

## Factors Associated with Postoperative Delirium among Geriatric Patients

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### **Abstract**

*Postoperative delirium is one of the most common cognitive disorders facing the geriatric patients undergoing surgery. **Objective:** To identify factors associated with postoperative delirium among geriatric patients. **Settings:** The study was carried out in three general surgical units at The Main University hospital and one surgical unit in Health Insurance hospital in Alexandria. **Subjects:** 100 surgical geriatric patients were included in the study aged 60 years and above, had normal cognitive function, had no depression, received general anesthesia and the duration of their operation not exceeding 4 hours. **Tools:** Five tools were used to collect data through patient's interview and observation namely Socio-demographic and Clinical Data Structured Interview Schedule, Short Portable Mental Status Questionnaire, Geriatric Depression Scale-Short Form, Visual Analog Scale and Delirium Observation Screening Scale. **Results:** Nearly one quarter of the surgical geriatric patients suffered from postoperative delirium and the main factors associated with delirium were age, marital status, level of education, physical status and clinical data of the geriatric patient, length of hospital stay, hospital environment and level of anxiety pre and postoperatively. Also, type and duration of operation affected significantly the occurrence of postoperative delirium. **Conclusion:** Postoperative delirium is a common problem among surgical geriatric patients. Many factors are associated with postoperative delirium either pre, intra or postoperatively. **Recommendations:** Careful assessment of patient's cognitive status on admission to the surgical units of hospital, active participation of family in geriatric patients' plan of care and providing a safe environment.*

### **Introduction**

Postoperative Delirium is defined as a transient, organic mental syndrome characterized by a reduced level of consciousness, reduced ability to maintain attention, perceptual disturbances and memory impairment<sup>(1)</sup>.

In the U.S.A, two studies estimated the delirium on hospital admission to range from 14% to 24% and during hospitalization from 6% to 56%<sup>(2,3)</sup>. Another study in U.S.A revealed that postoperative delirium ranges from <5% following cataract surgery

to as high as 60% after hip replacement<sup>(4)</sup>. In Egypt, Alexandria, the reported incidence rate of delirium among geriatric patients was 18.4 % in the intensive care units<sup>(5)</sup>. Studies in Assiut and Cairo revealed that the incidence rate of postoperative delirium among geriatric patients undergoing radical cystectomy was 30.8%<sup>(6)</sup> and after hip arthroplasty surgery was 32.65%<sup>(7)</sup>. Postoperative Delirium is a common complication afflicting surgical geriatric patients, its onset is short, generally ranging from hours to days and its degree of severity ranges from mild to very severe<sup>(1)</sup>.

In Age related changes play an important role in the increased risk of postoperative delirium among surgical geriatric patients. This is because of the central nervous system physiological changes as decrease in cerebral neuronal density, cerebral blood flow, metabolism, and levels of neurotransmitters as catecholamine, serotonin and acetylcholine. Also, nerve cell degeneration and atrophy which lead to some degree of recent memory loss. Moreover the older adults are more easily distracted, are less able to retain information longer than 45 minutes. Also, the hypothalamus becomes less effective at regulating body temperature and the brain affects the sleep wake cycle which leads to change in the sleep pattern and less anesthetic requirement<sup>(8,9)</sup>.

Other factors include preoperative factors such as age, gender, medical health history, polypharmacy, sleep disorder, hydration status, physical function, psychological factors and sensory impairment of the geriatric patients. Intra-operative factors include type of anesthesia, type and duration of surgery. Lastly, postoperative factors involve oxygen saturation, vital signs, blood glucose level of geriatric patients, and environmental factors such as noise or inadequate light, and unfamiliar objects as monitor or infusion pump<sup>(10)</sup>.

Postoperative delirium can be classified into three types. **The most common type is hyperactive delirium** in which the patient is agitated, restless and often hallucinating. The **hypoactive form** is characterized by lethargy, reduced psychomotor functioning and level of activity. It is considered to be a less common type, as it can be silent, unnoticed, or misdiagnosed as depression. The **mixed type** where the surgical geriatric patients fluctuates from hyperactive and hypoactive forms<sup>(11)</sup>.

