Factors Affecting Nursing Performance Regarding Complications Post Craniotomy in Neuro-Intensive care unit

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Abstract

Background: Craniotomy is a common neurosurgical procedure despite the potential life-saving benefits of craniotomy, it carries a significant risk of both neurological and systemic complications. There are several factors affect nursing performance. **Aim of the study:** evaluate factors affecting nursing performance regarding complications post craniotomy in neuro-intensive care unit. **Subjects and Methods: Research design: A** descriptive exploratory design.**Setting:** The study was conducted at neuro-intensive care unit and neurosurgical department at Zagazig University, Egypt. **Subjects**: conducted on (40) nurses and (40) patients post craniotomy. **Tools of data collection:** structured interview questionnaire for nurses, factors affecting nurse's performance, observational checklists, and interview Questionnaire for Patients **Results:** 72.5% of studied nurses had unsatisfactory total knowledge about craniotomy while 50% had satisfactory practice level. 32.5% of studied nurses had factors affecting their performance level. The majority of studied patients systemic postoperative complications were nausea, vomiting and urinary tract infection, while the most common neurosurgical post craniotomy complications were cerebral edema, seizures, hydrocephalus, and visual disturbances. There is negative correlation between patients complications and nurses knowledge and practice and total factor. **Conclusion:** three quarter of studied nurses had unsatisfactory total knowledge about craniotomy while one half of them had satisfactory practice level. Slightly less than one third of studied nurses had factors affecting their performance level. **Recommendations** Further studies to evaluate the effect of training or education program on nurses' performance regarding care of patients post craniotomy.

Keywords: *Complications, Craniotomy ,Factors Affecting, Nursing Performance.*

Introduction

Craniotomy is a common and fundamental neurosurgical procedure involving the temporary removal of a bone flap from the skull to access intracranial structures. This approach enables the surgical management of a wide range of neurological conditions, including brain tumors, traumatic brain injury (TBI), intracerebral hemorrhage, cerebral aneurysms, and refractory epilepsy. The procedure allows direct visualization and precise intervention while preserving surrounding brain tissue **(Smith &Batjer, 2024)**.

Despite the potential life-saving benefits of craniotomy, the procedure carries a significant risk of both neurological and systemic complications, especially in the early postoperative period. Neurological complications are among the most concerning and may include intracranial hemorrhage, cerebral edema, seizures, stroke, new or worsened neurological deficits, and increased intracranial pressure (ICP) **(Tomasiewicz et al., 2020)**.

While systemic complications due to the invasive nature of the surgery, patient comorbidities, and the effects of general anesthesia include deep vein thrombosis (DVT), cardiovascular instability, electrolyte imbalances, urinary tract infections, gastrointestinal disorders, and pulmonary problems (such as pneumonia or atelectasis) **(Wu et al., 2024).** Additionally, surgical site infections (SSIs) and cerebrospinal fluid (CSF) leaks pose serious risks, often requiring further medical or surgical intervention **(Patel et al .,2019).**

These complications can lead to delayed recovery, prolonged hospitalization, and in some cases, permanent disability. Additionally, cognitive impairments such as memory loss, language difficulties, and decreased level of consciousness are not uncommon, particularly when surgeries involve eloquent brain areas (**Wang et al., 2021).**

Effective postoperative nursing care plays a crucial role in the recovery of patients undergoing craniotomy. Postoperative nursing care is a fundamental component of the management plan following craniotomy. Nurses are responsible for early detection of complications. The nursing responsibilities are dynamic and must be tailored according to the patient's condition and the risk of complications during specific postoperative time frames. These are typically divided into three phases: immediate care (first 6 hours), early care (within the first 24 hours), and ongoing care (after 72 hours) **(Shady et al., 2025).**

Nursing performance in managing post-craniotomy patients is a corner stone of successful recovery, as these patients are vulnerable to rapid deterioration and life-threatening complications. The quality of nursing care directly influences outcomes such as infection rates, neurological stability, and length of hospital stay. Several categories of factors shape nursing performance, including individual nurse-related factors, organizational and environmental factors, and patient-related complexities **(Kim et al., 2021).** Individual nurse-related factors include the nurse's knowledge base, skills, clinical judgment, and experience in neurocritical care **(Al-Moteri et al., 2020).**

Many factors may affect nurses caring of patients post craniotomy and affecting their ability to apply its components such as lack of nurses' knowledge, inadequate time, shortage of nursing staff, increased work load and unavailability of supplies and equipment's; So, it is important to understand nurses' perceptions and to comprehend what factors influence their care to patients, because of their vital role in the global provision of health care **(Taha & Moghazy, 2024):**. By identifying these factors, healthcare institutions can implement targeted interventions to enhance nurses' competencies, reduce postoperative complications, and improve patient safety and outcomes in neurosurgical units **(Abdullah et al., 2024).**

Significance of the study:

Craniotomy is a vital neurosurgical procedure that allows direct access to the brain for the diagnosis and treatment of various intracranial conditions. Its importance lies in its ability to relieve life-threatening pressure, remove abnormal growths, repair damaged tissues, and improve neurological function. The procedure is often life-saving and can significantly enhance a patient's quality of life when performed with precision and followed by comprehensive postoperative care (**Sato et al .,2021).** Complications post craniotomy continue to be a major concern for medical professionals, common issues such as

hemorrhage, cerebral edema, cognitive impairments, behavioral abnormalities, electrolyte imbalances, infections, seizures, venous thrombosis, and hydrocephalus, prompt identification and effective management of these problems play a crucial role in achieving positive patient outcomes **(Hassan & Masror-Roudsary, 2023).**

Effective nursing practice minimizes risks post craniotomy such as increased intracranial pressure, hemorrhage, seizures, and hospital-acquired infections, enhance patient safety, and reduce postoperative morbidity **(Shady et al., 2025).** Nurses should have special skills and knowledge to prevent complications because they are the person who spends the most time caring the patient. Nurses should have the ability to maintain the patient's physiological and psychosocial stability after craniotomy with responding to their unique needs. Nurses should be able to provide safe, healing and caring environment, and capable to adapt to any change that happened to patients' condition (**Mofatteh et al., 2023)**. Therefor, this study aimed to assess factors affecting nursing performance regarding complications post craniotomy in neuro-intensive care unit.

