Relation between Delirium Symptoms and Patients' Outcomes during the Postoperative Period in Intensive Care Units

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Abstract

Background: Postoperative delirium is a neurocognitive complication with adverse consequences that may extend far beyond surgical recovery. Postoperative delirium is associated with a delay in postoperative recovery, increased costs, and increased morbidity and mortality. **Aim:** This study aimed to assess the relation between delirium symptoms and patients' outcomes during the postoperative period in intensive care units. **Study design:** A descriptive exploratory research design was utilized to achieve the aim of this study. **Setting:** This study was conducted in the intensive care unit at El-Demerdash hospital which affiliated to Ain Shams University hospitals. **Subjects:** Purposeful samples of 325 postoperative patients admitted to the intensive care unit were included in this study. **Tools of data collection:** (1) Patients' assessment questionnaire, (2) Richmond agitation-sedation scale, (3) Intensive care delirium screening checklist, (4) Outcomes assessment questionnaire. **Results:** The result of the current study showed that 73.3% of delirious patients had stayed in the ICU from 5-10 days, 43.4% remove intravenous lines accidently, 28.9% removed central line. There was a statistical relation between type of delirium and the studied patients' cognitive dysfunction p- value < 0.05. **Conclusion:** Delirium symptoms among the studied patients were altered patients' level of consciousness, attention, orientation and hallucinations. In addition to, psychomotor agitation / retardation, sleep/wake cycle disturbance and inappropriate mood/speech. As well, the results illustrated that there was no relation between delirium type and patients' readmission to the ICU, stroke, acute kidney injury and ICU mortality. **Recommendations:** Patients in the intensive care units should be assessed for delirium symptoms for early management and to prevent further complications and improve patients' outcomes.

Key words: Delirium, Delirium symptoms, Patients' outcomes, Postoperative Period.

Introduction:

Delirium is a common postoperative complication in the intensive care unit, often caused by multiple factors. It is defined as an acute neuropsychiatric disorder characterized by fluctuating disturbances in attention, awareness, and cognition **(Janssen et al., 2019).** It is a sudden, fluctuating disturbance in attention with altered levels of arousal and cognition, which occurs with physical or mental illness. It is characterized by the cardinal feature of inattention (reduced ability to direct, focus, sustain and shift attention) beside an altered level of consciousness, difficulties in processing normal thoughts and disruption to sleep–wake cycles **(Nicholas and shondipon,2018).**

Approximately 20-40% of critically ill patients experience a type of delirium during their stay at hospital. This number increases to 60-80% for patients who are mechanically ventilated as a result of the use of sedating medications, immobility, and prolonged length of stay **(Ibrahim et al., 2018).** In Egypt, detection of the incidence of delirium in different health care settings may be severely underestimated by medical and nursing staff **(Awad, 2019).**

From the investigator's point of view, the reported incidences of POD among surgical patients range from very low to high percentage. The variations in those rates have been related to the differences between studies regarding the inclusion criteria, preoperative medical interventions, the types of operations, as well the effects of certain sedatives, or sample sizes and the delirium assessment tools.

Postoperative delirium (POD) can differ in some ways from delirium that occurs in medical patients, delirium in medical patients occurs because of an acute illness or aggravation of a chronic disorder, whereas surgical patients are supposed to have ideal physical condition before surgery. Anesthesia and analgesic drugs do commonly not exist in medical patients, but they may play a major role in POD. Postoperative delirium commonly occurs from the second day to fifth day after surgery **(Jin et al., 2020).**

Delirium can be present with three motor subtypes which include hyperactive, hypoactive, and mixed that can have different diagnoses. The two most common types of delirium in a postoperative ICU, were mixed and hypoactive types. Hypoactive delirium is characterized by slowed mentation, lethargy, and decreased movement. Hyperactive delirium, alternatively, is characterized by increased activity levels, increased speed of actions or speech, restlessness, abnormal content of verbal output, hyper alertness, irritability, and combativeness, while the mixed type is characterized by patients who exhibited elements of both during a single episode **(Yang et al., 2020).**

