



## Postoperative Emergence Delirium in Adult Iraqi Patients after General Anesthesia for Different Surgeries

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Original Article

### Abstract

**Background:** Postoperative emergence delirium (ED) is a serious everyday problem during the postoperative period and stay in the PACU and after general anesthesia that can have potential risks on patient safety. ED was found to be associated with poor outcomes and long term mortalities.

**Objective:** To assess the incidence of postoperative emergence delirium and the associated risk factors in adult Iraqi patients after general anesthesia for different surgeries.

**Methods:** This was a prospective study conducted at AlSader Medical City during the period from October, 2023 to May 2024 included 180 Iraqi patients to whom different types of surgeries were performed under general anesthesia. Richmond Agitation and Sedation Scale (RASS) used in detection of emergence delirium.

**Results:** The mean age of patients was  $34.6 \pm 7.2$  (Range: 23 – 64) years. Males contributed for 58.3% overweight and obesity found in 58.9% of patients. We reported emergence delirium in 55 patients giving an incidence rate of 30.6%. The significant risk factors for ED were older age, male gender, Cholecystectomy surgery, using inhalational anesthetic agent, longer time of anesthesia, longer time of surgery and longer time of stay in PACU

**Conclusions:** Emergence delirium was frequently incident among Iraqi patients undergoing different type of surgeries under general anesthesia. The significant risk factors of emergence delirium included older age, male gender, Cholecystectomy surgery, using inhalational anesthetic agent, longer time of anesthesia, longer time of surgery and longer time of stay in PACU.

**Keywords:** Emergence Delirium, Incidence, risk factors, Iraqi Patients, Najaf

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## 1. INTRODUCTION

Emergence delirium and agitation are commonly incident after general anesthesia, they are abnormal mental status occur due administration of anesthetic agents during the emergence from anesthesia and transition from the unconscious state to full consciousness or wakefulness (1). According to the definition of the International Classification of Diseases, 10th revision, delirium is an etiologically non-specific organic cerebral syndrome characterized by simultaneous impairment of consciousness and attention, perception, thinking, memory, psychomotor behavior, emotions, and sleep-wake cycles (2). The Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5) of the American Psychiatric Association emphasizes that the key diagnostic criteria are acute onset and fluctuating course of cognitive impairment, disturbance of attention and consciousness, and association with a somatic condition (3). Potential complications and consequences of ED include prolonged length of stay in the intensive care unit (ICU), decreased cognitive performance, decreased quality of life, and increased long-term mortality (4–6). Delirium is not easy to diagnose in the ICU. Although more than 24 tools have been proposed to determine the presence of delirium, the most widely used is the Confusion Assessment Method-Intensive Care Unit (CAM-ICU), which has a sensitivity of 95% and a specificity of 89% (7). Postoperative delirium is frequently incident among adults after surgeries and general anesthesia. Delirium can occur during the postoperative period and called postoperative delirium (POD) which can occur from first to 7th postoperative day or immediately after emergence from general anesthesia (GA) and called emergence delirium (ED), the duration of postoperative delirium varies widely from several hours to several days. It represents a significant challenge to anesthesiologists, patients and their families. Different factors are associated with ED and the main proposed risk factors including patient's factors such as age and sex, type of surgery, longer duration of surgery, type of anesthesia ; use of inhalational agents, use of anticholinergics with benzodiazepine, pain, and invasive procedures and devices and method of assessment. The incidence of ED varies worldwide among the medical care centers, it ranges between 3.7% to 45% of patients undergoing surgeries under GA (1,8). ED is frequently reported among adults undergoing different types of surgeries under GA, however, ED has the same characteristics in almost all patients after different operations; it is characterized by alteration in the mental

status, lower awareness, and reduced attention (8–10). Despite the fact that ED is not well-defined, any delirium occurs during recovery period can be considered as ED. Hence, ED timing can be considered between discontinuation of anesthesia to the time of discharging patients to the ward. However, it can be recognized in the theater or operation room, post anesthesia care unit (PACU) or even in the intensive care unit (ICU). There are three types of delirium according to its presentation where it can present as Agitation, low motor function or mixed of both (10). Also some authors considered ED as inadequate emergence which is combined of hypoactive emergence and emergence agitation (11,12). Despite the general knowledge about the possible causes of delirium, the exact pathophysiological mechanism of its occurrence is unknown. Most likely, it is a combination of various factors. Potential pathogenetic mechanisms may be systemic inflammation, changes in the level of neurotransmitters (especially acetylcholine), electrolyte disturbances, hemodynamic instability, genetic factors [23–29]. Preoperative and intraoperative monitoring of patients can help in prediction of ED using different tools for assessment, however, there still no standard guideline and it still occurs frequently in almost all centers with considerable variable incidence worldwide (1). Despite the fact that the search for new strategies for the prevention and treatment of postoperative delirium is ongoing, the problem remains relevant (13–16). In Iraq, the exact incidence and possible risk factors of ED after general anesthesia in adults are scarce and this topic need further investigations, hence, the present study aimed to assess the incidence of ED and its risk factors among Iraqi patients undergoing different surgical interventions under general anesthesia in AlNajaf city.

