delirium in old-age patients who underwent elective surgery at Teaching Hospitals of Ethiopia

Bivariable logistic regression was fitted to identify candidate variables for the multivariable logistic regression. Accordingly, educational status, marital status, premedication with opioids and anti-cholinergics, comorbidity, pre-operative hemoglobin level, types of anesthesia, maintenance agent, post-operative pain, and post-operative sedation were associated to ED at p-value of < 0.25 (Table-7)

Factors independently associated with emergence delirium in old-age patients who underwent elective surgery at Teaching Hospitals of Ethiopia

Multivariable logistic regression was fitted to identify factors independently associated with emergence delirium. Accordingly, pre-operative low Hgb level, premedication of opioids and anti-cholinergics and moderate to severe post-operative pain at PACU were significantly associated with emergence delirium in multivariable logistic regression at p-value of < 0.05 .

Old-age patients who had given opioid premedication were 8 times (AOR: 8.0, 95%CI: 3.22 – 27.8), more likely to develop emergence delirium as compared to those patients who were not given opioid premedication. On the other hand, old-age patients who had anti-cholinergic premedication were 8.5 times (AOR: 8.5, 95%CI: 8.5(6.85 – 17.35), more likely to develop emergence delirium as compared to those who were not given anti-cholinergic premedication.

Old-age patients who had low pre-operative hemoglobin were 2 times (AOR; 2.0, 95% CI, 1.77 – 3.46), more likely to develop emergence delirium as compared to those who had normal hemoglobin. Those old-age patients experiencing moderate to severe pain at PACU were 3.10 times (AOR; 3.10, 95% CI, 2.07 – 9.84), more likely to develop emergence delirium as compared to old-age patients experiencing mild pain (Table-8)

Discussion

In this study the overall magnitude of emergence delirium among old-age patients who underwent elective surgery in the Teaching Hospitals of Ethiopia was 27.6%.

An observational study conducted at University of Gonder Hospital, in Ethiopia found out that the magnitude of emergence delirium at PACU among old-age patients who underwent surgical procedures was 40.7%. Another observational study conducted in China showed that, the magnitude of emergence delirium among old-age patients at PACU was 37.0%. Our finding is relatively low as compared to the previous study. This variation might be explained by the inclusion of patients who underwent emergency surgery (which had high magnitude of emergence delirium as it permit limited time to optimize patients operated on emergency setting), and might be due to the large sample size used in the previous study and tool difference(17,21).

A prospective study carried out in Thailand and retrospective study done in Korea showed that the magnitude of emergence delirium among old-age patients was 11.6% and 18.3%, respectively. Our finding is relatively high as compared to the previous study. The possible explanation for this discrepancy might be due to inadequate pre-operative optimization and reassurance of the patient, and or inadequate post-operative pain management in the present study, and the clinical set-up differences(20,23)

In our study, Old-age patients who had given opioid premedication were 8 times (AOR: 8.0, 95%CI: 3.22 – 27.8), more likely to develop emergence delirium as compared to those who were not given opioid premedication. This is in corroboration with the study conducted in Gonder, which agreed that old-age patients who had taken peri-operative opioids were 5 times (AOR: 5.0, 95%CI: 1.265–20.565), more likely to develop emergence delirium as compared to those who had not taken intravenous opioids. Similarly, the study conducted in China agreed that those old-age surgical patients who had taken peri-operative opioids were incredibly suffered from emergence delirium. Another study asserted that old-age patients who had pain management with opioids were more likely to develop emergence delirium as compared to those who had managed with non-opioid analgesics. This finding is supported by other study which argued that opioids increase the likelihood of adverse outcomes such as delirium. This variation might be explained as there exist increased drug sensitivity in the old-age patients due to the dramatic changes in receptor function which heightened sensitivity of the brain toward adverse effect of opioids leading to delirium(17,21,24,25)

Old-age patients who had anti-cholinergic premedication were 8.5 times (AOR: 8.5, 95%CI: 8.5(6.85 – 17.35), more likely to develop emergence delirium as compared to those who were not given anti-cholinergic premedication. The finding of our study is in agreement with the study conducted in Australia which contended that old-age patients who had taken anti-cholinergic medication were significantly associated with an increased risk of experiencing emergence delirium. Another study conducted in India argued that an anti-cholinergic medication like atropine was significantly associated with emergence delirium. The possible explanation might be due to anti-cholinergic medication blocks cholinergic transmission on the post-synaptic muscarinic receptors (M1 receptors), which were primarily located in the central nervous systems and involved in perception, attention and cognitive function(26,27).