Postoperative delirium (POD) increases morbidity rates through impairment of cognitive functions, by supporting the loss of functional self-rule, and by increasing the risk for falls and other complications associated with prolonged bed rest. Patients who experience an episode of delirium are at an increased risk of extended mechanical ventilation, increased financial costs, a higher risk of readmission and increased the risk of nosocomial infections. In addition, POD is an independent predicting factor for postoperative mortality after other types of surgery **(LaHue et al., 2019).**

Multifactorial and interdisciplinary interventions reduce the incidence of delirium rates between 30% and 53%. The interventions emphasis on early and frequent mobilization, adequate hydration, urinary and fecal continence, reorientation to place, time, and situation, therapeutic activities (walking, and engaging in self-care), use of glasses, hearing aids and other sensory devices, anesthesia protocols, quick removal of intravenous lines, drains, and restraints, nutritional optimization, non-pharmacologic sleep promotion interventions, and pharmacist participation in decreasing use of medications associated with delirium development **(Health Research and Educational Trust, 2018).**

Significance of the study:

Delirium is a significant concern in the ICU patient population that threatens patient health. Postoperative delirium can prolong the length of hospital stay, increasing the financial load on the healthcare system. It was observed that the medical records in the ICU at Ain Shams University Hospital lack information about delirium assessment. As a result, health care providers were having a hard time recognizing and managing ICU delirium patients.

Nurses remain with patients all the day and they can monitor timely changes in patients' conditions, actions, and attention. Bedside nurses play an essential role in the early determination and identification of delirium signs and symptoms and its relation to patients' outcomes. Early assessment of delirium symptoms will help to achieve easy and early recognition of delirium in ICU patients, initiate treatment in time which will enhance patient outcomes and prevent additional adverse consequences of delirium **(Sayed et al., 2020).**

Aim of the study:

This study aimed to assess relation between delirium symptoms and patients'

outcomes during the postoperative period in intensive care units.

Research questions

The current study answered the following questions:

- What are the symptoms of delirium among patients during the postoperative period in the intensive care unit?
- What are the outcomes of postoperative patients with delirium in the intensive care unit?
- What is the incidence of delirium among patients during the postoperative period in the intensive care unit?
- Is there a relation between delirium symptoms and patients' outcomes during postoperative period in the intensive care unit?

Subjects and methods

Research Design:

A descriptive exploratory research design was utilized to achieve the aim of this study.

Study Settings:

This study was conducted in the surgical intensive care unit (ICUs) at El-demerdash Hospital affiliated to Ain Shams university hospitals**.**

Subject:

The subjects of the present study included a purposive sample of 325 patients.

The inclusion criteria

All adult patients >18 years, patients who developed delirium symptoms postoperatively in the intensive care unit post 24 hours after admission, from both genders and conscious patients with 15 points according to Glasgow coma scale upon admission to the ICU.

The Exclusion Criteria

Patients who are diagnosed with delirium at the time of admission to the intensive care unit, comatose patients throughout their stay in the ICU and severely aphasic patients interfering with the assessment were excluded from this study.

Tools of Data Collection:

Data was collected through using the following tools:

1.Patient assessment questionnaire:

This tool is concerned with assessing of demographic characteristics and clinical data of the postoperative patients with delirium in the intensive care unit. This tool was developed by the researcher in English language based on the related literatures **(Jayaswal et al, 2019).** It consists of two parts:

Part I: Patients demographic characteristics: This part was used to assess patients' demographic characteristics such as age, gender, occupation, type of work, marital status, educational level, and residence. It includes one question in form of closed ended questions and six multiple choices questions.

Part II: Patients' clinical data: This part was used to assess past, present and family history of patients. The past history includes four questions regarding the presence of chronic disease, previous hospitalization, previous delirium symptoms and surgery.

The family history assess if a family member had experienced any psychological disorders due to other diseases or surgical interventions.

The present medical history was composed of two parts:

Preoperative data: It consists of eleven (11) questions about date of admission to ICU, date of discharge, or date of death if happened, preoperative diagnosis, type and name of

surgical procedure performed, history of smoking and alcohol intake.

Postoperative data: It consists of eight (8) questions about Glasgow coma score on admission, analgesia used in ICU with possible delirium side effects, date of delirium onset, date of delirium relieved, type of anesthesia, name of anesthetic drug and duration of surgery, and pain level.