## **2. PATIENTS and METHODS**

This was a prospective study conducted at AlSader Medical City during the period from October, 2023 to May 2024 included 180 Iraqi patients to whom different types of surgeries were performed under general anesthesia.

### **Study Population and sample:**

Adult Iraqi patients of both gender and have performed a type of surgical intervention under general anesthesia.

The required sample was calculated according to the standard sample size equations and calculator , the required sample was calculated using the Open Epi® online software , with a

precision of 5% with  $\alpha = 5\%$  and estimating a loss of 5%, the calculated sample size was 176 patients and approximated to 180 patients.

**Inclusion criteria:**

1. Adult Iraqi patients
2. Both genders
3. Class I and II American Association of Anesthesiologist (ASA) physical status classification
4. Undergoing surgical interventions under general anesthesia

**Exclusion criteria:**

1. Surgeries or concomitant pathology not fit for general anesthesia.
2. Recent or ongoing respiratory tract infection.
3. Having any type of behavioral, neurological or psychomotor disorders.
4. Having a history of obstructive sleep apnea syndrome.
5. Need for admission to ICU after the operation
6. Emergency surgeries
7. ASA physical state  $\geq 3$
8. High score of preoperative anxiety

**Preoperative preparation, anesthetic procedure and protocol**

Patients were scheduled for surgical intervention under GA from the waiting list. After going through the anesthesia consultation, where all patients were evaluated by the anesthesiologist. The required investigations were requested and a thorough physical examination was performed.

All anesthetic procedures were performed according to the usual standard clinical practice and protocols of the general anesthesia and resuscitation that followed in our hospital. Anxiolytic pharmacological premedication was administered. The degree of preoperative anxiety was evaluated using the Amsterdam Preoperative Anxiety and Information Scale (17)

The patients' behavior during induction of anesthesia was observed by the anesthesiologists. Intraoperative monitoring was according to the standard recommendations. Subsequently, inhalation induction was performed, using the tidal volume technique in progressive increments every 10 seconds . Once sufficient anesthetic depth had been achieved and after the

excitation phase had ceased , a peripheral venous line was channeled. Subsequently, the maintenance of anesthesia was performed. Induction and maintenance of anesthesia were assured according to the standard clinical anesthesia guideline and our hospital applied anesthesia protocols were strictly followed in all patients. After completing the surgical procedure, the corresponding inhalation agent was suspended, without increasing the flow of fresh gas, and the laryngeal mask/ endotracheal tube was removed when the patient moved consciously or when he or she opened the eyes, according to the usual technique. Patient was later transferred to the post anesthesia recovery room (PACU) when had coordinated spontaneous movements, stable SpO<sub>2</sub> without oxygen therapy, and good respiratory mechanic. Patients were given postoperative analgesia on request-based. Antiemetic also used in patients who need it.

**Assessment of emergence Delirium:**

Performed using the Richmond agitation and sedation (RASS) (18) according to the 10 point scale as listed below:

<b>Richmond Agitation and Sedation Scale (RASS)</b>	
+4	Combative
+3	Very agitated:
+2	Agitated
+1	Restless
0	Alert and calm
-1	Drowsy
-2	Light sedation
-3	Moderate sedation
-4	Deep sedation
-5	Unarousable

All Patients were briefed before surgery on the usage of the Visual analogue scale that utilized for evaluation of Pain and all patients gave their written agreement, and before their enrolment in the study.

Statistical methodology: The descriptive statistics for each of the qualitative variables presented as number and percentage. For the quantitative variables, the mean  $\pm$  standard deviation was calculated. When the predictor variable was qualitative, contingency analyzes were used using the Chi-Square statistic. To compare quantitative variables, parametric tests were applied. All statistical analyses performed with SPSS software version 28, at a significance level of  $\leq 0.05$ .

