Cross-sectional Study

Incidence and risk factors of emergence delirium in elderly patients after general or spinal anesthesia for both elective and emergency surgery

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ABSTRACT

Background: Emergence delirium is a poorly understood incident in elderly patients in PACU. The aim of this study was to determine the incidence of emergence delirium and its predictors in elderly patients after general or spinal anesthesia for both elective and emergency surgery.

Methods: In this prospective observational study, 172 consecutive patients were included. The study was performed in the post-anesthesia care unit for three months in 2020. We included elderly patients in both elective and emergency surgery. Patient interviews, chart reviews, and direct observation were among the data collection methods. The Nursing Delirium Screening Scale was the assessment tool. The outcome variable and independent variables’ association was determined by bivariate and multivariate logistic regression analysis.

Results: The incidence of emergence delirium at the post-anesthesia care unit was 40.7% (95% CI = 32–48). Postoperative pain (AOR = 3.9:95%CI = 1.13–13.60), preoperative anxiety (AOR = 7:95% CI = 1.76–28.55), perioperative narcotics (AOR = 5.1:95% CI = 1.27–20.57) and excessive blood loss (AOR = 6.5:95% CI = 2.47–17.02) were predictors of emergence delirium.

Conclusions: Delirium in the post-anesthesia care unit is common. Anxiety, perioperative narcotics, and intraoperative blood loss were predictors of emergence delirium.

1. Introduction

Delirium is an acute confusional state mainly outlined by fluctuating symptoms including inattention, disorganized thinking, and disturbance of consciousness. The incidence of delirium in elective major non-cardiac surgical patients was 54%, while the incidence of delirium in critically ill patients was 50–80% [1,2]. Elderly patients are highly vulnerable to emergence delirium, up to 70% [3–5]. Emergence delirium usually lasts for 15–30 min soon after anesthesia in the post anesthesia care unit [6,7].

Studies have found that 86% of patients who experienced emergence delirium were often violent, while 14% of them were simply incoherent. This implies that care givers will be challenged by patients with emergence delirium. Due to the unsafe behavior of patients, there might be delayed and unrecognized diagnoses that will affect their safety, recovery, and morbidity [8,9].

There is no substantial evidence on emergence delirium to recommend a specific type of anaesthetic technique, general or regional anesthesia. However, intraoperative monitoring to avoid swings in blood pressure has been advocated [10].

Emergence delirium contributes to the delayed recovery process, resulting in longer hospital stays, more resource utilization, higher hospital costs, and more staff needed for patient management [11]. Common risks that often occur are removal of dressings, removal of urinary and indwelling catheters, damage to the surgical site, drainage tubes, and monitors, making assessing such patients quite difficult for PACU staff [8].

It is a common problem after anesthesia, especially for anaesthetists, nurses, interns, and residents, who face a challenge in caring for patients with emergence delirium in the post-anesthesia care unit. As far as human resources are concerned, it increases the number of staff members available to restrain an agitated patient. Staff must be present on-site at all times, and while nurses or other professionals are attending delirium patients, other patients might be less closely watched, thereby increasing their anxiety. Therefore, the primary aim of this study was to determine the magnitude of emergence delirium and its predictors in...
elderly patients after anesthesia and surgery in the post-anesthesia care unit.

2. Methods

In this institution-based, prospective observational study, 172 consecutive patients were included. The study was performed in the post-anesthesia care unit for three months in 2020. The study was approved by the Ethical Review Board of the institution with approval Ref. No. 68/06/2020. The Research Registry number was stated as 8322, in accordance with the Declaration of Helsinki, 2013 [12]. This study has been reported in line with the STROCSS criteria [13].

The study included elderly patients after anesthesia for both elective and emergency surgery in the post-anesthesia care unit. Informed written consent was obtained from the study participants. Every participant was allowed to discontinue participation if they did not want to participate in the study. They were assured that their treatment and other benefits they could gain from the hospital were not interrupted due to their withdrawal. Those patients who developed emergence delirium during the data collection period were treated by the assigned health professionals. Confidentiality was ensured by removing the identifiers.