2. The Richmond Agitation-Sedation Scale (RASS):

This tool was used to assess the first item in the Intensive Care Delirium Screening Checklist. The RASS was adopted from **Sessler et al, (2002)**. It is a validated and reliable method to assess patient's level of sedation in the intensive care unit.

❖ **Scoring system:**

The RASS can describe patients' level of alertness or agitation. It ranges from −5 to +4. Patient alert and quiet (score 0), patient behavior that's restlessness (score +1), agitation (score +2), the patient is extremely agitated as pulls or removes tubes and catheter (score +3), a combative patient can violent and danger to staff (score + 4). The Patient has eye-opening and eye contact, which is sustained for quite 10 seconds (score -1). The client has eye-opening, but this is often not sustained for 10 seconds (score -2), patient has any movement in reaction to the speech, exclusive of eye contact (score -3), If a patient doesn't answer to speech but can physically be stimulated by shaking shoulder at that time rubbing sternum (score -4), the client has no response to speech or physical stimulation (score -5).

2.Intensive Care Delirium Screening Checklist (ICDS):

This tool was used to assess delirium in mechanically ventilated patients, and verbally communicating patients. The ICDSC was adopted from **Bergeron et al, (2001)**. It is consisted of 8-items designed for the bedside caregiver. The 8 items included altered level of consciousness, inattention, disorientation, hallucinations, psychomotor agitation/retardation, sleep/wake cycle disturbance, inappropriate mood/speech, and symptom fluctuation.

❖ **Scoring system:**

Each item was given one (1) point from total eight (8) points and a score of 4 or greater was considered a positive screen for delirium, and a score less than 4 is considered a negative screen for delirium.

4. Outcomes assessment questionnaire for patient with delirium:

This tool was developed by the investigator based on the related literature **(Jayaswal et al., 2019).** It was developed in an English language to assess the outcomes of patients with delirium during the postoperative period in the intensive care unit. It consisted of fourteen (14) questions.

The outcomes of delirium was assessed by calculating the duration of delirium sign and symptoms, assessing the type of delirium, calculating the numbers of days on the mechanical ventilator, the need for re-intubation, the incidence rate of unplanned removal of tubes or catheters by the patient, length of stay (LOS) in the intensive care unit, patient`s discharge from ICU, in-hospital mortality, permanent or temporary cognitive dysfunction, occurrence of acute kidney injury, stroke, limb ischemia, spinal cord ischemia and intensive care unit readmission.

Content validity and Reliability:

Validity of the developed tools was tested using face and content validity. Validity was tested through a jury of seven experts from medical surgical nursing and critical care nursing departments at faculty of nursing of Ain Shams University. The experts reviewed the tools for clarity, relevancy, comprehensiveness, simplicity, understanding and applicability.

Reliability: The developed tools were tested to determine the extent to which the tool items are related to each other. The alpha

Cronbach's test, which is a model of internal consistency, was used in the analysis to indicate how well the items in an instrument fit together conceptually, and its value for the tools was as following: 0.751 for the patient assessment questionnaire, 0.956 for Richmond Agitation Sedation Scale (RASS), 0.855 for Delirium Screening Checklist and 0.786 for the outcomes assessment questionnaire.

Pilot study:

A pilot study was carried out on 10% (32) of the patients to test feasibility, applicability, and clarity of the data collection tools as well as to estimate the time needed to fill in the tools. The subjects who were included in the pilot study were included in the study's subject because no modifications were done after conducting the pilot study.

Field Work:

- Official permission was obtained from the director of El-demerdash Hospital in which the study was conducted.
- The purpose of the study was identified to the studied patients in ICU who agreed to participate in the study before data collection.
- The actual work of this study started and completed within 3 months from July 2022 until September 2022.
- Data were collected by the investigator 7 days per week, in the morning shift started at 10 am, afternoon shift started at 4 pm and night shift started at 7 am in the previously mentioned setting.
- The used tools took about 40 minutes to be filled for each patient by the investigator.
- Patient assessment questionnaire took 15 minutes and Richmond agitation-sedation scale, intensive care delirium screening checklist both took about 15 minutes. Richmond agitation-sedation scale and Intensive care delirium screening checklist were done at the morning, afternoon, night shift for 3 days to all the study subjects. First three tools were done to all study subjects (325). The fourth tool was done only for patients who developed delirium and they were (76) patients and it took about (10) minutes to be completed.