Old-age patients who had low pre-operative hemoglobin were 2 times (AOR; 2.0, 95% CI, 1.77 – 3.46), more likely to develop emergence delirium as compared to those who had normal hemoglobin. Similar finding was observed in an observational study conducted in Germany which ascertained that old-age patients who had low hemoglobin in the post-operative period were 4 times (AOR; 4.0, 95% CI, 1.36–11.48), more likely to develop post-operative delirium as compared to old-age patients who had normal hemoglobin levels. Another study found out that old-age patients with more frequent low pre-operative hemoglobin levels were experience delirium. The possible explanation for this might be due to low hemoglobin level limit the cerebral oxygen delivery, in a sense in adequate cerebral oxygen supply with increased metabolic demand resulted in an imbalance of neurotransmitters, disintegration of blood brain barriers and subsequent neuro-inflammation(18,22).

In our study, old-age patients who had post-operative pain (Numeric Rating Scale >5) at PACU were 3.10 times (AOR; 3.10, 95% CI, 2.07 – 9.84), more likely to develop emergence delirium as compared to those who had no pain. Our finding is supported by the study conducted in Gonder, which extrapolated that emergence delirium was more likely when the pain numeric rating scale was greater than or equal to five (NRS ≥ 5). Comparably, the study conducted in Korea asserted that patients with pain (NRS ≥ 6) were 3.6 times more likely to develop emergence delirium, and more than half of those patients with emergence delirium were reported to had severe immediate post-operative pain at PACU. This is argued by other study which concluded that an inadequate analgesia in the peri-operative period had been strongly associated with emergence delirium. The possible explanation for this might be due to the perceived psychological effects of pain and pain may favors an alterations in the neurotransmitter systems inducing the pro-inflammatory mediators and impairs the physiological stress response resulting in neuro-physiological dysfunctions that may potentiate cognitive impairments that may manifested as delirium(7,21,28)

Strength and Limitation of the Study

To the best of our knowledge, this is one the interesting studies to investigate the magnitude of emergence delirium and associated factors among old-age patients who underwent elective surgery at PACU. This study will primarily maximize the old-age patient's safety and to reduce the magnitude of emergence delirium among old-age patients who underwent elective surgery.

The limitations of our study were ascertained that, we did not assessed emergence delirium among old-age patients after PACU discharge, or during hospital stay and the long-term outcome of emergence delirium. Therefore, we had no remark on the continued effects of emergence delirium beyond the PACU in the post-operative period and the consequence it may have on patient outcomes.

Conclusion And Recommendation

The magnitude of emergence delirium among old-age patients who underwent elective surgery in the Teaching Hospitals of Ethiopia was high.

The administration of pre-operative anti-cholinergic and opioids were independently associated with emergence delirium. Thus, Anesthesia teams should emphasize on pre-operative optimization and reducing or if possible omit opioid and anti-cholinergic premedications in old-age patients.

Low pre-operative hemoglobin was independently associated with emergence delirium. Hence, surgical teams and anesthesia provider should optimize patients with low pre-operative hemoglobin.

Post-operative pain at PACU was independently associated with emergence delirium. Anesthetists and PACU teams should ensure adequate post-operative analgesia with wise selection and dosing of analgesics (particularly, those devoid of opioid side effects), which may reduce the magnitude of emergence delirium.

Abbreviations

AOR – Adjusted Odds Ratio; ASA – American Society of Anesthesiologist; CAM – Confusion Assessment Method. COR – Crude Odds Ratio; CI – Confidence Interval; Hgb – Hemoglobin; ICU – Intensive Care Unit; NRS – Numeric Rating Score; PACU – Post-Anesthesia Care Unit; RASS – Richmond Agitation Sedation Scale; WHO – World Health organization.

Declarations

Data sharing statement

Data are available with Tajera Tageza Ilala, tajeratageza@gmail.com up on reasonable request

Ethics approval

Ethical letter was taken from Jimma University Institutional Review Board with Ref.No.JHRPG1/1269/21

Consent for publication: Not applicable.

