The Relationship between the Physical Restraints and Physiological Parameters among Critically Ill Patients

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Abstract

Background: Most of critically ill patients are mechanically ventilated, attached to multiple invasive devices, suffering of the disease, and the particularity of treatment. Physical restraints are commonly used in intensive care units to reduce the risk of injury and ensure patient safety. **Aim**: to assess the relationship between physical restraints and physiological parameters among critically ill patients. **Design**: a descriptive design was utilized. **Setting**: intensive care units in Tanta university hospitals. **Subject**: A convenient sample of all available nurses (n= 50) and a purposive sample of patients (n=100). **Data collection tools: 1.** Nurse's self- administered questionnaire, **2.** patient's clinical data, **3.** Sedation – Agitation Scale (SAS). **Results**: It was revealed that, 66% of studied nurses had unsatisfactory level of knowledge. There were a highly statistically significant difference regarding patients' physiological parameters between before, during and after physical restraint p=<0.01. **Conclusion:** It was concluded that, the most of nurses had unsatisfactory level of knowledge regarding physical restraint. There was a positive correlation between total score of patient's physiological parameters and total score of physical restraint (before, during and after). **Recommendation**: create an environment free from physical restraints, develop training programs, standards, and appropriate follow-up strategies for nurses regarding physical restraint.

Keywords: Physical restraint, Physiological parameters, Critically ill patients.

Introduction

Critically ill patients are the classifications of patients require continuous nursing monitoring and specialized care due to their life threatening conditions or injuries. Furthermore, they have the possibility of developing the alteration in their level of consciousness as confusion. So they can remove the connected life support and monitoring devices; as endotracheal tubes; nasogastric tube, arterial line, central lines and harming themselves ***(Dheef & Mohammed, 2023)***.

Due to the unfamiliar treatment environment, the suffering of the disease, and the particularity of treatment, patients often experience nervousness, restlessness, thus they can unintentionally remove some important tubes for life supporting. These acts not only cause physical trauma to the patient, but also bring a lot of treatment disturbances and risks. Therefore, they need protection to ensure their safety ***(Wang et al., 2023)***.

One of the most common methods used to maintain patient's safety in critical care units is physical restraints. Physical restraint refers to the use of any physical or mechanical equipment, materials or tools to attach or be adjacent to the patient's body to restrict the patient's free movement or prevent the patient from approaching some spaces ***(Canzan et al., 2021)***.

The use of physical restraints in the intensive care unit (ICU) is still reported in many studies conducted worldwide with high rates of mechanically ventilated patients being physically restrained. The main reason for using physical restraint in the ICU is to ensure patient safety by preventing them from removing life support devices or controlling disruptive behaviours. However, their use has been clearly associated to several short- and long-term physical and psychological harms, such as skin, neurological or cardiovascular injuries, increased risk of nosocomial infection, delirium and posttraumatic stress disorder at ICU discharge ***(Via- clavero et al., 2019)***.

Preventing and protecting the patient from harm are central nursing responsibilities. Nurses are most intimately involved in the decision to restrain and in its implementation and have a moral obligation to do no harm and to promote good efficiency. So nurses must be satisfied all the legal and ethical implications ***(Wong & Bressington, 2022***).

Although PR is used for safety purposes, studies show that its inappropriate use can endanger patient safety and cause serious physical and mental consequences. Its physical consequences include pressure ulcer, fracture, cardiac dysrhythmia, neuromuscular injuries, urinary and fecal incontinence, asphyxia, and strangulation-induced death. The mental consequences of inappropriate PR use include anger, frustration, aggression, fear, humiliation, low self-confidence, delirium, depression, and anxiety. It also prolongs the length of hospital stay and increases the risk of fall and nosocomial infections ***(Sharifi et al., 2021).***

Significance of the study:

There is a relationship between the application of PR and negative physiological and psychological effects on patients. PR is associated with neurovascular complications (e.g., redness, limb movement, oedema, and colour complications) , pressure injuries, delirium and increased length of stay ***(Cui et al., 2022).***

However, in Egypt physical restraint is a more traditional practice in ICUs. There are no available guidelines or legal regulations regarding physical restraint use. Most of patients' with restrain developed skin laceration, bedsores, limb edema, restricted circulation, orthostatic hypotension and constipation due to lack of nurses' knowledge and documentation of physical restraining and recommended need for standard guidelines and polices for physical restraint practices in Egyptian ICUs ***(Ahmed et al., 2019).***

In Egypt there is no national statistics available about hazards of physical restraint, so that the aim of this study to assess the relationship between the physical restraints and physiological parameters among critically ill patients.