Ethical Considerations:

- An approval of the study was attained from the Research Ethical Committee at Nursing Faculty of Ain Shams University before beginning the study.
- The investigator explained the objectives and aim of the study to the subjects included in the study.
- The investigator assured maintaining anonymity and confidentiality of the subjects' data, it would be used only for the study.
- Subjects were informed that they are allowed to choose to participate in the study or not and also, that they have the right to withdraw from the study at any time.

Data analysis:

The collected data were organized, categorized, tabulated and statistically analyzed using the statistical package for social science (SPSS) version (26) to assess the relation between delirium symptoms and patients' outcomes during the postoperative period in the intensive care unit.

Data were presented as number, percentage, means and standard deviation. Chi-square and Chocrane Q test was used to show relation between variables. Chi-square (X^2) test of significance was used in order to compare proportions between two qualitative parameters. Chi-square and standard deviation were used for quantitative data such as age, ICU length of stay, intubation duration and history of smoking. Frequency and percentage were used for qualitative data such as gender and educational level.

The observed differences and associations were considered as significantly if P value ≤ 0.05.

Results:

The main findings of this study were summarizing as follows:

Table (1): shows the socio-demographic characteristics of the studied patients and shows that 73.2% of the studied patients their age ≥ 40 years with a mean age 52.86 ± 16.22.

Figure (1): demonstrated that 23.4% of the studied patients had delirium symptoms.

Table (2): represented that 31.1% of the studied patients had diabetic foot and 21.5% of them had cerebrovascular disorder as a preoperative diagnosis. Most (97.5%) of patients had open surgery. Regarding the name of surgical procedure, it was revealed that 31.7% of the studied patients performed amputation and 24.9% undergoing craniotomy.

Table (3): shows the post-operative patients with delirium screening of patients under study and reported that the highest percent of positive delirium was found in the night shift of the first day postoperatively and represented 14.5% of patients with statistically significant differences between the three shifts where p-value 0.001.

Table (4): showed that 64.5% of patients had psychomotor agitation\retardation and symptoms fluctuation, 60.5% and 60.5% had altered level of consciousness and inappropriate mood/speech respectively.

Figure (2): illustrated that 53.9% of delirious patients in the study had hypoactive delirium, 23.7% of delirious patients had hyperactive delirium and 22.4% of them had a mixed types of delirium.

Table (5): showed that 21.1% of patients with delirium under study stayed on mechanical ventilation for duration of ≥ 5 days and 13.2 % were re-intubated. As regard to unplanned connections removal, it showed that 43.4% of patients with delirium under the study removed the intravenous lines (cannulas) and 34.2% removed the nasogastric tubes. Regarding length of ICU stay, it revealed that 73.7% of studied patients with delirium under study stayed in the ICU from 5 - <10 days. As well, 67.1% of them were discharged from ICU to the wards.

Table (6): found that there was a statistical relation between type of delirium and patients' cognitive impairment as p- value <0.05.

Table (1): Frequency and percentage distribution of the studied patients regrding socio-demographic characteristics (N=325).

Socio demographic characteristics	N	%
Age		
<30 years	30	9.2
30 < 40 years	57	17.6
≥40 years	238	73.2
Mean±SD	52.86±16.22	
Gender		
Male	156	48.0
Female	169	52.0
Marital status		
Single	18	5.5
Married	198	60.9
Divorced/ Widow	109	33.6
Educational level		
Can't Read and write.	56	17.2
Read and write.	93	28.6
Primary school	120	36.9
Secondary school.	48	14.8
Higher education	8	2.5
Residence		
Urban	160	49.2
Rural	165	50.8
Occupation		
Working	87	26.8
Not working	238	73.2
If yes what is type of job		
Worker	62	71.3
Employee	7	8.1
Seller	7	8.1
Teacher	8	9.2
Farmer	1	1.1
Carpenter	1	1.1
Driver	1	1.1