Aim of the study:

Assess factors affecting nursing performance regarding complications post craniotomy in neuro-intensive care unit

Research Questions:

- What is the level of nurses' knowledge regarding complications post craniotomy?
- What is the level of nurses' practice regarding complications post craniotomy?
- What are factors affecting nursing performance regarding complications post craniotomy?
- What is the patient health status post craniotomy?

What is the patient s' complications post craniotomy?

Subjects and Methods

Study Design:

To conduct this study, A descriptive research design was utilized.

Setting:

The current study was conducted in Neuro- intensive care unit and neuro-surgical department at accidental hospital, at Zagazig University Hospitals.

Subjects:

The study sample was a convenience sample which includes all available nurses (40) working in the above mentioned setting and a purposive sample of (40) patients who fulfilling the inclusion criteria ;(Any cause or indication of craniotomy, Both sexes, Age between 20-60years old and Mild and moderate cases only).

Tools of data collection:

Structured interview questionnaire for nurses and composed of five parts as the following It was adapted from **(Abd Elhaleem Et al .,2024).**

Part 1: Nurse's demographic characteristics

It composed of seven closed ended questions including (nurses'age, gender, qualification, marital status, experience years , attendance training courses about craniotomy and care of craniotomy, and presence of guideline about nursing care post craniotomy

Part2: Questions to assess nurses knowledge regarding anatomy and physiology of central nervous system :

It consisted of (12) MCQ questions such as (parts of CNS, parts of brain, functions of skull, functions of CSF, lobes of brain…etc) .

Part3: **Nurses' Knowledge assessment regarding craniotomy:**

It consisted of six MCQ such as (definition, indication, causes, complications ,diagnosis ,and how many hours for craniotomy surgery) .

Part4: Nurses' Knowledge assessment regarding postoperative care of craniotomy: It composed of 21 MCQ questions covered priorities of nursing care, nursing observation ,nursing intervention ,medications, discharge instruction**.**

Part5: Nurses' knowledge assessment regarding complications of craniotomy: It composed of 20 MCQ questions about increase intracranial pressure, hypovolemic shock, care of convulsions and seizures.

Scoring System:

Scoring system for the knowledge items**,** the correct answer was scored one grade, zero for incorrect answer and the maximum score was 59. For each area of knowledge, the scores of the items were summed – up and the total divided by the number of the items, giving a mean score for the each section and total score. These scores were converted into percent scores. Knowledge was considered satisfactory if the percent score was equal or above 80% for nurses, 60% for patient and unsatisfactory if less than 80% for nurses, 60% for patient based on statistical analysis.

Observational checklists for nurses :

It adapted from **(Abd Elhaleem et al .,2024).** It consist of three main parts (Immediate care, nursing care during first 24 hour and nursing care post 72 hr) post craniotomy as the following :-

Part I: Immediate postoperative care include the following procedures: Composed of three items first items covered **ABCDE** (with 27steps) covering airway (six steps), breathing (six steps), circulation (12 steps), disability (one step), exposure (tow steps). Second item check vital signs (six steps). Third items is Positioning and medication (three steps). Total steps (36) steps.

Part II: Nursing care during the first 24 hour composed of 15 items including assessment of neurologic status (five steps), measure vital signs (seven steps), relieving pain and preventing seizures (four steps), care of the patient on mechanical ventilator(six steps), wound dressing care (five steps), central venous catheter care(seven steps), urinary catheter care (five steps) nasogastric tube care (four steps), care of arterial line(four steps), monitor fluids and electrolyte level(four steps) monitor infection control measure(four steps), monitor blood glucose level(one step), monitoring ICP (five steps), patient safety(three steps) DVT prophylaxis(five steps). total steps (69) steps.

Part III: Nursing care post 72 hours post craniotomy: It is composed of five items, firstly covering continuous monitoring of general status to patient (11steps) with three sub-items where assessing vital signs (five steps), assess neurological status(three steps) and maintain hydration status(three steps).Secondly, diet and oral intake(six steps). Thirdly, prevention of wound infection (eight steps) .Fourthly, bed sores prevention (seven items).Fifthly, psychosocial adjustment (10 items) . Total steps (42).

Scoring system:

Scoring system for the practice items, the items observed to be done correctly were scored one and the items not done or incorrectly were scored zero. The score of the items were summed- up and the total divided by the number of the items. These scores were converted into percent score. The nurse had satisfactory level of practice when the total score equal or above 80% and unsatisfactory if it below 80% based on statistical analysis .

Factors affecting nurse's performance regarding the care and complications post craniotomy

It consisted of 70 questions about nurses related factors (24) questions (six questions Physical, eight questions Psychological, five questions social and economic, five questions Professional) and 10 questions Patients related factors as (Age ,sex ,health status …etc) and 36 questions about work related factors (Increase burden, lack of experience, Lack of training , Lack of equipment ,work hour…etc). It adapted from **(El Desouky et al., 2020).**

Factors scoring system: Each factor item that found to affect nurses' performance was scored one, while factor that unaffected was scored zero. The scores of the three factors were summed up and the total divided by the number of the items, giving a mean score for the total factors. This was converted into a percentage score. The factor was considered to have a high influence or affected on nurses' performance if the percentage score was ≥ 60% and unaffected on nurses' performance if <60%based

on data entering and statistical analysis.