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Author contributions: All authors share a genuine contributions in conceptualizing, drafting the article and reviewing it for vital intellectual content, methodology, funding acquisition, data curation, and or statistical analysis and interpretation of data; agreed to submit to the current journal; gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

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References

1. Card E, Pandharipande P, Tomes C, Lee C, Wood J, Nelson D, et al. Emergence from general anaesthesia and evolution of delirium signs in the post-anaesthesia care unit. *Br J Anaesth* [Internet]. 2015;115(3):411–7.
2. Solomon Assefa¹ and Wosenyeleh. Sahile A. Assessment of Magnitude and Associated Factors of Emergence Delirium in the Post Anesthesia Care Unit at Tikur Anbesa Specialized Hospital. 2017.
3. Mantz J, Hemmings HC. Case Scenario: Postoperative Delirium in Elderly Surgical Patients. 2010; (January):189–95.
4. Atanasova MP. Postoperative delirium, hyperactive and hypoactive type, after elective abdominal surgery, a challenge for the ICU staff. *Anaesthesiol Intensive Care*. 2012;41(3):3–6.

5. Ansaloni L, Catena F, Chattat R, Fortuna D, Franceschi C, Mascitti P, et al. Risk factors and incidence of postoperative delirium in elderly patients after elective and emergency surgery. *Br J Surg*. 2010;97(2):273–80.
6. Whitlock EL, Vannucci A, Avidan MS. Postoperative delirium. *Minerva Anesthesiol*. 2011;77(4):448–56.
7. Morales-vera E, Valle-leal JG. Colombian Journal of Anesthesiology Delirium in the elderly patient after anesthesia: associated factors Delirio en el adulto mayor sometido a anestesia. Factores asociados. 2018;46(1):273–8.
8. Lautner CA, Liu L, Gomis P, Leon A, Debre R, Reims CHU, et al. Emergence delirium in adults in the post-anaesthesia care unit. 2006;96(6):747–53.
9. Robinson TN. and BE. “Postoperative delirium in the elderly: diagnosis and management.”. *Clin interventions aging vol*. 2008;3(2):351–5.
10. Demeure MJ, Fain MJ. The Elderly Surgical Patient and Postoperative Delirium. *J Am Coll Surg*. 2006;203(5):752–7.
11. Wong CL, Mhsc F, Maltzahn M, Von. Postoperative Delirium: Risk Assessment, Prevention. Detect Manage. 2021;16(1):37–42.
12. Trabold B, Metterlein T. Postoperative delirium: Risk factors, prevention, and treatment. *J Cardiothorac Vasc Anesth [Internet]*. 2014;28(5):1352–60.
13. Roggenbach J, Klamann M, Haken R, Von, Bruckner T, Karck M, Hofer S. Sleep-disordered breathing is a risk factor for delirium after cardiac surgery: a prospective cohort study Sleep-disordered breathing is a risk factor for delirium after cardiac surgery. a prospective cohort study; 2014.
14. Saller T, MacLulich AMJ, Schäfer ST, Crispin A, Neitzert R, Schüle C, et al. Screening for delirium after surgery: validation of the 4 A's test (4AT) in the post-anaesthesia care unit. *Anaesthesia*. 2019;74(10):1260–6.
15. Sieber FE, Zakriya KJ, Gottschalk A, Blute M, Lee HB, Rosenberg PB, et al. Sedation Depth During Spinal Anesthesia and the Development of Postoperative Delirium in Elderly Patients Undergoing Hip Fracture Repair. 2010;21224.
16. Guo Y, Jia P, Zhang J, Wang X, Jiang H, Jiang W. Prevalence and risk factors of postoperative delirium in elderly hip fracture patients. *J Int Med Res*. 2016;44(2):317–27.
17. Zhang Y, Ting S, Bin H, Xue N, Li Y, Xin D. Emergence delirium is associated with increased postoperative delirium in elderly: a prospective observational study. *J Anesth [Internet]*. 2020; (0123456789).
18. Robinson TN, Raeburn CD, Tran ZV, Brenner LA, Moss M. Motor subtypes of postoperative delirium in older adults. *Arch Surg*. 2011;146(3):295–300.
19. Mekonen T, Mihretie G, Assefa D, Fekadu WMY. Magnitude and Associated Factors of Delirium among Hospitalized Patients, Ethiopia. 2017.
20. Iamaroon A, Wongviriyawong T, Sura-arunsumrit P, Wiwatnodom N, Rewuri N, Chaiwat O. Incidence of and risk factors for postoperative delirium in older adult patients undergoing noncardiac surgery: a prospective study. 2020;1–8.