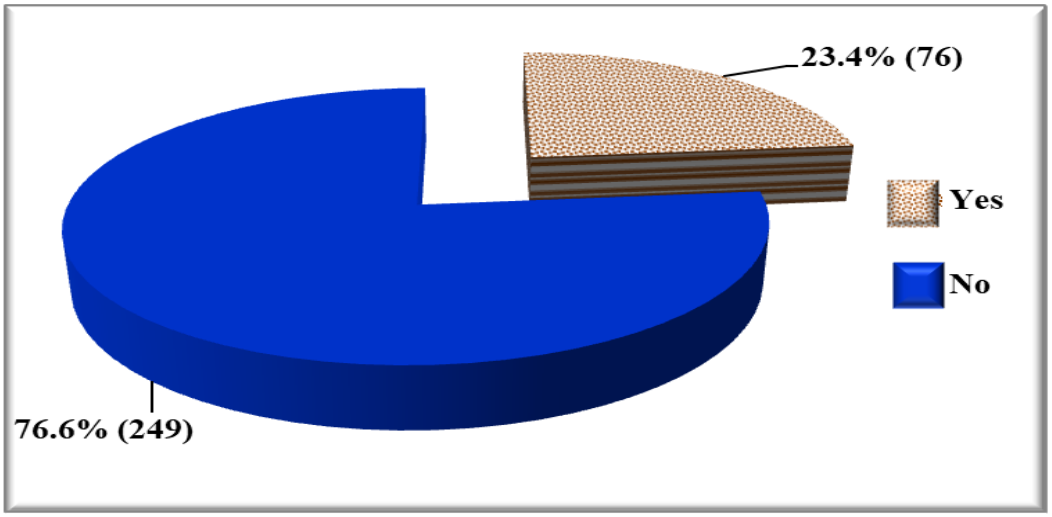

Figure (1): Frequency and percentage distribution of the studied patients as regard to occurrence of delirium (N=325).

Table (2): Frequency and percentage distribution of the studied patients as regard to the present medical history (n =325).

Present medical history	N	%
Preoperative diagnosis		
• Trauma	26	8
• Cerebrovascular disorder	70	21.5
• Diabetic foot.	101	31.1
• Intestinal obstruction.	25	7.7
• Peritonitis.	20	6.2
• Cancer colon.	47	14.5
• Fasciitis	16	4.9
• Hernia	16	4.9
• Others 1	4	1.2
Others 1 (thyroid carcinoma, breast cancer, and cirrhotic liver).		
Type of surgical procedure		
• Open surgery	317	97.5
• Minimal invasive surgery (Endoscopy).	8	2.5
Surgical procedure's name		
• Appendectomy	20	6.2
• Craniotomy	81	24.9
• Colectomy	36	11.1
• Colostomy	35	10.8
• Inguinal hernia repair	16	4.9
• Orthopedic surgery	15	4.6
• Amputation	103	31.7
• Debridement of fasciitis	16	4.9
• Others 2	3	0.9
Others 2 (Endoscopic retrograde cholangiopancreatography, tracheostomy, and hepatectomy)		

Table (3): Frequency and percentage distribution of the studied patients regarding post-operative delirium screening (N=325)

Post-operative delirium screening			N	%	P-value	
First day	Morning shift	Positive screen for delirium	7	2.2	0.001**	
		Negative screen for delirium	318	97.8		
	Evening shift	Positive screen for delirium	35	10.8		
		Negative screen for delirium	290	89.2		
	Night shift	Positive screen for delirium	47	14.5		
		Negative screen for delirium	278	85.5		
Second day	Morning shift	Positive screen for delirium	56	17.2	0.390	0.001**
		Negative screen for delirium	269	82.8		
	Evening shift	Positive screen for delirium	51	15.7		
		Negative screen for delirium	274	84.3		
	Night shift	Positive screen for delirium	48	14.8		
		Negative screen for delirium	277	85.2		
Third day	Morning shift	Positive screen for delirium	49	15.1	0.004**	
		Negative screen for delirium	276	84.9		
	Evening shift	Positive screen for delirium	41	12.6		
		Negative screen for delirium	284	87.4		
	Night shift	Positive screen for delirium	29	8.9		
		Negative screen for delirium	296	91.1		

Table (4): Frequency and percentage distribution of the studied patients according to symptoms of delirium (n=76).