Aim Of The Study

This study aims to assess the relationship between physical restraints and physiological parameters among critically ill patients, through the following:

1. Assessing of nurse's knowledge regarding physical restraint.
2. Assessing of patient's physiological parameters related to physical restraint.

Research Question:

Is there a relationship between physical restraints and physiological parameters among critically ill patients?

SUBJECTS AND METHODS

A descriptive design was utilized for the conduction of this study. This design helps the investigator to describe and document aspects of situation as it naturally occur. As well, this design helps to establish data base for future research ***(Siedlecki, 2020).***

Setting:

The study was conducted in four ICUs (Neurological ICU which is located in 1st floor containing 17 beds in two rooms with 9 ventilators and 17 monitors, Anesthesia ICU located in 5th floor containing 19 beds in three rooms with 19 ventilators and 19 monitors, and medical ICU located in 3rd floor containing 12 beds in three rooms with 6 ventilators and 12 monitors, Respiratory ICU located in 1st floor containing 6 beds in one room with 6 ventilators and 6 monitors) affiliated to Tanta University Hospitals.

Subjects:

The subjects of the present study included:

1. **A convenience sample** of all available nurses 50 nurses working in ICUs at Tanta University Hospital
2. **A purposive sample** of 100 patients admitted in ICUs and underwent physical restraint at Tanta University Hospital.

Inclusion criteria:

1. All adult patients with agitation, disturbed conscious level (GCS 8-12) and connected to mechanical ventilation from both genders.
2. Patients need physical restraint for the first time.

Tools for data collection:

The data were collected through the following tools:

I: Nurse's self- administered questionnaire: It was developed by the investigator in Arabic language after reviewing the most relevant and recent literature ***(Woldekirkos et al., 2021; Salehi et al., 2021)***.

It was divided into two parts:

Part I: Nurse's personal characteristics, included 6 closed ended questions (as age, sex, educational level, years of experience and previous training courses).

Part II: Nurses' knowledge regarding physical restraint. It included 60 questions in 7 sections as definition of physical restraint, indication for use of physical restraint, types of physical restraint, standards of use of physical restraint, alternatives to physical restraint, complications of physical restraint, precautions and nursing care needed for patient with physical restraint.

Scoring system:

Each question was scored as (3) for (yes) answer, (2) for (No) answer and (1) for (don't know) answer. The total questions were 60 questions, the total knowledge scores ranged from 60-180 scores

Total level of knowledge was categorized into:

- 80% or more was considered satisfactory level of knowledge (144-180) scores.
- Less than 80% was considered unsatisfactory level of knowledge (1-143) scores.

II: Patient clinical data: It was developed by the investigator in English language after reviewing the most relevant and recent literatures ***(Anderson & Bladerston, 2019)***. This tool was divided into four parts:

1. Patient's characteristics form: This form includes patient's age, sex, diagnosis, past medical history, allergy history, indications for physical restraints, types and time of Physical restraint released added that duration of physical restraint and types of material used for physical restraint.
2. Patient's physiological parameters related to physical restraint: It was included 48 items in 6 sections as vital signs, Capillary refill, ABG, hydration, skin condition and elimination.
3. Critical care pain observation tool standardized adopted tool contained 4 items to assess patient's pain related to physical restraint.

III: Sedation - Agitation Scale (SAS) standardized adopted scale contained 7 items ***(Urden et al., 2019).***

Scoring system:

It contained 7 item with 7 scores. (7) for unarousable, (6) for Very sedated, (5) for sedated, (4) for Calm and cooperative, (3) for agitated, (2) for very agitated and (1) for dangerously agitated. The total score ranged from 1-7 scores. It categorized into:

- 80% or more was considered accepted patient's response (6-7) scores.
- Less than 80% was considered unaccepted patient's response (1-6) scores.

II- Operational Design:

The operational design includes preparatory phase, content validity, reliability, pilot study, ethical consideration and field work.

The preparatory Phase:

It included reviewing of related literature and theoretical knowledge of various aspects of the study using books, articles, internet's periodicals and magazines to develop tools for data collection.

Validity and reliability of the study:

Content validity and Reliability:

Testing validity of the proposed tools by using face and content validity. Face validity: aimed to inspect the items to determine whether the tools measure what supposed to measure ***(King et al., 2020)*****. Content validity:** was conducted to determine whether the content of the tool cover the aim of the study ***(Hong et al., 2019)*****.** It measured by a jury of 5 experts, three of them professors of medical surgical nursing and one of them assistant professor of medical surgical nursing and one of them lecturer of medical surgical nursing at faculty of nursing Ain Shams University. The expertise reviewed the tools for clarify of sentences, relevance, accuracy, comprehensiveness, simplicity and applicability, minor modification was done. Finally, the final forms were developed.