### 3. RESULTS

A total of 180 patients were enrolled in this study with a mean age of  $34.6 \pm 7.2$  (Range: 23 – 64) years. Males were dominant contributed for 58.3% of the studied group. ASA I was reported in 53.3% of patients, overweight and obesity found in 32.8% and 26.1%, respectively, (**Table 1**). Types of performed surgeries are summarized in (**Table 2**). Anesthesia and operation parameters and related variables in addition to the pain during stay in PACU are shown in (**Table 3**). We reported emergence delirium in 55 patients giving an incidence rate of 30.6%, (**Figure 1**). To assess the possible risk factors for ED we conducted a regression analysis using ED as dependent variable and other variables as independent predictors in the equation. Regression analysis showed that older age, male gender, Cholecystectomy surgery, using inhalational anesthetic agent, longer time of anesthesia, longer time of surgery and longer time of stay in PACU are significant risk factors for ED with an odds ratio of 2.28, 1.89, 2.73, 3.44, 1.27 and 3.19, respectively, (P. value $<0.05$ ). According to these OR values the stronger risk factor was Inhalational anesthesia followed by longer time of surgery, and cholecystectomy surgeries. While the least significant risk factor was the longer time of stay in PACU. Other variables showed no significant association, (P. value  $>0.05$ ), (**Table 4**).

Table 1. Baseline characteristics of the studied groups

Variable		No.	%
Age (year)	≤ 30	38	21.1
	31 - 40	63	35.0
	41 - 50	51	28.3
	>50	28	15.6
	Mean (SD)	34.6 (7.2)	-
Gender	Male	105	58.3
	Female	75	41.7
ASA	I	96	53.3
	II	84	46.7
BMI	Normal	74	41.1
	Overweight	59	32.8
	Obese	47	26.1

Table 2. Types of scheduled surgeries for the studied group

Type of Surgery	No.	%
Cholecystectomy	39	21.7
GIT	36	20.0
Ophthalmological	31	17.2
Otolaryngology	24	13.3
Orthopedic	18	10.0
Urology	12	6.7
Thyroidectomy	11	6.1
Breast and Ovary	9	5.0
Total	180	100.0

Table 3. Anesthesia and operative parameters

Variable	Statistic	Values
Total anesthesia time (min)	Mean $\pm$ SD	52.3 $\pm$ 9.4
Operative time (min)	Mean $\pm$ SD	45.6 $\pm$ 7.2
Wake up time (min)	Mean $\pm$ SD	10.2 $\pm$ 1.6
Time of stay in recovery room (min)	Mean $\pm$ SD	44.6 $\pm$ 8.3
Pain during stay in recovery room No. (%)	None	113 (62.8)
	Mild	41 (22.8)
	Moderate	17 (9.4)
	Intense	9 (5.0)

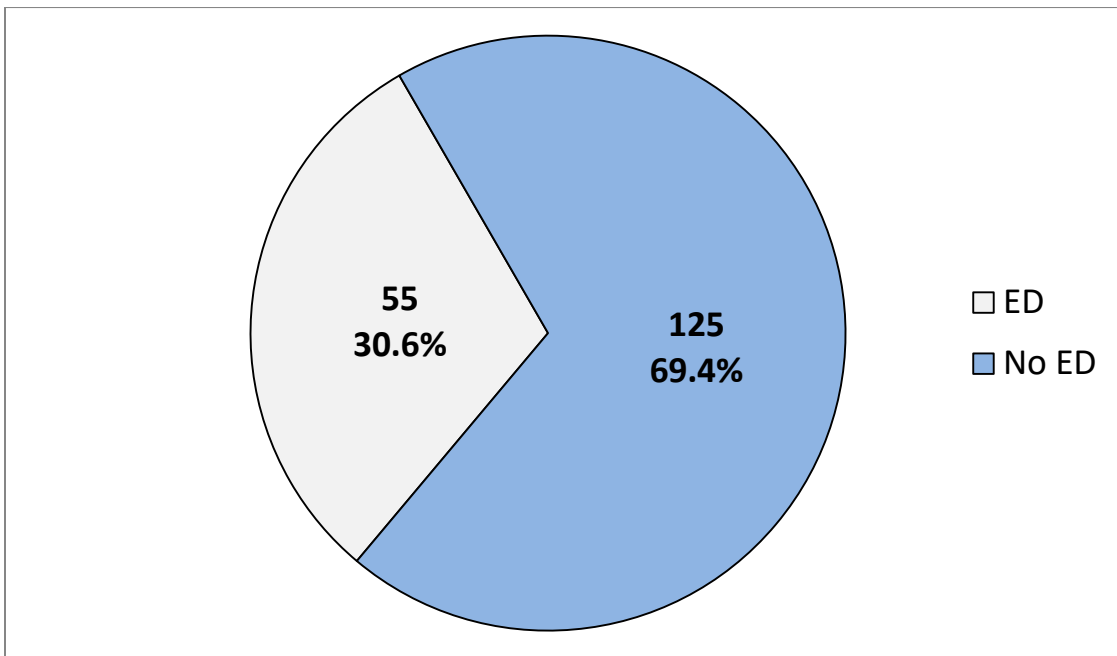


Figure 1. Frequency distribution of incident emergence delirium (ED) among the studied group