Delirium Symptoms	Yes		No	
	N	%	N	%
Altered level of consciousness	46	60.5	30	39.5
Inattention	39	51.3	37	48.7
Disorientation	43	56.6	33	43.4
Hallucinations	43	56.6	33	43.4
Psychomotor agitation/retardation	49	64.5	27	35.5
Inappropriate mood/speech	46	60.5	30	39.5
Sleep/wake cycle disturbance	18	23.7	58	76.3
Symptoms fluctuation	49	64.5	27	35.5

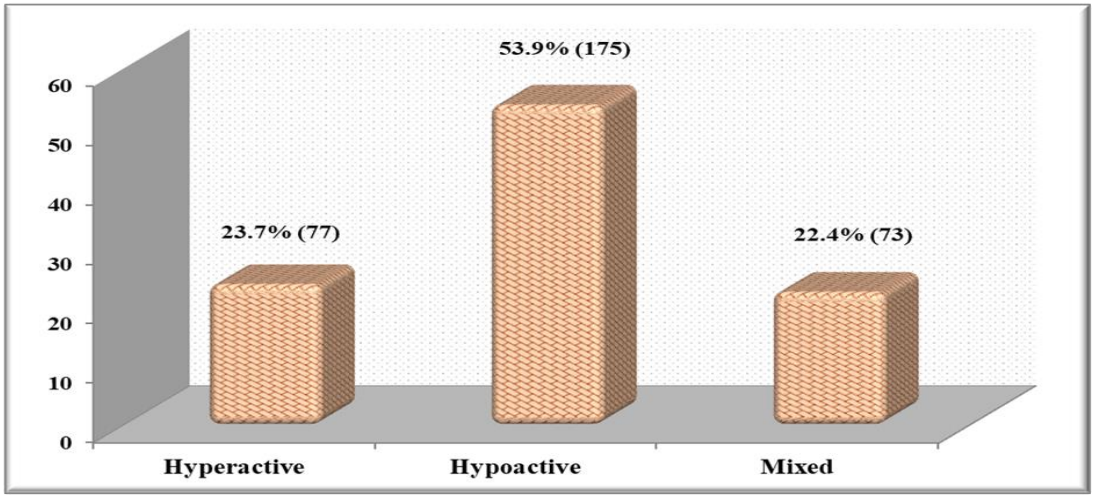

Figure (2): Frequency and percentage distribution of the studied patients regarding type of delirium (n=76)

Table (5): Frequency and percentage distribution of the studied patients regarding outcomes of delirium (n=76).

Patients` outcomes due to delirium	N	%
The number of days on mechanical ventilation		
No	45	59.2
<5 days	15	19.7
5 days or more	16	21.1
Re-intubation:		
Yes	10	13.2
No	66	86.8
Type of unplanned removal of connections:		
Oxygen face masks		
Yes	21	27.6
No	55	72.4
Intravenous lines (cannulas)		
Yes	33	43.4
No	43	56.6
Central venous catheter (CVC)		
Yes	22	28.9
No	54	71.1
Nasogastric tube		
Yes	26	34.2
No	50	65.8
Drains		
Yes	19	25
No	57	75
Endotracheal tube		
Yes	10	13.2
No	66	86.8
Length of stay in ICU in days:		
< 5 days	6	7.9
5< 10 days	56	73.7
≥ 10 days	14	18.4
Patients` discharge from ICU:		
Yes (to the ward)	51	67.1
No (die)	25	32.9

Table (6): Relation between type of delirium and patients' outcomes.

Patient`s delirium side effects	Type of delirium						p- value
	Hyperactive		Hypoactive		Mixed		
	N (18)	%	N (41)	%	N (17)	%	
ICU mortality							
Yes	4	22.2	14	34.1	7	41.2	0.467
No	14	77.8	27	65.9	10	58.8	
Permanent /temporary cognitive impairment:							
Yes	6	33.3	8	19.5	9	52.9	0.039*
No	12	66.7	33	80.5	8	47.1	
Acute kidney injury:							
Yes	2	11.1	15	36.6	6	35.3	0.128
No	16	88.9	26	63.4	11	64.7	
Stroke:							
Yes	1	5.6	3	7.3	2	11.8	0.777
No	17	94.4	38	92.7	15	88.2	
Limb ischemia:							
Yes	0	0.0	0	0.0	0	0.0	NA
No	18	100.0	41	100.0	17	100.0	
Spinal cord ischemia:							
Yes	0	0.0	0	0.0	0	0.0	NA
No	18	100.0	41	100.0	17	100.0	
Re-admission to ICU:							
Yes	2	11.1	9	22.0	1	5.9	0.256
No	16	88.9	32	78.0	16	94.1	