The main outcome variables of the study were determined by the Nursing Delirium Screening Scale (Nu-DESC). This tool assessed five areas: disorientation; inappropriate behavior; inappropriate communication; illusions or hallucinations; and psychomotor retardation. Each feature is scored from 0 to 2 based on severity, with 0 = absent, 1 = mild, and 2 = severe. The positive Nu-DESC score is ≥ 2 and the maximum total score is 10 [14].

The sample size was calculated using a single population proportion formula. Since there was no previous study done similar to this study, we took a proportion of 50% by assuming 95% of the confidence interval with a 5% margin of error, and finally, the sample size for the study was calculated as: where \( n = \) the desired sample size; \( z = \) is the standard normal distribution; \( p = \) population proportion (50%, 0.5), and \( q, \) which is 1–0.5 = 0.5. \( d = \) degree of accuracy desired (marginal error is 5% (0.05)); then the sample size was \( n = 384.16 \approx 385. \) Among the total number of operations, elderly patients getting an operation in our hospital annually number below 10,000. A correction factor formula was used to get the exact sample size.

Here, in the Hospital, an average of 80–82 cases were done in a month. Therefore, by considering that 246 cases were operated on average, \( n_f = \frac{385}{100} \) Where; \( n_f = \) adjusted sample size, \( n = \) Initial sample size. \( N = \) population size. \( n_f = \frac{385}{100} = 151 \) with 10% non response rate, \( n_f = 176 \) Where; \( n_f = \) final adjusted sample.

Study participants were selected by consecutive sampling and included all elderly patients aged 60 years and older who underwent operations in the study period. However, patients who had known psychiatric disorders and intubated patients at the post-anesthesia care unit were excluded from the study.

Before data collection, training was given for data collectors. The data collection procedures used interviews, chart review, and direct observation of patients during the first hour. Recording the event-based instrument Nursing Delirium Screening scale ≥ 2 at any time is considered an emergence delirium at the Post Anesthesia Care Unit. The questionnaire was primarily prepared in English, and the tools were translated into Amharic (the local language). Data collection procedures included variables like age, sex, body mass index, weight, height, American Society of Anesthesiologists physical status, urgency of the procedure, duration of anesthesia, and surgery, coexisting illnesses which were recorded from the chart.

To ensure the quality of the data, pre-tests of the data collection tool were conducted on 10% of the study sample size. Data collectors were provided adequate information regarding the assessment tools of the instrument, the Nursing Delirium Screening Scale. The data collectors were closely monitored by the principal investigator throughout the study period. The collected data were checked for completeness, accuracy, and clarity on the day of data collection before being entered into the database by the principal investigator.

After collecting the data, it was entered into the Epi-info software version 7, and then transferred to SPSS version 20. A descriptive statistic was used to explain the study participants in relation to study variables and was presented as the median (inter-quartile range). The associations between the outcome variable and independent variables were determined by binary logistic regression analysis. The strengths of the associations between variables were determined by calculating the Crude and Adjusted Odds Ratio with 95% CI. The minimum value of statistical significance is \( P < 0.2 \) for bivariable and 0.05 for multivariable binary logistic regression. Finally, data were presented using numbers, frequencies, tables, charts, and figures accordingly. The Hosmer and Lemeshow tests were used to assess the goodness of fit.

3. Results

3.1. Socio-demographic characteristics

A total of 176 patients’ data were collected, with response rate of 172 (97.7%). Four patients were excluded from the analysis due to incomplete data. Among the respondents, the majority of them were male, 93 (54.1%) (Table 1).

3.2. Preoperative variables

The majority of patients were American Society of Anesthesiologists I, 109 (63.4%). Among all elderly patients, 95 (55.2%) of them had elective procedures. 57 (33.2%) of the study participants had comorbidities (Table 2).

3.3. Intraoperative and postoperative risk factors

Among all elderly patients who underwent operations, general surgery was the most operated procedure relative to the other specialties, 77 (44.8%). From the available, induction agents, ketamine was predominantly used, 58 (33.7%). General anesthesia with endotracheal tube was the most commonly used anesthesia technique, accounting for 131 (76.2%) (Table 3).

3.4. The magnitude of emergence delirium

The overall magnitude of emergence delirium in elderly patients was 40.7% (95%CI = 32–48). The proportion of patients experiencing emergence delirium in the post-anesthesia care unit was 31% within the first 11–20 min (Fig. 1).