Occurrence of Postoperative Delirium causes higher perioperative morbidity and mortality, longer

hospitalization, increased costs and rate of discharge to long term care facilities. Postoperative delirium is usually undetectable and its related factors are still unrecognized because health care providers consider it as part of normal aging or is misdiagnosed with other diseases<sup>(12)</sup>. So, it is important for gerontological nurse to identify the postoperative delirium and its associated factors as early as possible to prevent its negative consequences.

### *Aim of the Study*

To identify factors associated with postoperative delirium among geriatric patients.

### Research Question:

What are the factors associated with postoperative delirium among geriatric patients?

### *Materials and Method*

#### *Materials*

Design: The study followed a descriptive research design.

Settings: This study was carried out in two hospitals in Alexandria, The Main University Hospital and Gamal Abd El-Nasser Health Insurance Hospital. Three general surgical units namely (Anal and Colon surgery, Oncology surgery, Liver and Gallbladder surgery) were selected from The Main University Hospital and one general surgical unit was selected from Gamal Abd El Nasser Health Insurance Hospital. The selection of these units was based on high rate of surgical geriatric patients' admission.

Subjects: Epi info program was used to estimate the sample size based on the following:

Population size: 240

Expected frequency: 50%

Maximum acceptable error: 10%

Confidence coefficient: 95%

Minimum sample size= 96

The study comprised one hundred (100) surgical geriatric patients admitted to the above units and fulfilling the following criteria: age 60 years and above, have normal cognitive function, have no depression, received general anesthesia and the duration of the surgical operation not exceeding 4 hours. The number of patients selected from The Main University Hospital were 57, (17 from Anal and Colon surgery, 27 from Oncology surgery, and 13 from Liver and Gallbladder surgery units). While, number of patients selected from Gamal Abd El-Nasser Health Insurance Hospital were 43.

**Tools:** Five tools were used for data collection:

#### **Tool I: Short Portable Mental Status Questionnaire (SPMSQ)**

It was developed by Pfeiffer (1975)<sup>(13)</sup> and used to assess the preoperative cognitive function of the surgical geriatric patients. This tool consists of 10 items measuring orientation, memory and arithmetic calculation. It was translated into Arabic by “Abd El Salam. R 2012”<sup>(14)</sup> and proved to be valid and reliable  $r = 0.89$ . The total score is 10 and it is classified as: No cognitive impairment (Score 0-2), Mild cognitive impairment (Score 3-4), Moderate cognitive impairment (Score 5-7) and Severe cognitive impairment (Score 8-10).

#### **Tool II: Geriatric Depression Scale–Short Form (GDS-SF)**

This scale was developed by Yesavage (1983)<sup>(15)</sup> to assess the presence of preoperative depression of surgical geriatric patients. This tool consists of 15 statements measuring feeling of happiness, feeling of boredom, and acceptance of life. It was translated into Arabic by “El Husseini S 2013”<sup>(16)</sup> and proved to be valid and reliable  $r = 0.70$ .

The total score is 15: No depression (Score 0–4), Mild depression (Score 5–8),

Moderate depression (Score 9–11) and Severe depression (Score 12-15).

#### **Tool III: Socio-demographic and Clinical Data Structured Interview Schedule**

This tool was developed by the researchers based on relevant literature to collect information related to. **Part I.** Socio-demographic data of the surgical geriatric patients such as (age, sex, marital status, level of education, and place of residence. **Part II.** Medical health history: physical status of the patient, presence of chronic disease before hospital admission, and medications taken. **Part III.** Sleeping hours, hydration status such as amount of fluids consumed per day, capillary refill, skin turgor and duration of fasting before the surgery. **Part IV.** Postoperative data type of surgery, its duration, oxygen saturation, blood glucose level and vital signs. **Part V.** Environmental factors such as presence of inadequate light, night light, noise or unfamiliar devices such as monitors.