Interview questionnaire for patient:

It was adapted from **(Abdelmowla et al., 2020)** after modification. Divided into four parts:

Part I: Personal characteristics of the studied Patients :

Consisted of six closed ended questions including patient's age, sex, marital status, level of education, occupation, and residence.

Part II: Medical history of patients:

Consisted of 10 closed ended questions covering smoking, alcohol or drug abuse, chronic disease, onset of disease, presence of trauma, duration of stay in ICU, previous neurosurgery.

The scoring system:

Each items with (Yes) was scored one and the (No) scored zero. The score of the items were summed-up and the total divided by the number of the items. These scores were converted into percent score.

Part III: : Patient assessment questionnaire :It included five Sections.

Section A: Level of Consciousness (Glasgow coma scale):

Consisted of the three responses (eye opening, verbal response, and motor response) fully conscious patient scored 13-15, patient with semiconscious level scored 9-12 moderate and patient with un conscious level scored eight or less**.**

Section B: Vital Signs Recording Chart

Covered temperature , pulse, respiration and blood pressure measurement in the first, second and third day post craniotomy.

Section C: Assessment of Motor Function:

Consisted of four items including muscle size, muscle tone, muscle power and involuntary movements.

Section D: Assessment of Laboratory Investigation

Consisted of five lab investigation as Blood picture, Blood sugar, Kidney Function , Prothrombin and Serum electrolytes (Na^+,K^+).

Section E: Assessment of Diagnostic procedure:

Consisted of six diagnostic test as X- rays ,CT scan , EEG , Angiography MRI and CSF analysis.

Scoring system:

Each items was occurred scored one and was not occurred scored zero. The score of the items were summed- up and the total divided by the number of the items. These scores were converted into percent scores.

Part IV: Assessment patients'complications:

was adapted from **(Abdelmowla et al.,2017).** It included two main items, systemic postoperative complications and neurosurgical postoperative complications as the following:

First : Systemic postoperative complications:

covered eight complications, including, anesthesia complications, pulmonary complications, cardiovascular complications, gastrointestinal complications, metabolic complications, thromboembolic complications, potential complications related to hospitalization, age and concurrent medical conditions and wound complication.

Second: Neurosurgical postoperative complications:

It consisted of 20 complications such as: cerebral edema ,brain or nerve damage ,stroke, behavioral changes, CSF leak, diabetes insipidus, intracranial hemorrhage, pneumocephalus postoperative hematoma, seizures, vasospasm, visual disturbances, sphincter disturbances,residual neurological problems, meningitis, brain abscess, speech disturbances, brain herniation.

Scoring system:

Total scores was summed up for each complication present.

Content validity and Reliability:

The tools were revised by a panel of five experts from medical-surgical nursing staff who reviewed the tool's content for clarity, relevance, comprehensiveness, applicability, understanding, and ease for

implementation. All recommended modifications were done.The reliability of tools was tested by measuring their internal consistency. It demonstrated a good level of reliability with Cronbach's Alpha as preventive measures was 0.815 for knowledge, 0.933 for Observational Checklists for nurses practice. While factors that affect nursing practice was 0.830

Table test of reliability of study tools by Cronbach's Alpha

Tool	Cronbach's Alpha	No. of Items
Knowledge	.815	58
Observational Checklists for nurses practice	.933	147
factors that affect nursing practice	.830	72

Filed work:

Field work of the present study was executed in 12 months from June 2024 to the end of August 2025 as the following two monthes prepare literature review, tow monthes prepare the tool, four monthes collect the data, two monthes statistics and two monthes write the tables, discussion and recommendation.

The first phase of the work is the preparatory phase that done by meeting with head units for the mentioned siting after obtaining the official permissions, to clarify the objective of the study and applied methodology.

The second phase that done by meeting the study subjects, each nurse was met individually, got a full explanation about the aim of the study and was invited to participate. The nurse who gave his/her verbal informed consent to participate was handed the self-administered questionnaire and was instructed during the filling. The same was done with patients.

The data were collected five days a week (Saturday to Wednesday) in the morning and afternoon shifts, the time used for finishing the self- administered questionnaire ranged between 20-30 minutes for each nurse according to nurses' physical and mental readiness and for nurses practice, also the researcher was observing nurses' practical skills about studied procedures. Patient data were collected in the same time of week and shifts. The time used for finishing the each questionnaire ranged between 20-30 minutes for each patient according to patient state and availability of patients files.

Pilot study:

A pilot study was done on five nurses and patient (10%)of total sample size excluded from the main study sample . The goal of the pilot study was to check the clarity, applicability, relevance and feasibility of the tools, to identify the difficulties may be faced during the data collection. It also helped to estimate the time needed to fill in the sheets. Simple modifications were done in the tool according to expertise recommendations.

Administrative and Ethical consideration:

First, the study proposal was accepted by the Zagazig University Faculty of Nursing's Post Graduate Committee and Research Ethics Committee (REC) with the code of EG ZU.NUR/216/10/6/2024

Before starting any step in the study, An official permission for data collection in Zagazig University Hospitals was obtained from the hospital administrative personnel by the submission of a formal letter from the dean of the faculty of nursing Zagazig University explaining the aim of the study in order to obtain permission and help.

Following full explanation of the study's aim, each participant provided their informed consent to participate. Participants were given the right to refuse participation and were informed that they could withdraw at any time while filling out the questionnaire.