21. Assefa MT, Chekol WB, Melesse DY, Nigatu YA. Incidence and Risk Factors of Emergence Delirium after Anesthesia in Elderly Patients at a Postanesthesia Care Unit in Ethiopia: Prospective Observational Study. *Patient Relat Outcome Meas.* 2021;12:23–32.
22. Kunz JV, Spies CD, Bichmann A, Sieg M, Mueller A. Postoperative anaemia might be a risk factor for postoperative delirium and prolonged hospital stay: A secondary analysis of a prospective cohort study. *PLoS ONE.* 2020;15(2):1–12.
23. Park EA, Kim MY. Postoperative delirium is associated with negative outcomes and long-term mortality in elderly koreans: A retrospective observational study. *Med.* 2019;55(10).
24. Swart LM, van der Zanden V, Spies PE, de Rooij SE, van Munster BC. The Comparative Risk of Delirium with Different Opioids: A Systematic Review. *Drugs Aging.* 2017;34(6):437–43.
25. Siwek M. Adverse CNS effects of opioid analgesics. 2021.
26. Dawson AH, Buckley NA. Pharmacological management of anticholinergic delirium - theory, evidence and practice. 2015.
27. Maravi P, Mishra DK, Singh A, Niranjana V. Atropine eye- drop- induced acute delirium: a case report. 2020;2019–20.
28. Rim JC, Kim JA, Hong JI, Park SY, Lee JH, Chung CJ. Risk factors of emergence agitation after general anesthesia in adult patients. *Anesth Pain Med.* 2016;11(4):410–6.

Tables

Table - 1. Confusion Assessment Method (CAM)

Criterion	Features
1	Acute onset and fluctuating course
2	Inattention
3	Disorganized thinking
4	Altered level of consciousness

Table - 2. Richmond Agitation Sedation Scale (RASS)

Richmond Agitation Sedation Scale (RASS)		
4	Combative	Violent, immediate danger to his/her self or staff
3	Very agitated	Pulls or removes tube or catheters, aggressive
2	Agitated	Frequent non-purposeful movements, fight
1	Restless	Anxious, but no aggressive movements
0	Alert and Calm	
-1	Drowsy	Sustained awakening to voice (>10sec)
-2	Light sedation	Briefly awakens with eye contact to voice (<10sec)
-3	Moderate sedation	movement or eye-opening to voice, but no eye contact
-4	Deep sedation	No response to voice, but movement or eye-opening to physical stimulation
-5	Unarousable	No response to voice or physical stimulation

Table - 3. Sample Size allocation among four Teaching Hospitals of Ethiopia

Hospital	Annual PACU admission	Sample Size Obtained
Jimma Medical Center	472	123
Hawassa University Comprehensive Specialized Hospital	384	100
Tikur Ambessa Teaching and Specialized Hospital	572	149
Ambo Referral Hospital	44	12

Table - 4. Sociodemographic characteristics of old-age patients who underwent elective surgery at Teaching Hospitals of Ethiopia, Ethiopia (n=384)

Variables	Categories	Frequency (%)	Emergence delirium, frequency(%)	
			Yes(n=106)	No(n=278)
			106(27.6)	278(72.4)
Sex	Male	222(57.8)	63(28.4)	159(71.6)
	Female	162(42.2)	43(26.5)	119(73.5)
Age	60-64	134(34.9)	36(26.9)	98(73.1)
	65- 74	170(44.3)	42(24.7)	128(75.3)
	>75	80(20.8)	28(35.0)	52(65.0)
Level of education	No	143(37.2)	62(43.4)	81(56.6)
	Low education	126(32.8)	18(14.3)	108(85.7)
	High education	115(29.9)	26(22.6)	89(77.4)
Marital status	Single	49(12.8)	23(46.9)	26(53.1)
	Married	312(81.3)	71(22.8)	241(77.2)
	Divorced	23(6)	12(52.2)	11(47.8)