#### **Tool IV: Visual Analog Scale (VAS)**

This scale was developed by Cline (1992)<sup>(17)</sup> to assess the pre and postoperative level of anxiety of surgical geriatric patients. It consists of a 100 mm horizontal line labeled at the left side with (not at all anxious) and the right side with extremely anxious. Geriatric patients are asked to indicate their anxiety level by placing x on the VAS. The intended of feeling is scored by measuring the distance from lowest anchor point to the subject’s mark.

This tool proved to be valid and reliable by “Elsakhy. N 2014”<sup>(18)</sup>  $r = 0.81$ .

#### **Tool V: Delirium Observation Screening Scale**

This scale was developed by Schuurmans, Donders Shortridge-Baggett, and Duursma (2003)<sup>(19)</sup> to assess the post operative delirium for surgical geriatric patients. It consists of 13-items of verbal and nonverbal behavior measuring orientation, attention, perception, and memory. It is designed to be used by the

Geriatric nurse to optimize recognition of delirium, and record observations of 3 consecutive shifts (morning, evening and night). The total score is 13 and the cut-off point is 3 where below three indicates absence of delirium and three or more indicates the presence of delirium. This tool was translated into Arabic by the researchers and tested for its contents validity and reliability  $r=0.89$ .

### **Method**

- 1- Permission to carry out the study from the responsible authorities was obtained.
- 2- Survey was done at The Main University Hospital and Gamal Abd El-Nasser Health Insurance hospital by the researcher to select inpatient units with high rate of geriatric surgical patients.
- 3- Tool III Socio-demographic and clinical data structured interview schedule of the geriatric surgical patients was developed by the researchers based on thorough review of literature.
- 4- Tool V (Delirium Observation Screening Scale) was translated into Arabic by the researchers and used to assess postoperative delirium. The content validity was tested by 7 experts in the related fields (Gerontological Nursing, Psychiatric and Mental Health Nursing, Medical Surgical Nursing, Critical Care Nursing, Nursing Education). The scale was tested for its reliability  $r=0.89$ .
- 5- A pilot study was done on 10 surgical geriatric patients selected from the surgical urological unit in The Main University Hospital.
- 6- The researcher used Tool I and II to identify the geriatric patients fulfilling the study criteria.

- 7- The researcher designed a schedule for data collection based on days of the week for the operating theatre in each unit. She interviewed the patients fulfilling the study criteria on the first day of hospital admission to collect the required data using tool III and IV. Time of interview was 45-60 minutes.
- 8- On the first postoperative day, the researchers assessed level of anxiety of the patient using Tool IV. Then, they measured vital signs and blood glucose level of each patient. In case of hyperthermia, hypertension, tachycardia, or hyperglycemia, vital signs and glucose level were remeasured again on the second and third postoperative days to confirm the results.
- 9- Oxygen saturation of each patient was measured by the researcher on the first postoperative day using pulse oximeter.
- 10- Assessment of delirium was carried out by the researcher for each patient three times in any of the three working shifts (morning, evening or night) on the first, second and third postoperative day.

Data collection started from the beginning of March 2014 till the end of June 2014.

### **Ethical considerations:**

Verbal consent from surgical geriatric patients was obtained after explanation of the study purpose. Anonymity, privacy of each patient, and confidentiality of the collected data were assured throughout the study.

### **Statistical Analysis**

Statistical analysis was performed using two tailed tests and alpha error of 0.05. Descriptive statistics (mean and standard deviation) were used to present normally

quantitative data while frequencies and percentages were for qualitative. To test association between different factors and post operative delirium, Pearson Chi Square test was used. Exact test as an alternative to chi square was used for small sample size.

## **Results**

### **1- Sociodemographic characteristics of geriatric patients:**

Of the 100 elderly patients undergoing surgery and included in the study. 67% were 60 to less than 70 years. Males constituted 79.0%. Almost all 87.0% were married. Higher levels of education (secondary or University) were reported by 43.0%. Illiteracy was prevailing among 40.0%. Only 2% of them live alone and the rest with their families. About 51% of them suffered from chronic diseases mainly D.M, hypertension and heart disease. 94%, 87% and 79% of them had intact senses( hearing and visual) and ambulate without aid.