Statistical analysis:

All data were collected, tabulated and statistically analyzed using SPSS 20.0 for windows (SPSS Inc., Chicago, IL, USA 2011). Quantitative data were expressed as the mean ± SD & (range), and qualitative data were expressed as absolute frequencies (number) & relative frequencies (percentage). Percent of categorical variables were compared using Chi-square test or Fisher's exact test when appropriate. Pearson's correlation coefficient was calculated to assess relationship between various study variables, (+) sign indicate direct correlation & (-) sign indicate inverse correlation, also values near to 1 indicate strong correlation & values near 0 indicate weak correlation. Multiple linear regression is used to describe data and to explain the relationship between one dependent continues variable and one or more independent variables. All tests were two sided. p-value < 0.05 was considered statistically significant, p-value ≥ 0.05 was considered statistically insignificant. All tests were two sided. p-value < 0.05 was considered statistically significant (S), and p-value ≥ 0.05 was considered statistically insignificant (NS).

Results:

Table 1: show that more than half (57, 5%) of studied nurses below 30 years, with mean± SD 28.3±4, range from 22 to 37 years. The three fifths (60%) of nurses were male and having working experience less than 5 years. More than half them (52. 5%) of were married and having a bachelor's degree. Only 35% of studied nurses were received training courses about skull surgeries while 52.5% reported that there guidelines about skull surgeries in ICU.

figure (1): Percent of studied nurses' knowledge regarding care of patients post craniotomy was 27.5% of nurses had satisfactory knowledge level and 72.5% unsatisfactory knowledge level .

figure (2): found that one half (50%) of studied nurses had satisfied level. However 50% of them had unsatisfied level, with allover (mean± SD) (116.6±18.7) and range from 84 score to 144.

Figure (3): indicates the most prominent factor affecting nursing performance regarding nursing care after cranial surgeries were work environment, (82.5%). Followed by nurses' social and economic factor (40%), work-specific factors (40%). Then professional factors, patient-specific factors, work organization (37.5%) foreach. After that; mental health factors (32.5%), beer relationship (27.5%), nursing and doctor relationship (25%). On the contrary, the lowest percentage (22.5%) was related to nursing-related factors, mainly physical factors (20%).

Table 2: Reveals that more than one half (52.5%) of patients their age ≥45 years old, with mean 44.4±6, ranged from 33 to 55 years. (55%) of studied patients were males and educated, (40%) of them were worked. The majority (85%) of studied patients were married. Additionally, 50% of studied patients living in rural area.

Table 3: showed variability in systemic postoperative complications which happen for patients that nausea, vomiting and urinary tract infection represent mostly of patient (95%).

figure (4):show the most common neurosurgical postoperative complications: of patients were cerebral edema, seizures, postoperative hydrocephalus, visual disturbances, in 77%, 70%, 70%, 65% of patients respectively, then postoperative hematoma, behavioral changes, residual neurological problems, pneumocephalus, sphincter disturbances in (45%, 40%, 37.5%, 27.5%,22.5%) of patients respectively. In addition, 17.5% of patients were suffering from intracranial hemorrhage, brain nerve damage for each. Also speech disturbances were in 15%. While the least neurosurgical postoperative complications were stroke, vasospasm, and brain abscess in 7.5% of patients for each one. Lastly meningitis was defined in 5% of patients.

Table 4: showed that there is significant and direct association between knowledge score, factor score, and practice score. While is significant and inverse association between Knowledge score ,with number of complication which happen for patients

Also, this table showed that there is significant and direct association between factor score with practice score. While is significant and inverse association with number of complications which happen for patients.

In addition, this table showed that there is significant inverse association between practice score with number of complications which happen for patients.

Table 1: Frequency and Percentage Distribution of Demographic Characteristics of Studied Nurses (n=40):

Demographic characteristics	No.	%
Age groups		
<30 years	23	57.5
≥30 years	17	42.5
Mean ±SD	28.3±4	
median (range)	28(22-37)	
Sex		
Male	24	60.0
Female	16	40.0
Marital Status		
Single	18	45.0
Married	21	52.5
Other	1	2.5
Qualification		
Diploma	1	2.5
Technical Institute	18	45.0
Bachelor's Degree	21	52.5
Experience years		
<5 years	24	60.0
≥5 years	16	40.0
Mean ±SD	4.5±1.7	
median (range)	4(2-10)	
Training courses about craniotomy		
Yes	14	35.0
No	26	65.0
Guideline for craniotomy In ICU		
Yes	21	52.5
No	19	47.5