Table - 5. A cross-tabulation of the pre-operative factors in old-age patients who underwent elective surgery at Teaching Hospitals of Ethiopia, Ethiopia (n=384)

Variables	Categories	Frequency (%)	Emergence delirium, frequency (%)		
			Yes(n=106)	No(n=278)	
			106(27.6)	278(72.4)	
Patient ASA status	ASA-1	84(21.9)	25(29.8)	59(70.2)	
	ASA-2	285(74.2)	73(25.6)	112(74.4)	
	ASA-3	15(3.9)	8(53.3)	7(46.7)	
Comorbidity	Yes	76(19.8)	35(46.1)	41(53.9)	
	No	308(80.2)	71(23.1)	237(76.9)	
Premedication	Anticholinergics	Yes	105 (24.7)	57(60)	48(40)
		No	289(75.3)	49(17.0)	240(83.0)
	Opioids	Yes	120(31.3)	65(54.2)	55(45.8)
		No	264(68.8)	41(15.5)	223(84.5)
	Others (steroids, diazepam)	Yes	95(27.3)	37(35.2)	58(64.8)
		No	279(72.7)	69(24.7)	210(75.3)
Pre-operative Hgb levels	Anemic	73(19.0)	61(83.6)	12(16.4)	
	Not-anemic	311(81.0)	45(14.5)	266(85.5)	

Table - 6. A cross-tabulation of the intra-operative and post-operative factors in old-age patients who underwent elective surgery at Teaching Hospitals of Ethiopia, Ethiopia (n=384)

Variables		Categories		Frequency (%)	Emergence delirium, frequency (%)	
					Yes(n=106)	No(n=278)
					106(27.6)	278(72.4)
Types of anesthesia	Regional Anesthesia	176(45.8)		34(19.3)	142(80.7)	
	General Anesthesia	208(54.2)		72(34.6)	136(65.4)	
Induction agent	Ketamine	28(13.1)		10(35.7)	18(64.3)	
	Propofol	62(29.1)		25(40.3)	37(59.7)	
	Thiopental	38(17.9)		14(36.8)	24(63.2)	
	Ketofol	85(39.9)		29(34.1)	56(65.9)	
Maintenance agent(s)	Inhalational	184(86.4)		73(39.7)	111(60.3)	
	Propofol	3(1.4)		1(33.3)	2(66.7)	
	Others	26(12.2)		4(15.4)	22(84.6)	
Inhalational agent for maintenance	Halothane	68(32.1)		34(50)	34(50)	
	Isoflurane	144(67.9)		44(30.6)	100(69.4)	
Duration of surgery	Short duration (<2hours)	70(18.2)		16(22.9)	54(77.1)	
	Longer duration (>2hours)	314(81.8)		90(28.7)	224(71.3)	
Post-operative pain	No - mild	362(94.3)		93(25.7)	269(74.3)	
	Moderate - severe	22(5.7)		13(59.1)	9(40.9)	

Table - 7. Bivariable logistic regression of factors associated with emergence delirium in old-age patients who underwent elective surgery at Teaching Hospitals of Ethiopia, Ethiopia (n=384)