### **2- Occurrence of postoperative delirium:**

Among the studied geriatric patients, 21% developed postoperative delirium.

### **3- Factors associated with postoperative delirium:**

**Table (1)** reveals that postoperative delirium increases significantly with age where 40% of postoperative patients aged 75-85 years developed delirium compared to only 9.8% of those 60 to less than 65 years  $P=0.017$ . As well, marital status, educational level and living condition affected significantly the occurrence of postoperative delirium ( $P=0.000$ ,  $0.001$ ,  $0.006$  respectively). While, no significant relation was observed between gender and postoperative delirium  $P = 0.118$ .

**Table (2)** shows that the presence of chronic diseases and the medication used enhance significantly the occurrence of postoperative delirium  $P=0.00$  (especially Diabetes mellitus, Hypertension and Heart diseases  $P= 0.002$ ,  $0.0009$ ,  $0.000$

respectively). Also, hypoglycemic, antihypertensive and cardiac drugs are significantly associated with postoperative delirium  $P= 0.002$ ,  $0.009$ ,  $0.00$  respectively. Hearing problems 83.3%, visual difficulty and not using aids 100% and those need assistance for mobility 90% were significantly associated with postoperative delirium  $P=0.006$ ,  $P=0.001$ ,  $P=0.001$  respectively.

**Table (3)** shows a significant relation between the duration of hospital stay, previous hospitalization, its frequency and postoperative delirium  $P= 0.001$ ,  $P= 0.00$  and  $0.009$  respectively. Moreover, the type and duration of the surgical operation affected significantly the occurrence of postoperative delirium  $P =0.017$ ,  $P= 0.000$  respectively. The increased preoperative fasting hours, and the inadequate fluid intake, the increased postoperative delirium  $P=0.001$ .  $P=0.00$  respectively.

**Table (4)** shows a significant relation between oxygen saturation, vital signs and random blood sugar and postoperative delirium  $P=0.00$ ,  $P=0.014$ ,  $P=0.00$ ,  $P=0.007$ , and  $P=<0.001$  respectively. As well, amount of fluid intake after the surgery, patient skin condition, its elasticity and capillary refill are significantly associated with postoperative delirium  $P=0.00$ ,  $P=0.001$  respectively. Decreased number of sleeping hours, significantly lead to increase postoperative delirium  $P=0.00$ . Also, Geriatric patients attached to either the central line, with urinary catheter or nasogastric tube had postoperative delirium than those attached to peripheral line or tube drain. The difference was statistically significant  $P= 0.036$ .

It appears from **table (5)** that patient's environmental surrounding including presence of sufficient light and the number of patients per room had a significant relation with postoperative delirium  $P=0.00$ ,  $P=0.00$  respectively.

**Table (6)** shows that Pre and Post operative level of anxiety had a significant relation with postoperative delirium  $P=0.00$ .

### **Discussion**

Postoperative delirium is a common type of delirium which can develop from one to four days after the operation<sup>(2)</sup>. Identifying the factors associated with postoperative delirium is important in its prevention and management. So, the aim of the present study is to identify the factors associated with postoperative delirium among geriatric patients.

The present study revealed that 21% of the studied geriatric patients developed delirium after surgical operations. This result is in accordance with other studies conducted in U.S.A, which reported that the incidence rate of postoperative delirium ranged from 7% to 14% after general surgery among surgical geriatric patients<sup>(20,21)</sup>. A Study conducted by Large et al (2013) in Chicago revealed higher rate (29%) after radical cystectomy<sup>(22)</sup>. Higher rates were also observed in other studies in Egypt namely 32.65% after hip arthroplasty surgery<sup>(7)</sup> and 30.8 % after radical cystectomy<sup>(6)</sup>. These differences may be due to the difference in inclusion criteria of study subjects.