Discussion

The current study revealed that less than three quarters of studied patients had age > 40 years old with a mean age of 52.86 ± 16.22 years. The current study finding disagrees with **Xiao et al., (2020),** who reported that the average age was 70 years old (ranging from 65 to 93 years old) among patients in a study entitled "Incidence and risk factors for delirium in older patients following intensive care unit admission".

As regard to gender, the current study result showed that more than half were females. This finding is in the same line with Khan et al., (2020) who reported that more than one half of studied patient were women. Also, **Ravi et al., (2019)** reported that more than two thirds of the patients were women.

Regarding present medical history, the finding of the present study illustrated that more than quarter of studied patients had diabetic foot and performed amputation surgery. This finding is in the same line with **Chen et al. (2022)** who found that more than third of the studied patients had diabetic foot and performed amputation surgery in a study entitled "Preoperative risk factors for delirium after major amputation". This finding disagreed with **Styra et al. (2019)** who demonstrated that few of the studied patients had diabetic foot and performed amputation surgery.

In this study, there was more than fifth of studied patients had cerebrovascular disorder as a preoperative diagnosis and performed craniotomy surgery. This finding is in the same line with **Ali et al., (2021)** who reported that about one fifth of the studied patients had cerebrovascular disorder as a preoperative diagnosis and performed craniotomy surgery in a study entitled "Incidence and risk factors of delirium in surgical intensive care unit". This finding is contradicted with **Xing et al. (2019)** who illustrated that less than tenth of the studied patients had cerebrovascular disorder as a

preoperative diagnosis and performed craniotomy surgery. This result may be due to old age of the study subjects, as three-quarters of them had an age over 40 years. Aging is caused by the accumulation of a wide range of molecular and cellular damage over time. This leads to a gradual decrease in physical and mental capacity and growing the risk of chronic disease (diabetes mellitus and hypertension).

Concerning occurrence of delirium, the present study results demonstrated that less than one quarter of the studied patients had delirium. This study finding is in accordance with **Gao et al. (2022)** who reported that less than quarter of the studied cardiac surgical patients had delirium. While this finding is contradicted with **Casey et al. (2020)** who reported that more than third of the studied patients had delirium.

Regarding post-operative delirium screening, the present study demonstrated that the percent of positive delirium cases was in the night shift of the first day postoperatively and represent one seventh of patients. These findings were matched with **Fahimi et al. (2020)** who found that the percent of positive screen for delirium was found during the night shift of the first day postoperatively among one seventh of patients in a study titled "The effects of multimedia education on postoperative delirium in patients undergoing coronary artery bypass graft".

While, this result contrasted with **Hur et al. (2021)** who reported that among the various departments in a hospital, the incidence of delirium was the highest in the ICU, and it is well-documented that delirium occurs among quarter of the critically ill adults in ICUs within the first 24 hours after admission in a study entitled "A Machine learning–based algorithm for the prediction of intensive care unit delirium (PRIDE). " As well, the present study results demonstrated that there were statically significant differences between the three days after surgery and the occurrence of delirium with p-value = 0.001.

From the investigator's point of view, the selection of postoperative days from day 1 to day 3 as the POD assessment time, to avoid the influence of inadequate recovery from general anesthesia and emergence delirium. POD episode could be occurred any time during the entire postoperative period.

Concerning type of delirium, the current study mentioned that more than one half of delirious patients in the study had hypoactive delirium and more than fifth of patients had hyperactive delirium. In addition, the current study revealed that more than fifth of patients with delirium included in the study had a mixed type of delirium.

From the investigator's point of view, there is a difficulty in diagnosing postoperative delirium and detection of the stereotype prevailing of hyperactive delirium which is easier to identify due to its presentation. Hypoactive delirium in contrast is more common and is associated with worse outcomes, but it may be more difficult for the casual or the untrained observer to detect it. For obvious reasons, the hyperactive type is likely to be the main type presented in contrasting studies. Thus, those studies might have missed hypoactive delirium and underestimated its incidence. However, all studied patients who at high risk for hypoactive delirium were prioritized for screening or detection as hypoactive delirium is difficult to be detected and might be missed.