Variables	Categories		Emergence delirium, frequency (%)		COR(95% CI)	p-value
			Yes(n=106)	No(n=278)		
			106 (27.6)	278(72.4)		
Educational status	High education		26(22.6)	89(77.4)	1	
	Low education		18(14.3)	108(85.7)	0.57(0.22 - 0.66)	0.22
	No		62(43.4)	81(56.6)	2.62(0.90 - 3.40)	0.18
Marital status	Married		71(22.8)	241(77.2)	1	
	Single		23(46.9)	26(53.1)	3.0(0.46 - 3.33)	0.22
	Divorced		12(52.2)	11(47.8)	4.16(1.57 - 8.75)	0.23
Comorbidity	No		71(23.1)	237(76.9)	1	
	Yes		35(46.1)	41(53.9)	2.85(2.11 - 10.0)	0.16
Pre-operative Hemoglobin level	Not-anemic		45(14.5)	266(85.5)	1	
	Anemic		61(83.6)	12(16.4)	30.1(3.10 - 26.0)	0.24
Types of anesthesia	Regional anesthesia		34(19.3)	142(80.7)	1	
	General Anesthesia		72(34.6)	136(65.4)	2.21 (1.82 - 9.2)	0.22
Premedication	Anti-cholinergic	No	49(17)	240(83)	1	
		Yes	57(60)	38(40)	7.35(5.5 - 11.3)	0.12
	Opioids	No	41(15.5)	223(84.5)	1	
		Yes	65(54.2)	55(45.8)	6.43(20 - 55)	0.23
Types of surgery	Others(Plastics and EENT)		2(7.4)	23(92.6)	1	
	Urology		8(19.5)	33(80.5)	2.79(1.21 - 9.33)	0.44
	Neurologic surgery		10(37.0)	17(63.0)	6.76(2.0 - 17.15)	0.23
	Oral and maxillofacial		10(19.6)	41(80.4)	2.80(0.42 - 8.55)	0.26

	Gynecology	10(22.7)	34(77.3)	3.38(1.06 - 12.0)	0.54
	Thoracic	13(41.9)	18(58.1)	8.31(4.44 - 21.1)	0.19
	Orthopedics	18(27.7)	49(72.3)	4.22(0.65 - 3.88)	0.20
	General surgery	35(35.7)	63(64.3)	6.39(1.46 - 17.2)	0.22
Post- operative pain	No-mild	93(25.7)	269(74.3)	1	
	Moderate- severe	13(59.1)	9(40.9)	4.18(7.3 - 17.1)	0.23
Sedation levels	Calm or no answers	56(21.9)	200(78.1)	1	
	Restless	10(31.3)	22(68.7)	1.62(22 - 38)	0.22
	Agitated	9(33.3)	18(66.7)	1.78(2.4 - 3.1)	0.24
	Very agitated	17(47.2)	19(52.8)	3.19(1.5 - 6.4)	0.19
	Combative	14(42.4)	19(57.6)	2.63(1.6 - 8.1)	0.21

N.B: Bold p-value = significant association on bivariable logistic regression at p-value < 0.25. 1- Reference group

Table - 8. Results of multivariable logistic regression of factors independently associated with emergence delirium in old-age patients who underwent elective surgery at Teaching Hospitals of Ethiopia, Ethiopia (n=384)