The age of the geriatric patient is significantly associated with postoperative delirium, where geriatric patients aged seventy years or more suffered from postoperative delirium compared to those in the younger age e.g. less than seventy years. This is in agreement with other studies which reported that advanced age is a well established risk factor for postoperative delirium among geriatric patients<sup>(23,24)</sup>. This can be explained by the fact that as the person ages, greater number of normal physiological and degenerative changes in central nervous system occur putting him at risk to develop postoperative delirium.

The present study revealed that elderly persons who live alone experienced

postoperative delirium compared to those living with their families (table 1). This indicated the importance of social relation, interaction and support with elders as this help in cognitive stimulation. In addition, persons living alone usually visit the physician more often, take more medications and have multiple psychosomatic illnesses. This is in accordance with other studies conducted in Canada by Benoit AG et al (2005)<sup>(25)</sup> and Laxton & Perrin (2003)<sup>(26)</sup>.

The present study revealed that as the education level decreases, postoperative delirium risk increases. This may be explained by the fact that greater number of education years lead to more cognitive reserve, and make the patient resistant to neuronal injury<sup>(27)</sup>. This result is supported by another study conducted in U.S.A<sup>(28)</sup>, where one estimates that those who completed seventh grade are at a 60% higher risk for delirium when compared with those who completed high school. Contrary, a study conducted by Tagarakis GI et al (2007)<sup>(29)</sup> in Germany reported no association between educational level and postoperative delirium.

The present study revealed no association between gender and postoperative delirium (table 1). This is in agreement with Abd El Rahman et al (2013)<sup>(6)</sup>. In contrast, a study in U.S.A 2007 reported that females are at higher risk for developing postoperative delirium due to their longevity<sup>(29)</sup>. While another study reported that males have been identified to be at higher risk<sup>(30)</sup>.

The present study revealed that nearly all surgical geriatric patients with at least one or more chronic diseases that require multiple drug intake had postoperative delirium (table 2). This result is in accordance with other studies conducted by Rudolph JL et al and Norkiene I et al (2007) in Boston, and Massachusetts<sup>(31- 32)</sup>.

Stimulation of senses had a significant effect on postoperative delirium. It helps the

elders to be oriented to person, place and time which played a dominant role in cognitive function. In the present study, geriatric patients with visual and hearing problems and not using appropriate aids developed postoperative delirium than those with intact senses (table 2). This is in agreement with other studies in U.S.A<sup>(33,34)</sup>. Moreover, limited mobility and the need for assistance in performing activities of daily living increases the risk of postoperative delirium (table 2). This is in line with the study of Leung JM et al (2006) in California<sup>(35)</sup>.

The duration of the surgical operation and the length of hospital stay affected significantly postoperative delirium (table 3). This may be due to the fact that geriatric patients undergoing surgery for long duration surgery are lying down in the recumbent position for long period, this usually lead to decrease in lung capacity and consequently decrease in the cerebral blood oxygenation. The same was reported in other studies in Europe<sup>(36, 37)</sup>. This Also, the operation process is considered a stressful situation predisposing to cognitive dysfunction. In this context, the study of Rossi G (2010) in California<sup>(38)</sup> reported that the longer the duration of surgery, the more likely the patient to develop postoperative cognitive dysfunction. Moreover, the type of operation seems to be an associated factor with postoperative delirium (table 3). This result is in accordance with other study<sup>(39)</sup>.

Among the preoperative factors that had a positive correlation with postoperative delirium were fasting hours, and fluids intake before surgery (table 3). This may be explained to the fact that long period of fasting may lead to decrease in blood glucose level and fluid volume reaching the cerebral circulation and this in turn, will lead to acute confusion status. As well, decrease amount of fluid intake after the surgery, skin condition, and delayed capillary refill affect the occurrence of postoperative delirium (table 4). As

dehydration status increases, the postoperative delirium risk increases. This can lead to decreased in fluid volume, and cerebral blood flow, which increases the risk of postoperative delirium. This result confirms that of Ganai S et al (2007) in U.S.A<sup>(40)</sup>.