This finding is in the same line with **Wang et al. (2020)** who stated that more than half of patients with delirium had hypoactive delirium, more than fifth of patients had hyperactive delirium and also, more than fifth of patients had a mixed type in a study entitled "Incidence and risk factors of postoperative delirium in patients admitted to the ICU after elective intracranial surgery".

Concerning to the symptoms of delirium, the current study mentioned that more than two thirds of the studied patients had psychomotor agitation\retardation and symptoms fluctuation, less than two thirds had altered level of consciousness and inappropriate mood/speech. This study finding was in accordance with

Boettger et al. (2019) who demonstrated that about two thirds of delirious patients had psychomotor agitation\retardation, symptoms fluctuation and altered level of consciousness and inappropriate mood/speech.

Concerning the outcomes of delirium, the current study mentioned that more than one fifth of patients with delirium in the study stayed on mechanical ventilator for duration of ≥ 5 days. From the investigator's point of view, this finding may be due to the higher comorbidities, sepsis, obsessive use of narcotics and benzodiazepines which may be the reason for the longer duration on mechanical ventilator. Also, may be due to complications such as pulling out of the endotracheal tube as a result of agitation which increased the duration of mechanical ventilator and period of stay in ICU.

This study finding was in accordance with **la Cour et al. (2020)** who demonstrated that about fifth of patients with delirium stayed on mechanical ventilator for duration ≥ 5 days in a study entitled "Distribution of delirium motor subtypes in the intensive care unit ".

Also, the current study found that less than two fifths of patients with delirium in the study were re-intubated after self-extubation. From the investigator's point of view, unplanned removal of the connected devices (endotracheal tubes, intravenous lines, nasogastric tubes) represents a distinctive sign of hyperactive delirium and consider as the most frequent outcome for this type. This finding was in contrast with **Chaiwat et al. (2019)** who stated that more than tenth of patients with delirium were re-intubated in a study entitled "Postoperative delirium in critically ill surgical patients: incidence, risk factors, and predictive scores".

As well, the present study revealed that there was statistical relation between types of delirium and studied patients' cognitive dysfunction with p- value <0.05. From the investigator's point of view, this finding may suggest that postoperative delirium and postoperative cognitive dysfunction could be distinct manifestations of neurocognitive deficits, triggered by interactions between surgery, anesthesia, and one or more preoperative vulnerabilities (e.g., inflammation, preclinical Alzheimer neuropathology and blood–brain barrier dysfunction).

This study finding is in accordance with **Huang et al. (2021)** who found that patients with POD were associated with worse cognitive outcomes with p- value <0.05 in a study entitled "Association of postoperative delirium with cognitive outcomes".

Conclusion:

Delirium symptoms among the studied patients included altered level of consciousness, attention, orientation and developed hallucinations, psychomotor agitation / retardation, sleep/wake cycle disturbance, inappropriate mood/speech, and symptom fluctuation. The results showed that the outcomes associated with delirium among patients in the intensive care unit include increase period of stay on the mechanical ventilator, re-intubation, readmission, unplanned removal of tubes or catheters by the patient, increase length of stay in the intensive care unit, increase duration of delirium sign and symptoms and cognitive dysfunction. The incidence of delirium among the studied patients during the postoperative period in the ICU was 23.4%. The results illustrated that there was statistical relation between symptoms of delirium and outcomes of patients during postoperative period in the ICU.

Recommendations:

The results of this study recommended the following:

- A simplified and comprehensive booklet should be available for postoperative patients who suffered from delirium after discharge including information about delirium, therapeutic regime, and self-care.
- Encourage long term multidisciplinary care and follow up visits for postoperative patients who suffered from delirium after discharge to avoid

readmission to hospital and worsening outcomes of patients.
- Patients' assessment for delirium during the postoperative period should be started from the first day of their admission to the intensive care unit.
- Establishing training programs in hospitals focusing on the short and long-term care for patients with delirium during postoperative period.

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