Numeric Pain Rating Scale

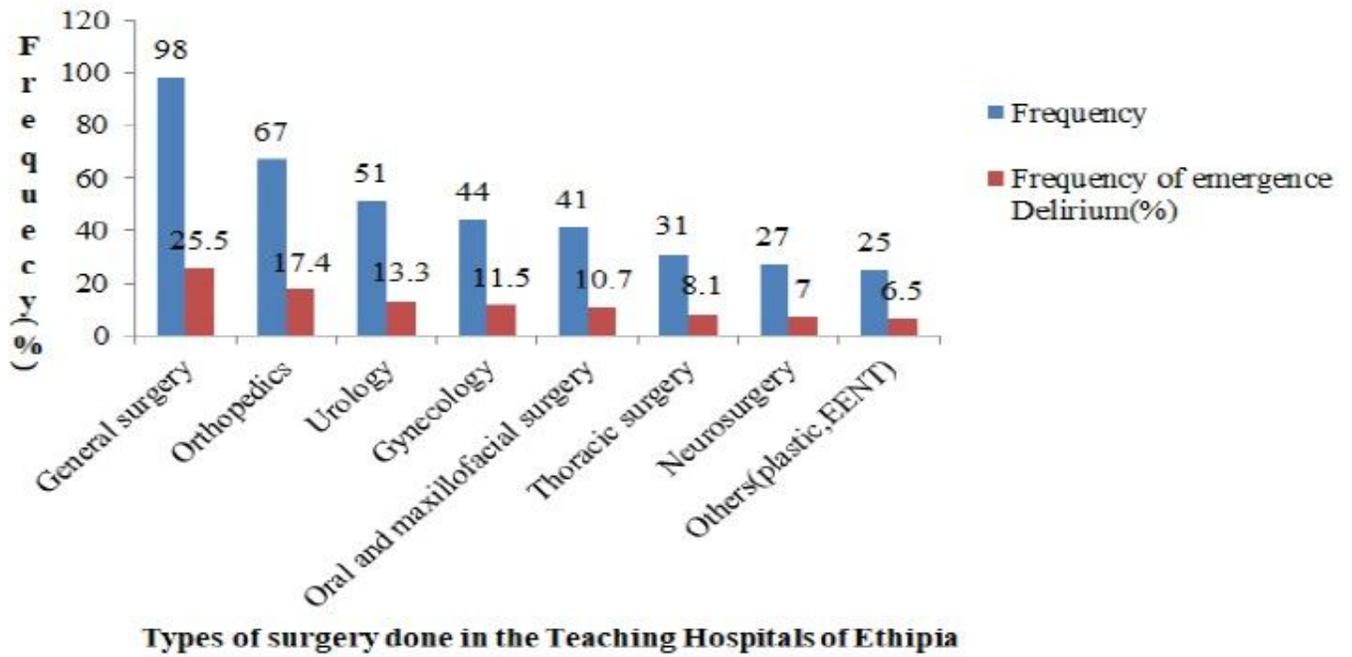


Figure 2

The frequency of types of surgery done and its respective magnitude of emergence delirium in old-age patients who underwent elective surgery at Teaching Hospitals of Ethiopia

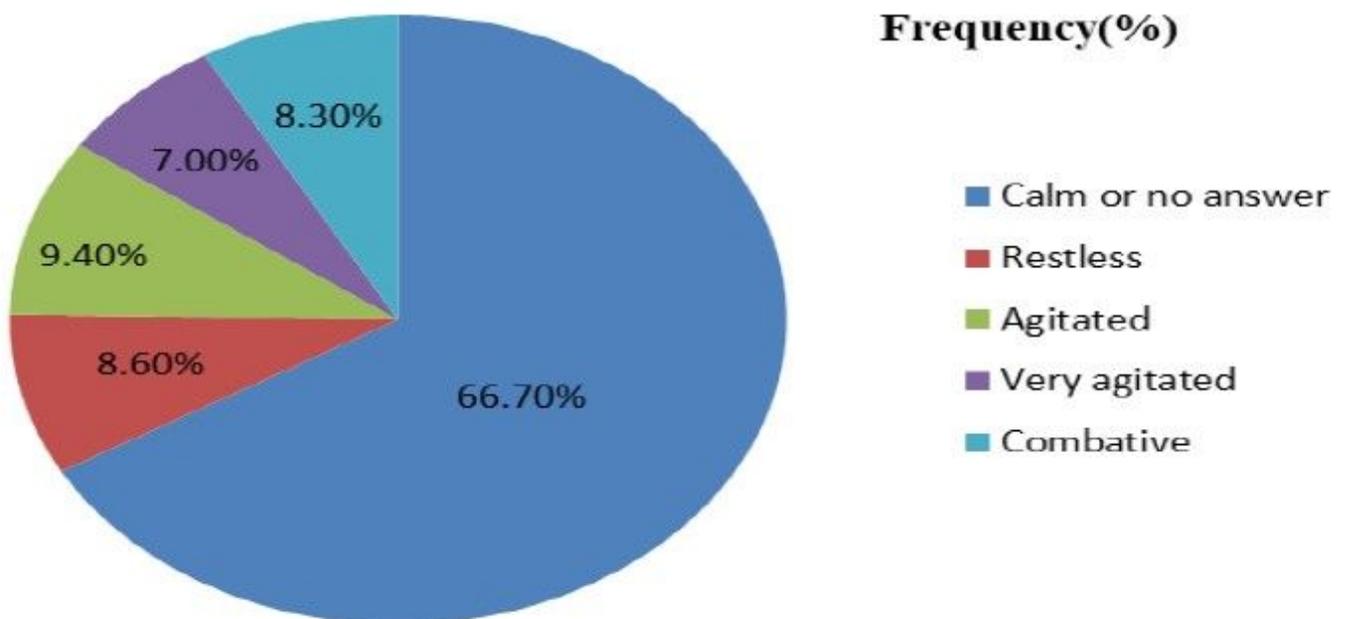


Figure 3

The frequency of sedation score in old-age patients who underwent elective surgery in the Teaching Hospitals of Ethiopia