The present study also reveals a significant relation between postoperative factors and postoperative delirium (table 4). Oxygen saturation is positively associated with postoperative delirium. This result is supported by Browne et al (2003) in U.S.A<sup>(41)</sup> who stated that postoperative hypoxia is a risk factor for the development of postoperative cognitive dysfunction. Also, increased blood glucose level, temperature, blood pressure and pulse are associated with postoperative delirium (table 4). This is because high blood glucose level causes disturbance in the cerebral circulation, metabolism leading to delirium. The same result was found in other study<sup>(42)</sup>. Hyperthermia has a harmful effect on the brain cell leading to disturbance in cognitive function and postoperative delirium. This result is in accordance with the study conducted by Gerigore A et al (2009) in Sanfancisco<sup>(43)</sup>. As well, increased blood pressure lead to decrease in blood supply to the brain which has an effect on cognitive functions. The same result was reported by Moritz S et al (2010)<sup>(44)</sup> in U.S.A. Moreover, tachycardia is considered a predictor (act as compensatory mechanism) to increase the cerebral blood flow demand which leads to delirium.

Adequate sleeping hours enhances the concentration, memory, learning, and improves mood. The present study revealed that inadequate sleeping hours had a statistically significant relation with postoperative delirium (table 4). As well, devices attached to surgical geriatric patients postoperatively especially the central line and urinary catheter are associated with delirium (table 4). This may due to the high risk of infection from these

devices. This is in agreement with Dumbrell AC et al (2006)<sup>(45)</sup> in U.S.A.

Pre and Postoperative level of anxiety of geriatric patients, lead to postoperative delirium (table 6). This result is in agreement with that of Ansaloni L, et al (2010) in Italy<sup>(23)</sup>.

### **Conclusion**

It can be concluded from the present study that postoperative delirium is a common problem among surgical geriatric patients. Many factors are significantly associated with postoperative delirium. These include age, marital status, level of education, residence, health condition, and anxiety level of geriatric patients. Duration of surgery, Fluid intake before and after surgery, oxygen saturation, vital signs, blood glucose level, fasting period and sleeping hours affect significantly postoperative delirium.

In addition, length of hospital stay, previous hospitalization, hospital environment and devices attached to the

geriatric patients are associated factors for postoperative delirium.

### **Recommendations**

*Based on the results of the present study the following recommendations are suggested:*

- Educate geriatric nurses about the use of cognition test in order to identify patients at risk to develop postoperative delirium and institute measures for its prevention.
- Develop simple educational booklet about postoperative delirium and make it available in different surgical geriatric units for family members and nursing staff.
- Nurses should avoid interrupting sleep of postoperative patients as much as possible.
- Geriatric nurses should provide the patients with adequate amount of fluid before and after surgery. Stress on the use of visual or hearing aid and provide assistance when needed.



**Table (1): The relationship between socio-demographic characteristics of the geriatric patients and postoperative delirium.**

Sociodemographic characteristics	Postoperative Delirium				Total		P value
	Yes		No		No	%	
	No	%	No	%			
<b>Age in year</b>							
• 60-	5	9.8	46	90.2	51	100	0.017*
• 65-	6	24.0	19	76.0	25	100	
• 70-	6	42.9	8	57.1	14	100	
• 75-85	4	40.0	6	60.0	10	100	
<b>Gender</b>							
• Male	14	17.7	65	82.3	79	100	0.118
• Female	7	33.3	14	66.7	21	100	
<b>Marital status</b>							
• Married	12	13.8	75	86.2	87	100	0.000*
• Widow	6	66.7	3	33.3	9	100	
• Divorced	3	75.0	1	25.0	4	100	
<b>Education level</b>							
• Illiterate	18	45.0	22	55	40	100	0.001*
• Read and write	1	33.3	2	66.7	3	100	
• Primary& preparatory	0	0.0	14	100	14	100	
• Secondary	1	2.7	36	97.3	37	100	
• University	1	16.7	5	83.3	6	100	
<b>Living condition</b>							
• live with Family	19	19.4	79	80.6	98	100	0.006*
• Live alone	2	100	0	00.0	2	100	

\*The difference is statistically significant p 0.05.