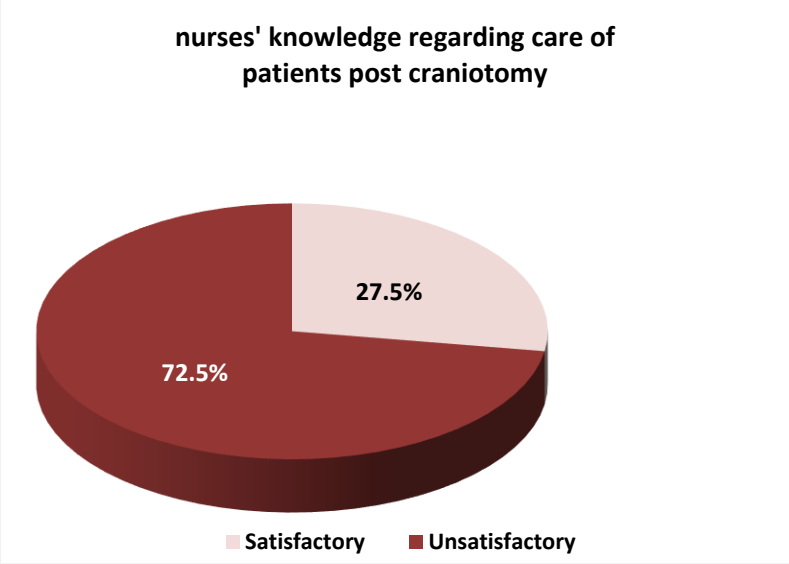


figure (1): Percent of studied nurses' knowledge regarding care of patients post

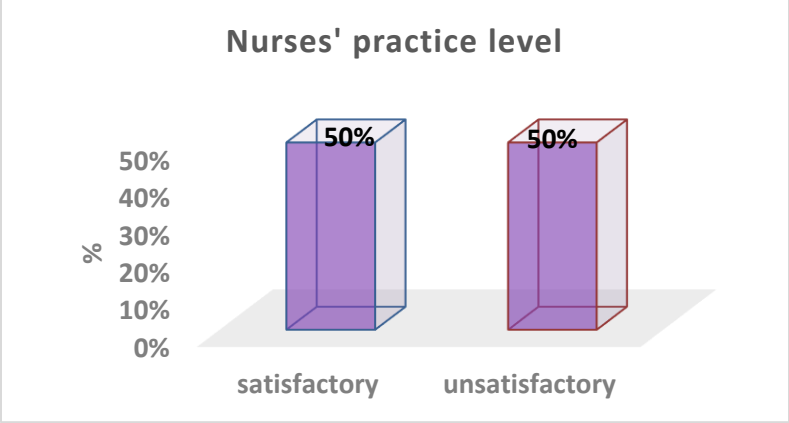
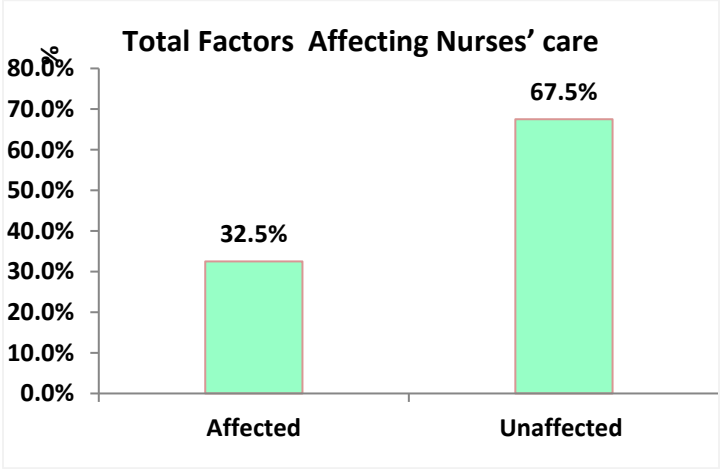


figure (2): Percent of studied nurses' practice post craniotomy was 50% of nurses had satisfactory practice level and 50% unsatisfactory .



Figure(3): Factors Affecting nurses care post craniotomy

Table (2): Frequency Distribution of Personal Characteristics of Studied Patients (n=40):

Variables	N0.	%
Age per years	19	47.5
<45 years	21	52.5
≥45 years		
Mean ±SD	44.4±6	
Median(range)	45(33-55)	
Sex		
Male	22	55.0
Female	18	45.0
Education		
Educated	22	55.0
not educated	18	45.0
Occupation		
Work	16	40.0
not work	24	60.0
Married status		
Single	6	15.0
Married	34	85.0
Residence		
Rural	20	50.0
Urban	20	50.0

Table 3: Frequency and Percent Distribution Systemic Post craniotomy Complications of Patients Complication (n=40):

Postoperative systemic complications	No.	%
Anesthesia complications		
Allergic reaction to anesthesia	2	5.0
pulmonary complication		
Pneumonia	18	45.0
Postoperative atelectasis	8	20.0
Respiratory failure	9	22.5
Pulmonary embolism	10	25.0
Neurogenic pulmonary edema	12	30.0
Cardiovascular complications:		
Hypotension	13	32.5
Hypertension	15	37.5
Bradycardia	5	12.5
Tachycardia	13	32.5
Heart failure	3	7.5
Gastrointestinal complication		
Nausea	38	95.0
Vomiting	38	95.0
Gastric irritation	37	92.5
Gastric stress ulceration	10	25.0
Hemorrhage	4	10.0
Diabetes insipidus	7	17.5
Hyperglycemia	13	32.5
Hypernatremia	12	30.0
Thromboembolic complications		
: DVT	21	52.5
Potential complications related to hospitalization, age and concurrent medical conditions:	3	7.5
Pulmonary embolism	8	20.0
Myocardial infraction	38	95.0
Urinary tract infection	8	20.0
Pressure sores		
Wound complication		
Reaction to blood transfusion:	9	22.5
Impaired wound healing	22	55.0
Wound infection	21	52.5