3.5. Predictors for emergence delirium

Among the study variables: maintenance agents, types of anesthesia, types of induction agents, alcohol consumption, comorbidities, pre-
Table 2
Preoperative variables of the study subjects (n = 172).

| Variables                        | Category | Frequency | Percentage (%) |
|----------------------------------|----------|-----------|----------------|
| Co-morbidities                   | Yes      | 57        | 33.2%          |
|                                  | No       | 115       | 66.8%          |
| Fasting duration (minutes)       | <360 min | 87        | 50.6%          |
|                                  | ≥360 min | 85        | 49.4%          |
| Benzodiazepine premedication     | Yes      | 14        | 8.1%           |
|                                  | No       | 158       | 91.9%          |
| Electrolyte abnormalities        | Yes      | 12        | 6.9%           |
|                                  | No       | 160       | 93.1%          |
| ASA physical status              | ASA I    | 109       | 63.4%          |
|                                  | ASA II   | 54        | 31.4%          |
|                                  | ASA III  | 9         | 5.2%           |
| Previous hospital admission      | Yes      | 31        | 18%            |
|                                  | No       | 141       | 82%            |
| History of substance abuse       | Yes      | 62        | 36.1%          |
|                                  | No       | 110       | 63.9%          |
| Urgency of surgery               | Elective | 95        | 55.2%          |
|                                  | Emergency| 77        | 44.8%          |

Note: LMA = Laryngeal Mask Airway, GA = General Anesthesia, SA = Spinal Anesthesia, ETT = Endotracheal tube.

4. Discussion

Emergence delirium is a confusional state that occurs during the recovery phase of anesthesia. It was associated with increased patient morbidity and mortality. The magnitude of emergence delirium in the post-anesthesia care unit was up to 80% of surgical procedures. It mostly occurs during the first 15–30 min of post-surgical anesthesia [8].

The study was conducted to determine the magnitude of emergence delirium and its predictors among elderly patients after anesthesia at the Post Anesthesia Care Unit. The overall magnitude of emergence delirium in elderly patients was 40.7% (95% CI = 32–48).

A prospective study done in Black Lion Hospital in Ethiopia showed that the incidence of emergence delirium in the general surgical population was 31.7%. This is relatively low when compared with this study. The possible explanation of this discrepancy could be that elderly patients were more likely to develop emergence delirium than adult age groups [7].

A study conducted in Canada showed that the incidence of emergence delirium in elderly patients was 41.6%. This is approximately in line with our findings [15]. However, another study found that the incidence of emergence delirium was 23%. This finding was higher than in the above study. The possible explanation for the high incidence of emergence delirium in our study might be inadequate preoperative optimization and reassurance of patients, inadequate postoperative pain management, or could be due to clinical set-up differences [16].

Another study found that the incidence of emergence delirium varies from 10% to 46% in the general surgical population. It occurs in approximately 7.8% of elderly patients with benign prostatic hyperplasia undergoing transurethral resection of the prostate. The possible explanation might be due to the use of continuous bladder irrigation after transurethral resection of the prostate and irritation from catheters being often a distressing risk factor for emergence delirium [17].

A study conducted in the United States of America on elderly patients showed that the incidence of emergence delirium varies between 5.1% and 52.5% of those who underwent major surgery. Certain procedures, such as hip fracture and aortic surgery, have a higher risk of postoperative delirium. The possible reasons could be due to major surgery, high intraoperative bleeding, and prolonged duration of surgery [18].

Another study conducted in China showed that patients who developed postoperative delirium in elderly patients were significantly associated with the risk of developing delirium, with an incidence of 36.8% of surgical patients suffering from emergence delirium [9].

In this study, perioperative narcotics users were 5.1 times (AOR = 5.1, 95% CI = 1.27–20.57) more likely to develop emergence delirium than those who had not been given intravenous narcotics. Those patients who had excessive blood loss were 6.5 times (AOR = 6.5, 95% CI = 2.47–17.02) more likely to develop emergence delirium than those who had less intra-operative blood loss.