**Table (2): Relationship between presence of chronic diseases, medication taken, physical status of geriatric patients and postoperative delirium.**

Presence of chronic disease #	Postoperative Delirium				Total		P Value
	Yes		No		No	%	
	No	%	No	%			
<b>No</b>	2	4.1	47	95.9	49	100	0.00*
<b>Yes</b>	19	37.3	32	62.7	51	100	
• Diabetes mellitus	14	37.8	23	62.2	37	100	0.002*
• Hypertension	6	50.0	6	50.0	12	100	0.009*
• Heart disease	8	72.7	3	27.3	11	100	0.00*
<b>Medication used*</b>	14	37.8	23	62.2	37	100	0.002*
• Hypoglycemic agent	6	50.0	6	50.0	12	100	0.009*
• Antihypertensive drugs	8	72.7	3	27.3	11	100	0.00*
• Cardiac drugs							
<b>Hearing</b>							
• No problem	16	17.2	78	82.9	94	100	0.006*
• Hearing difficulty without using aids	5	83.3	1	16.7	6	100	
<b>Vision</b>							
• No problem	8	9.2	79	90.8	87	100	0.001*
• Visual difficulty without using glasses	13	100	0	0.0	13	100	
<b>Mobility</b>							
• Ambulate without aid	4	5.1	75	94.9	79	100	0.001*
• Need person for help	9	90.0	1	10.0	10	100	
• Use walker or can	6	75.0	2	25.0	8	100	
• Use wheelchair	2	66.7	1	33.3	3	100	

\*The difference is statistically significant p 0.05

# Multiple Response Variable.

**Table (3): Relationship between Preoperative factors of geriatric patients and postoperative delirium.**

Preoperative factors	Postoperative Delirium				Total		P Value
	Yes		No		No	%	
	No	%	No	%			
<b>Length of hospital stay(day)</b>							
• <5	8	12.7	55	87.3	63	100	0.001*
• 5-	6	22.2	21	77.8	27	100	
• 10-	4	66.7	2	33.3	6	100	
• 15+	3	75.0	1	25.0	4	100	
<b>Previous hospitalization</b>							
• No	2	3.3	58	96.7	60	100	0.000*
• Yes	19	47.5	21	52.5	40	100	
<b>Frequency of previous hospitalization</b>							
• One time	9	34.6	17	65.4	26	100	0.009*
• Two time	3	42.9	4	57.1	7	100	
• Three time	7	100	0	0.0	7	100	
<b>Type of operation</b>							
• Upper GIT and liver surgery	4	9.1	36	90.9	40	100	0.017*
• Wound debridement	13	41.9	18	58.1	31	100	
• Lower GIT surgery	8	23.1	10	76.9	18	100	
• Mastectomy	1	20.0	4	80.0	5	100	
• Vascular surgery	0	0.0	3	100	3	100	
<b>Duration of operation (minutes)</b>							
• 60-	0	0.0	69	100.0	69	100	0.000*
• 90-	5	45.5	6	54.5	11	100	
• 120-	13	81.3	3	18.8	16	100	
• 180-	3	75.0	1	25.0	4	100	
<b>Fasting hours</b>							
• 6-	1	2.00	49	98.0	50	100	0.001*
• 8-	16	37.2	27	62.8	43	100	
• 10-	1	50.0	1	50.0	2	100	
• 12-	3	60.0	2	40.0	5	100	
<b>Fluids before surgery(L)</b>							
• <1.5	10	100	0	00.0	10	100	0.00*
• 1.5-2	11	50.0	11	50.0	22	100	
• >2	0	0.00	68	100	68	100	

\*The difference is statistically significant p 0.05.