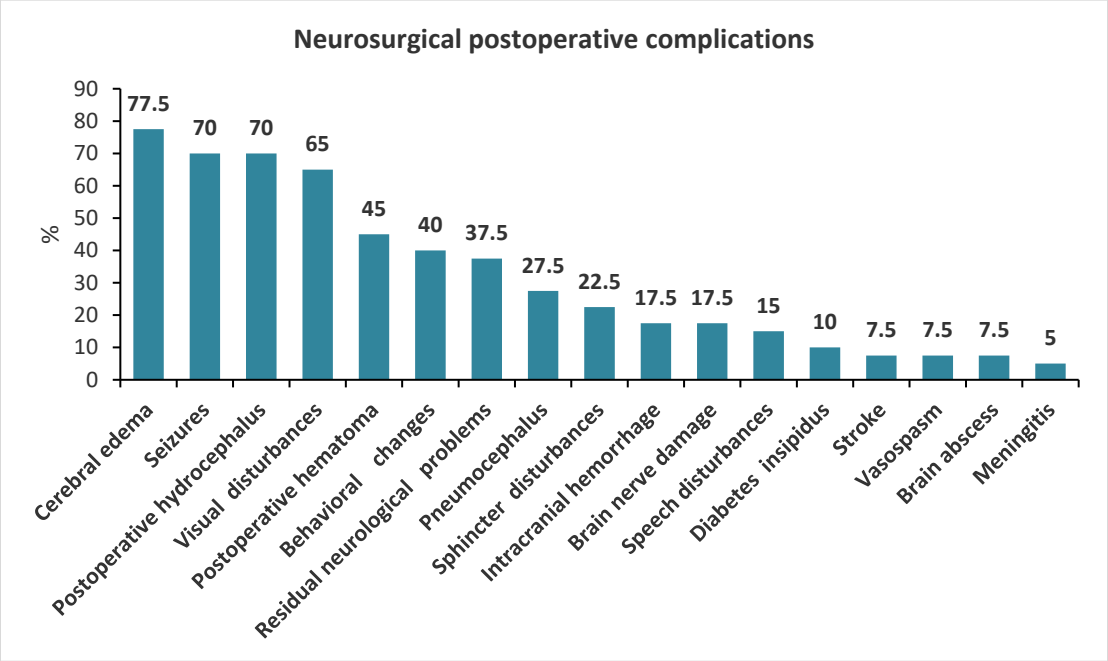


Figure 4: percent of neurosurgical postoperative complications: of patients

Table 4: Correlation Matrix between Knowledge Score, Factor Score, Practice Score and Number of Complications which Happen for Patients (n=40):

Predictors	B	Std. Error	T	Sig.	R	R^2
(Constant)	30.664				0.708	0.501
Knowledge score	-.324	.057	-5.719	.0001		
Practice score	-0.143	.041	3.469	.001		
Factor score	-.190	.067	-2.813	.008		

Discussion:

The result of present study clarified that more than half of studied nurses below 30 years, with mean± SD 28.3±4 ,range from 22 to 37 years. The three fifths of nurses were male and having working experience less than 5 years. More than half of them were married and having bachelor's degree .This may be due to high percentage of graduated male were usually assigned for bedside nurse in the ICU according to hospital policy and our cultural recommended the marriage in young age . the current study agree with various studies about craniotomy procedure in different settings in Egypt, **AbdElhaleem,(2024)** in her study about "Nurses' Performance for Caring of Patients during the First 48 Hours Post Brain Tumors Craniotomy at El Fayoum university hospital" who found that the mean age among study nurses was (24.4±2.3) years old ranged between (20 and 29) years and agreed with **Pervaiz & Yousef, (2021)** who applied study in Lahore Pakistan entitled "Knowledge and practice of Nurses' about post operated pain management at neurosurgery department in Tertiary Care Hospital" who stated that mean age among study nurses was (1.53±.577) years old ranged between (20 and 30) years.

Regarding gender and marital status, the present study consistent with **Kreem et al., (2019)** who applied study in Kufa, Iraq entitled "Effectiveness of educational program on nurses' knowledge regarding pre they found post-operative nursing management" they found that highly percentage of the studied nurses were male while less than half of them were single, and also consistent with **Abd**

Elhaleem et al.,(2024) that more than half of the studied nurses were males, but disagree with current study in more than half of them were single.

According to educational level, The results revealed that, more than half of them were having bachelor's degree. This may be due to majority of the nurses graduated from faculty of nursing. From the researcher point of view, this may be because many bedside nurses in governmental hospitals looking for complete the faculty of nursing and ICU work need high qualified nurses.

The current findings were supported by **Alnajar et al., (2019)** who conducted a study in Jordan under titled "Knowledge and attitudes toward cancer pain management among nurses at oncology units" they revealed that the majority of the studied nurses had bachelor's degree in nursing.

According to experience and training courses, the study reported that three fifths of the study nurses had experience less than 5 years, While less than half the studied nurses received training courses about brain craniotomy. In my opinion, this finding may be due to most nurses may have lack of time, heavy workload in their units, no availability of training program produced to them from hospital and new graduated working in ICU.

These findings were differed from **Clement et al., (2019)** who done study entitled "Effectiveness of SIM on Care of Patient with Craniotomy among Staff Nurses Working in Neurological Units" they reported that less than half of the studied nurses had experience from 1 to 5 years and less than two thirds of them didn't attend any program regarding care of patient with craniotomy.

On the other hand, **Ammash & Ahmed, (2023)** they conducted study entitled "Effectiveness of an Educational Programe on Nurses knowledge about Craniotomies Complications" they found that years of experience of the studied ranged from 5 to 15 years (mean= 7.5 years), while **Ahmed et al., (2021)** They conducted study entitled "Assessment of Nurses Performance Regarding External Ventri-cular Drain among patients with Brain Tumor" they revealed that more than two thirds of them attended previous training courses.

On the light of the current study, the results indicated that more than one quarter of studied nurses had satisfactory knowledge level. However, about three quarter of them had unsatisfactory knowledge level, with allover (mean± SD) (33.78±11.43) and range from 9 score to 54. This could be attributed to lack of training courses, guidelines, and working experience less than 5 years.

This result was matched with **El-Maksoud et al., (2019)** who done study in Alexandria under title "Impact of a Nursing Educational Program on the Expected Postoperative Outcomes of Patients Undergoing Brain Surgeries" they showed that highly percentage of the studied nurses had unsatisfactory level of knowledge. Also this result aligned with **Kreem & Hamza, (2019)** they showed that most of nurses in surgical units had knowledge deficit concerning management regarding pre and post-operative nursing management. Inaddition, **Ammash & Ahmed, (2023)** they found that the majority of nursing staff lacked sufficient understanding knowledge of craniotomy complications.

Also agree with **Gamal et al.,(2023)** they apply study on "Effect of Guidelines Regarding Care of Intracranial Hypertension Patients on Critical Care Nurses' Knowledge and Practices" that quasi-experimental study showed more than half of studied nurses had unsatisfactory knowledge level. Too agree with **Abdelrahman & El-Sayed,(2023)** they apply study on "Impact of a Nursing Educational Program on the Expected Postoperative Outcomes of Patients Undergoing Brain Surgeries " and they found only one quarter of sample had satisfactory knowledge and level .

the current study result illustrated that, one half of studied nurses had satisfied level of practice. However, half of them had unsatisfied level, with allover (mean± SD) (116.6±18.7) and range from 84 score to 144. From the researcher point of view this result may be due to lack of knowledge, training, guidelines, and equipment, there many factors affecting nurse performance.