Participants who had moderate to severe post-operative pain were 3.9 times (AOR = 3.9, 95%CI = 1.13–13.60) more likely to develop emergence delirium than patients who had no to mild pain. The study also revealed that those elderly patients who had pre-operative anxiety were 7 times (AOR = 7, 95%CI = 1.76–28.55) more likely to develop emergence delirium than the non-anxious patients (Table 4).

Table 3
Intraoperative and postoperative variables (n = 172).

| Variables                        | Category | Frequency | Percentage (%) |
|----------------------------------|----------|-----------|----------------|
| Types of surgery                 | Gynecology| 31        | 18%            |
|                                  | Urology  | 16        | 9.3%           |
|                                  | Orthopedics| 26      | 15.1%          |
|                                  | General surgery | 77 | 44.8% |
|                                  | Cardiac   | 4         | 2.3%           |
|                                  | Neurosurgery | 13     | 7.6%           |
|                                  | Ear,Nose, Throat surgery | 5 | 2.9% |
| Induction agents                 | Propofol | 14        | 8.2%           |
|                                  | Thiopental | 22       | 12.8%          |
|                                  | Ketofol  | 46        | 26.7%          |
|                                  | Ketamine | 58        | 33.7%          |
| Types of Anesthesia              | Spinal Anesthesia | 32 | 18.6% |
|                                  | GA with LMA | 9       | 5.2%           |
|                                  | GA with ETT | 13      | 7.6%           |
| Use of muscle relaxants          | Yes      | 129       | 73%            |
|                                  | No       | 43        | 25%            |
| Maintenance agents               | Halothane | 88       | 51.2%          |
|                                  | Isoflurane| 52        | 30.2%          |
| Use of intravenous narcotics     | Yes      | 109       | 63.4%          |
|                                  | No       | 63        | 36.6%          |
| Use of anti-cholinergics         | Yes      | 59        | 34.7%          |
|                                  | No       | 113       | 65.3%          |
| Duration of Surgery              | <120 min | 56        | 32.6%          |
|                                  | ≥120 min | 116       | 67.4%          |
| Blood transfusion                | Yes      | 14        | 8.1%           |
|                                  | No       | 158       | 91.9%          |
| Intraoperative excessive blood loss| Yes    | 74        | 43%            |
|                                   | No      | 98        | 57%            |
| Naso Gastric Tube                | Yes      | 20        | 11.6%          |
|                                   | No      | 152       | 88.4%          |
| Bladder catheter                 | Yes      | 168       | 97.7%          |
|                                   | No      | 4         | 2.3%           |
| Postoperative pain               | None to mild pain | 47   | 27.3%          |
|                                   | Moderate to severe pain | 125 | 72.7% |
| Postoperative pain management    | Opioids | 32        | 18.6%          |
|                                   | NSAIDs  | 85        | 49.4%          |
|                                   | Infusion | 9         | 5.3%           |
|                                   | Nerve blocks | 46 | 26.7% |
| Preoperative Anxiety             | Yes      | 26        | 15.1%          |
|                                   | No       | 146       | 84.9%          |

medication with benzodiazepines, and ASA physical status were significant in bi-variable binary logistic regression analysis (P-value < 0.2). However, pre-operative anxiety, peri-operative narcotics, excessive blood loss, and post-operative pain were associated in multi-variable binary logistic regression analysis (P-value < 0.05).

In this study, elderly patients who had used peri-operative narcotics were 5.1 times (AOR = 5.1, 95% CI = 1.27–20.57) more likely to develop emergence delirium than those who had not been given intravenous narcotics. Those patients who had excessive blood loss were 6.5 times (AOR = 6.5, 95% CI = 2.47–17.02) more likely to develop emergence delirium than those who had less intra-operative blood loss.

Participants who had moderate to severe post-operative pain were 3.9 times (AOR = 3.9, 95%CI = 1.13–13.60) more likely to develop emergence delirium than patients who had no to mild pain. The study also revealed that those elderly patients who had pre-operative anxiety were 7 times (AOR = 7, 95%CI = 1.76–28.55) more likely to develop emergence delirium than the non-anxious patients (Table 4).

Another study conducted in the United States of America on elderly patients showed that the incidence of emergence delirium varies between 5.1% and 52.5% of those who underwent major surgery. Certain procedures, such as hip fracture and aortic surgery, have a higher risk of postoperative delirium. The possible reasons could be due to major surgery, high intraoperative bleeding, and prolonged duration of surgery [18].