Table 4. Results of logistic regression analysis for the factors associated with incident emergence delirium among the studied group

Variable in the equation	OR	95%CIOR	P. value
Older Age	2.28	1.66 - 5.38	0.001 sig
Male gender	1.89	1.16 - 5.08	0.001 sig
Type of surgery			
Cholecystectomy	2.73	1.91 - 6.81	0.001 sig
GIT	1.14	0.92 - 2.39	0.221 ns
Ophthalmological	1.02	0.88 - 1.94	0.364 ns
Otolaryngology	1.11	0.87 - 2.14	0.322 ns
Orthopedic	1.18	0.66 - 2.47	0.293 ns
Thyroidectomy	1.06	0.74 - 1.89	0.354 ns
Others	0.91	0.38 - 1.79	0.418 ns
Type of anesthetic (Inhalational)	3.44	1.17 - 6.22	0.001 sig
Duration of stay in PACU	1.27	1.04 - 3.11	0.012 sig
Duration of surgery	3.19	2.15 - 7.33	0.001 sig

OR: odds ratio, CI: confidence interval, sig: significant, ns: not significant , GIT: gastrointestinal tract

#### 4. DISCUSSION

Postoperative behavioral changes, mainly emergence delirium is a serious everyday problem during the postoperative period and stay in the PACU and after general anesthesia that can have potential risks on patient safety. In our study, the overall incidence of ED was 30.6%, which is relatively higher rate, however, the incidence rates of ED are widely varied and may reached up to 45% in some centers and according to the surgical field (1,8). In our study we observed that most ED patients were combative or very agitated which consistent with other studies conducted by Solomon and Sahile (19). Our reported ED rate was close to that reported in recent Iraqi study conducted by Shamsi et al. in Karbala province (20). Furthermore, in Ethiopia, Solomon and Sahile reported an ED incidence of 31.7% among 1233 patients scheduled for different types of surgery (19). In our study, despite the several tools and scales that are available for diagnosis of ED, we used the RASS for detection of ED, because it is a reliable, valid and highly sensitive tool and widely used in previous studies (10,11,18–20).

According to our results of regression analysis, we found that older age, male gender, Cholecystectomy surgery, inhalational anesthetic agent, longer time of anesthesia, longer time of surgery and longer time of stay in PACU are significant risk factors for incidence of ED and the stronger factor was type of anesthesia (Inhalational) followed by longer time of surgery, and cholecystectomy surgeries. While the least significant risk factor was the longer time of stay in PACU. Solomon and Sahile (19) found that older age and longer duration of stay in PACU were significant risk factors, moreover, they found that substance abuse, using benzodiazepine, excessive blood loss and postoperative pain were significant risk factors for ED. Our findings agreed that found in previous studies that investigated the risk factors of ED in other populations (4,10,11); Park et al. stated that incidence of ED increases with advancing age. From other point of view, ED was found to be associated with poor outcomes and long term mortalities among Korean patients (4). Shamsi et al found that ED was significantly associated male gender, operation lasting for 1-2 hours (20). Furthermore, Miao et al. (10) found that male gender, smoking, substance abuse, preoperative anxiety, ASA of III and IV class, preoperative behavior disorder, inhalational anesthesia, longer duration of surgery and postoperative pain were significant risk factors. However, the variation in the reported risk factors among studies can attributed to the nature of these studies and differences in the populations.

## **5. CONCLUSIONS**

Emergence delirium was frequently incident among Iraqi patients undergoing different type of surgeries under general anesthesia in a rate of 30.6%. The reported rate was comparable to other studies worldwide. Significant risk factors that contributed to the occurrence of emergence delirium among Iraqi patients in Najaf included older age, male gender, Cholecystectomy surgery, using inhalational anesthetic agent, longer time of anesthesia, longer time of surgery and longer time of stay in PACU. We recommended further studies in multiple center included larger sample size for further assessment.

### **Ethical Clearance:**

Ethical issues were taken from the research ethics committee. Informed consent was obtained from each participant. Data collection was in accordance with the World Medical Association

(WMA) declaration of Helsinki for the Ethical Principles for Medical Research Involving Human Subjects, 2013 and all information and privacy of participants were kept confidentially.

**Conflict of interest:** Authors declared none

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