The current study findings agree with **Jasim et al., (2023)** they found Nurses and caregivers who provided post-craniotomy care were evaluated in a quasi-experimental manner. Prior to the intervention, most participants performed poorly post-operative care procedures. Prior to using the educational program, only 18% of participants had scores in the satisfactory level. Too agree with **Abd Elhaleem**

et al., (2024). they found that two third had satisfactory practice levels regarding postoperative care for brain tumor craniotomy patients. Also agree with **Gamal et al.,(2023)** that quasi-experimental study showed more than half of studied nurses had unsatisfactory levels .

The current study findings were disagree with a study done in Egypt by **Ahmed et al., (2021)** they found that more than three quarters of studied nurses were competent in caring of external ventricular drain with brain tumor while, less than one quarter of them were incompetent. Also, disagreed with **Jasim et al., (2023)** who found that the majority of the nurses had poor practice concerning patient with craniotomy. In addition to **(Wu et al., 2024).** who applied study entitled "Assessment of nurses' knowledge and practice on measures to prevent increase in intracranial pressure among neurosurgical patients" who showed that most of the studied nurses had poor practice regarding prevention of increased intracranial pressure among neurosurgical patients.

Too agree with **Abdelrahman & El-Sayed,(2023)** they apply study on "Impact of a Nursing Educational Program on the Expected Postoperative Outcomes of Patients Undergoing Brain Surgeries " and they found only one quarter of sample had satisfactory practice level . Also these findings were contradicted with **Shady et al ., (2022)** who concluded that the studied nurses had unsatisfactory level of skills regarding of staff nurses regarding care of craniotomy patient.

it was found that slightly less than one third of studied nurses factors affecting their performance level. One other hand ,mor than half of them unaffected level, with allover (mean± SD) (35.25±11.91) and range from 20 score to 63. In the researcher's view the majority of nurses stated that these factors had no discernible impact on their performance. Their great adherence to hospital protocols, regular handling of neurosurgical cases, sufficient professional experience, and established abilities in managing critical postoperative situations may all be responsible for this. Even under trying situations, these strengths probably help maintain a consistent performance level.

This result was matched with **Al Maaitah et al., (2024)** who done study under title " Predictors of clinical performance among emergency nurses " they showed that was discovered that little less than one-third of the nurses in the study had factors influencing their performance level. On the other hand, the overall (mean± SD) score ranges from 20 to 63, with 67.5% unaffected.

In corbarated to **Gizaw et al., (2023)** who done study under title " Job performance and associated factors among emergency department nurses in Addis Ababa " they showed that seventy-five percent of the 172 emergency nurses performed well in Workload, decrease payment, incentive programs, awareness of job goals. Also **Al Qadire & Aljezawi, (2018)** who done study under title " Caring performance of newly graduated nurses " they showed that work stress and financial issues were identified as performance-affecting factors.Also similarity to **Wai et al., (2023)** in a study entitled " Factors affecting nursing job performance among staff nurses in Yangon", they presented that Work demands, resources, and role clarity were major influencing factors, but most nurses reported inadequate coping and support.

The present study revealed that more than one half of patients their age ≥45 years old, with mean 44.4±6, ranged from 33 to 55 years. More than half of studied patients were males and educated, less than half of them were worked. The majority of studied patients were married. Additionally, one half of studied patients living in rural area. The present study was in harmony with **Orringer et al., (2020)** who apply study on "Effectiveness of an Interventional Program on Patient's Performance About Self-Care After Craniotomy Surgery" they reported that more than half the sample is men, married patient was the greater ratio of sample.

Furthermore, this result was comparable with **El Ashery et al., (2024)** they stated that less than two-thirds of the patients who underwent brain surgery lived in rural areas, between the ages of 40 and 60, and more common in men. Also, **Eigl et al ., (2024)** supported this result in study about "Brain Tumors Excision Guided by Neuronavigation: Practical Application and Results" who clarifie that brain tumors are more common in men than in women, with a mean age of 47. The current study showed variability in systemic postoperative complications which happen for patients that nausea, vomiting, and urinary tract infection represent mostly of patients.

On the same hand, with **Uribe et al,. (2021)** who carried out study on Postoperative nausea and vomiting (PONV) after craniotomy: an evidence-based review of general considerations, risk factors, and considerations, conducted a comprehensive review and found that the incidence of post operative nausea and vomiting (PONV) after craniotomy ranges from 22% to 70% without prophylactic treatment.
Likely, **Freeman et al., (2023)** they done study on "Most Common Post-Surgery Complications." That report Urinary tract infection and post operative nausea and vomiting (PONV) are among the most common systemic complications postoperatively, especially due to catheters and anesthesia .In the same line with **Li et al., (2019)** they conducted study on "Risk factors for intracranial infection after craniotomy: A case–control study." Identified as a common hospital-acquired infection post-neurosurgery, but not universal (not up to 95%).
On the other hand, **Sanchez-Ledesma et al., (2022)** they apply study on "Postoperative nausea and vomiting after craniotomy: incidence and risk factors." performed a prospective study on 229 patients undergoing craniotomy and reported an overall Postoperative nausea and vomiting incidence of less than half. They identified female sex and the absence of steroid administration as significant risk factors. Furthermore, this result was contraindicated with **Pruitthithada (et al., 2020)** they apply study on "Postoperative Nausea and Vomiting in Neurosurgical Patients." That reported less than half had nausea and vomiting within 72 hours post-craniotomy.