Another study conducted in China showed that patients who developed postoperative delirium in elderly patients were significantly associated with the risk of developing delirium, with an incidence of 36.8% of surgical patients suffering from emergence delirium [9].

In this study, perioperative narcotics users were 5.1 times (AOR = 5.1, 95% CI = 1.27, 20.57) more likely to develop emergence delirium than those who had not taken intravenous narcotics. This finding was supported by another study in which opioids increased the risk of adverse outcomes such as delirium, but whether this risk differs between the various opioids remains controversial [19]. The possible explanation for the differences in the risk of emergence delirium among the various opioids will be as a result of their specific pharmacokinetic and pharmacodynamic properties.
In this study, participants who had excessive intraoperative blood loss were 6.5 times (AOR = 6.5, 95% CI = 2.47, 17.02) more likely to develop emergence delirium than those who had less intraoperative bleeding. Another study found that excessive intraoperative blood loss was a high risk factor for postoperative emergence delirium. The possible explanations were that the blood loss resulted in a decline of blood pressure and cerebral blood flow, which implicated the emergence of delirium [20]. Another prospective study agreed that intraoperative excessive blood loss was 1.6 times significantly associated with post-operative emergence delirium [21].

In this study, patients who had moderate to severe postoperative pain were 3.9 times (AOR = 3.9, 95% CI = 1.13, 13.59) more likely to develop emergence delirium than patients who had mild to moderate postoperative pain. This finding was supported by another study, which stated that patients with postoperative pain with a numeric rating scale greater than or equal to five were more likely to develop emergence delirium than those who had no to mild pain [22].

In this study, patients who had preoperative anxiety were 7 times (AOR = 7, 95% CI = 1.76, 28.55) more likely to develop emergence delirium than those who were not anxious. This finding was supported by a study done by Wada et al. who explained that patients with preoperative anxiety were 4.37 times more likely to develop emergence delirium than patients who were not anxious preoperatively [23].

4.1. Strength and limitations of the study

To the best of our knowledge, this is one of the few studies to investigate the magnitude of emergence delirium and its predictive factors in the country. This finding will help to primarily reassure patients and to decrease the magnitude of the problem in low-income countries. Finally, our study has some limitations. We didn’t study the duration of delirium, and we only took the first occurrence of emergence delirium.

5. Conclusions and recommendations

In this study, emergence delirium has been identified as a significant problem and is presented as a challenge in the recovery process for patients and post-anesthesia care unit providers. This study showed that postoperative pain, perioperative narcotics, excessive blood loss, and preoperative anxiety were predictors of emergence delirium. Reassuring patients preoperatively, giving full Finally, we recommend researchers further study the effects of using a large sample size for longitudinal follow-up studies. Information about anesthesia, and adequate post-
operative pain management
will decrease the magnitude of emergence delirium. Finally, we recommend researchers further study the effects of using a large sample size for longitudinal follow-up studies.

Ethical approval

The study was approved by the Ethical Review Board of the institution with approval Ref. No. 68/06/2020. The study included elderly patients after anesthesia for both elective and emergency surgery in the post-anesthesia care unit. Informed written consent was obtained from the study participants. Every participant was allowed to discontinue participation if they did not want to participate in the study. They were assured that their treatment and other benefits they could gain from the hospital were not interrupted due to their withdrawal. Those patients who developed emergence delirium during the data collection period were treated by the assigned health professionals. Confidentiality was ensured by removing the identifiers.

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Authors’ contributions

All authors agreed to be held accountable for all aspects of the work and ‘made a significant contribution to the work reported, including conception, study design, execution, data acquisition, analysis, and interpretation, or in all these areas; participated in writing, revising, or critically reviewing the article; gave final approval of the version to be published; and agreed on the journal to which the article has been submitted.’

Registration of research studies

Name of the registry: research registry.
Unique Identifying number or registration ID: 8322.
Hyperlink to your specific registration (must be publicly accessible and will be checked): https://www.researchregistry.com/browse-the-registry/#home/

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Declaration of competing interest

The authors declared that they have no conflicts of interest.

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Appendix A. Supplementary data

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