**Table (4): Relationship between postoperative factors of geriatric patients and postoperative delirium.**

Postoperative factors	Postoperative Delirium				Total		P Value
	Yes		No		No	%	
	No	%	No	%			
<b>Oxygen saturation</b>							
• 90%-95%	19	82.6	4	17.4	23	100	0.00*
• 96%-100%	2	2.6	75	97.4	77	100	
<b>Random blood sugar</b>							
• Normal	8	9.5	76	90.5	84	100	<0.001*
• Hyperglycemia	13	81.3	3	18.8	16	100	
<b>Temperature</b>							
• Normal	19	19.4	79	80.6	98	100	0.014*
• Hyperthermia	2	100.0	0	0.0	2	100	
<b>Pulse</b>							
• Normal	2	3	69	97	71	100	0.00*
• Tachycardia	19	65.5	10	34.5	29	100	
<b>Blood pressure</b>							
• Normal	7	11.9	52	88.1	59	100	0.007*
• High blood pressure	14	34.1	27	65.9	41	100	
<b>Fluids after surgery(L)</b>							
• <1.5	6	85.7	1	14.3	7	100	0.00*
• 1.5-2	5	38.5	8	61.5	13	100	
• >2	10	12.5	70	87.5	80	100	
<b>Skin condition</b>							
• Normal	0	00.0	77	100	77	100	0.00*
• Dry	14	93.3	1	6.7	15	100	
• Extremely dry	7	87.5	1	12.5	8	100	
<b>Skin elasticity</b>							
• Elastic	0	00.0	77	100	77	100	0.00*
• Non elastic	21	91.3	2	8.7	23	100	
<b>Capillary refill time(Sec)</b>							
• Normal	10	11.4	78	88.6	88	100	0.001*
• Delayed capillary refill	11	91.7	1	8.3	12	100	
<b>Sleeping hours</b>							
• 3-5	17	89.5	2	10.5	19	100	0.00*
• 6-7	2	3.6	54	96.4	56	100	
• 8+	2	8.0	23	92.0	25	100	
<b>Devices attached#</b>							
• Peripheral line	17	17.7	79	82.3	96	100	0.036*
• Tube drain	7	41.2	10	58.8	17	100	
• Nasogastric tube	2	50.0	2	50.0	4	100	
• Central line	4	100.0	0	0.0	4	100	
• Urinary catheter	4	100.0	0	0.0	4	100	

\*The difference is statistically significant p 0.05.

# Multiple Response was given.

**Table (5): The relationship between environmental surrounding, devices attached to geriatric patients and postoperative delirium.**

Environmental surrounding	Postoperative Delirium				Total		P Value
	Yes		No		No	%	
	No	%	No	%			
<b>Sufficient lightening</b>							0.000*
• No	18	62.1	11	37.9	29	100	
• Yes	3	4.2	68	95.8	71	100	
<b>Number of patients per room</b>							0.000*
• 1-2	2	4.4	43	95.6	45	100	
• 3-4	15	29.4	36	70.6	51	100	
• 4-5	4	100	0	0.0	4	100	
• 5+							

\*The difference is statistically significant p 0.05.

**Table (6): The relationship between level of anxiety of geriatric patients and postoperative delirium.**

Level of anxiety	Postoperative Delirium				Total		P Value
	Yes		No		No	%	
	No	%	No	%			
<b>Before operation</b>							0.000*
• 1-3(mild)	0	0.0	26	100.0	26	100	
• 4-7(moderate)	7	11.9	25	88.1	59	100	
• 8-10(severe)	14	93.3	1	6.7	15	100	
<b>After operation</b>							0.000*
• 1-3(mild)	6	7.2	77	92.8	83	100	
• 4-7(moderate)	14	93.3	1	6.7	15	100	
• 8-10(severe)	1	50.0	1	50.0	2	100	

**Table (7): Stepwise multiple liner regression analysis of factors associated with postoperative delirium among geriatric patients.**

The strongest factors associated with the occurrence of postoperative delirium among geriatric patients	B	S.E.	P Value
• Duration of operation in minutes	0.405	0.045	0.031*
• Fluids before surgery(L)	0.587	1.990	0.048*

SE= standard error of the un standardized coefficient (B).

\*The difference is statistically significant p 0.05.

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