Regarding neurosurgical postoperative complications of patients:

The present study showed the most common neurosurgical postoperative complications of patients were cerebral edema, seizures, postoperative hydrocephalus, Visual disturbances, then postoperative hematoma, behavioral changes, residual neurological problems, pneumocephalus, sphincter disturbances. In addition, fewer patients were suffering from intracranial hemorrhage, brain nerve damage for each. Also, speech disturbances, the least neurosurgical postoperative complications were stroke, vasospasm, brain abscess. Lastly meningitis was defined in only 5% of patients. The study agree with **Wang et al.,(2023)** they apply study on Malignant cerebral edema after cranioplasty: a case report and literature review that report more than half patients who developed massive cerebral edema immediately after cranioplasty following decompressive craniectomy.
The study consistent with **Kim H et al.,(2022)** they done study on Factors Associated Postoperative Hydrocephalus in Patients with Traumatic Acute Subdural Hemorrhage that data from a total of 63 patients who underwent unilateral craniectomy were analyzed. Postoperative hydrocephalus was identified in mor than half patients via brain CT scans. Also, this result was supported by **Hanko et al., (2021**) they conducted study on Incidence and risk factors of early postoperative complications in patients after decompressive craniectomy they reported that the most frequent surgical complication observed in our patients was a development of CT-hypo dense extra axial (subdural) fluid collections, occurring in 41 patients (34.75%).
Moreover, this result was in harmony with **Al-Mutar et al ,. (2024)** who apply study on complications following craniotomy for supra antorial tumors that postoperative complications occurred in 35% of patients with hematoma occurred in 6.7% and postoperative infection in 8.3%. Hematoma mostly developed during intensive care unit (ICU) observation with site of tumors can predict hematoma and death complication
The current study showed that there is significant and direct association between knowledge score, factor score, practice score. While is significant and inverse association between Knowledge score, with number of complication which happen for patients.
The present study concur with **Al-Dossary et al .,(2020)** who apply study on the impact of knowledge and attitudes on the performance of nurses in Saudi Arabia that found a significant positive correlation between nurses' knowledge and their clinical practice scores.
On the same hand, **Saleh et al.,(2018)** they apply study on the relationship between nurses' knowledge and performance in infection prevention in intensive care units. Reported that higher knowledge among

ICU nurses was significantly associated with fewer recorded patient complications.

On the other hand, **Karadag & Watson, (2020)** they apply study on the effect of educational interventions on nurses' knowledge and behavior. Suggested that knowledge does not always predict performance or outcomes unless accompanied by institutional support and continuous training.

Moreover, the pervious result was differed from **AlYami et al., (2019)** who apply study on knowledge, attitudes, and practices of infection control among nurses in Saudi Arabia, they found inconsistencies in how knowledge translated into clinical outcomes, noting that other factors such as workload, fatigue, and staffing ratios played significant roles in complications.

The result of the present study clear that, there is significant and direct association between factor score with practice score. While is significant and inverse association with number of complication which happen for patients.

The result agree with **Kılıç et al., (2019)** they conducted study on Can factor scores be used instead of total score and ability estimation?. The study investigated the relationships among total scores, ability estimations, and factor scores in high-stakes testing. Findings revealed a strong positive correlation between factor scores and ability estimations, suggesting that factor scores can reliably reflect underlying abilities, which may translate into better practice outcomes.

On the light of the results of the current study, there is significant inverse association between practice score with number of complication which happen for patients. This result agree with **Al-Dossary et al .,(2020)** they found that higher clinical practice scores among nurses were associated with fewer patient complications in Saudi hospitals. Also agree with **Saleh et al,. (2018)** they showed a significant negative correlation between infection prevention practice scores and the rate of hospital-acquired infections.

While the previous result was contrasted to **Karadag & Watson ,(2020)** they found that while practice scores were important, other factors (e.g., staffing, fatigue, and work environment) had a strong impact on complication rates, also **AlYami et al.,(2019)** they found that despite high self-reported practice scores, actual outcomes did not always improve, highlighting gaps between perception and performance.

Regarding Multivariate linear regression for predicting number of complications in studied patients, the current study showed increase of knowledge score, factor score, practice score of nurses are significant predictors for decrease number of complications in studied patients. This result like **Al-Dossary et al., (2020)** they found positive association between nurses' knowledge and practice and patient outcomes, where higher scores were linked to fewer complications. Also, **Saleh et al., (2018)** they showed that better knowledge and infection control practices significantly reduced hospital-acquired complications in ICU settings.

In addition, these findings align with **Aiken et al.,(2021)** they carried out study on Nurse staffing and education and hospital mortality in nine European countries: A retrospective observational study, they found that better-educated nurses and improved practice environments were associated with lower patient mortality and complication rates.

Conclusion:

On the light of the results of the present study, it can be concluded that about three quarters of studied nurses had unsatisfactory total level of knowledge about craniotomy while one half of studied nurses had satisfactory practice level about craniotomy. Slightly less than third of studied nurses had factors affecting their performance level. Moreover, the current study concluded that most systemic postoperative complications which happen for studied patient are nausea, vomiting, and urinary tract infection while the most common neuro surgical postoperative complications are cerebral edema, seizures, hydrocephalus, and visual disturbance. Furthermore, there is negative correlation between patients complications and nurses knowledge and practice and total factor.

Recommendations:

Based on findings, the study recommended:

- Nurses should be encouraged to attend national and international conferences, workshops, and training courses related to the care of patient post craniotomy.
- Periodic training and educational programs regarding care of patients post craniotomy to refresh their knowledge and practice.

Suggestion for Further Studies:

- Further research should be conducted to Assess factors affecting nursing performance regarding complications post craniotomy in neuro-intensive care unit.

A further study is necessary to identify effects on educational program on nurses' performance and factors affecting nurses' role regarding regarding complications post craniotomy in neuro-intensive care unit.

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