Testing reliability: the tools were measured to ensure that an assessment tool produces stable with consistent result overtimes. The reliability coefficient for study tools were calculated using the correlation coefficient Cronbach's alpha test as:

Tool	No. of questions	Cronbach's alpha
Nurse knowledge	60	0.826
Patient's physiological parameters observation	48	0.672
Sedation - Agitation Scale (SAS)	7	0.864

Pilot study:

A pilot study was carried out on 10% (5 nurses and 10 patients) from the study subjects to test the clarity, applicability, feasibility and

relevance of the tools used and to determine the needed time for the application of the study tools. The nurses and patients who were included in the pilot study excluded from the main study group.

Field work:

- An official permission was obtained from Tanta University Hospital director.
- The sample of the study was recruited according to inclusion criteria.
- The researcher started data collection by introducing herself to nurses and explaining the aim of the study and oral approval from nurses to participate in the study was obtained prior to any data collection.
- Assessing nurses' knowledge regarding physical restraint by using nurse's self- administered questionnaire.
- The researcher distributed the questionnaire to the nurses in the morning and afternoon shifts. It took about 20-30 minutes for each nurse to answer the questionnaire.
- The researcher collected data for patients during data collection period, they were 100 patients met the inclusion criteria.
- The researcher interviewed patient's relatives to explain the aim of the study and obtained oral approval prior to any data collection.
- Assessing patient's clinical data was done by assessing of patient's physiological parameters before, during and after using physical restraint. It was done by the researcher and took about 30-45 minutes for each patient.
- Data were collected three days per week (Sunday, Tuesday & Thursday) during morning and afternoon shifts. It took six months from October 2021 and was completed by the end of March 2022 in the previous mentioned setting.

III-Administrative Design:

An official permission was obtained by submission of a formal letter issued from the Dean of faculty of nursing/ Ain Shams University to hospital director and nursing director of Tanta University Hospital to collect the necessary data for current study after a brief explanation of the purpose of the study and its expected outcomes.

Ethical consideration:

Approval of the study protocol was obtained from The Scientific Research Ethical Committee/ Ain Shams University Faculty of Nursing before starting of the study. The researcher clarified the aim of the study and its objectives to the study sample (nurses and patients) included in the study. The researcher assured maintaining anonymity and confidentiality of the study subjects' data. Study sample was informed that participation will be voluntary and they have the right to withdraw from the study at any time without giving any reasons.

IV- Statistical Design:

The data were collected and coded. Then the collected data were organized, analyzed using appropriate statistical significance tests using the computer Statistical Package for Social Science (SPSS) version 26, data were presented in tables and Charts using numbers and percentage mean and stander deviation (SD). Cochran's Q (Related-Samples more than two Nonparametric Test) and Chi-square test ($\mathbf{X_2}$) was used to show relation between qualitative variables.

Significance of results was considered as follow:

*No significant (NS) difference at $p>0.05$.

* Significant(S) difference at $p<0.05$.

* Highly significant (HS) difference at $p<0.01$.

Results

Table 1: illustrated that 54% of nurses their age ranged between (30-<40) years with **Mean age 35 ± 5.3** and were male. Concerning level of education 46% had bachelor's degree of nursing. About workplace, 30% of studied nurses worked at chest ICU. Also, none of nurses had previous training regarding physical restraint. 40% of studied nurses had a (5-<10) years' experience in ICU.

Figure 1: demonstrated that 66% of studied nurses had unsatisfactory level of knowledge regarding physical restraint and 34% of them had satisfactory knowledge.

Table 2: regarding relation between total nurses' knowledge level related to physical restraint and their personal characteristics, this

table revealed that, there were a statistically significant relation between nurses' knowledge and their age, gender and years of experience in ICU, (0.007, 0.057 and 0.036 respectively at P<0.05). While, there were no statistically significant relation between nurses' knowledge and their level of education and workplace (0.530 and 0.835 respectively at P>0.05).

Table 3: illustrated that 42% of studied patient were less than 60 years age with **Mean age 49 ± 7.3** and 54% of them were male. About 30% of patients admitted at neurological ICU and medical ICU. Also, 51% of them stay at ICU less than one month.48% of patients were unconscious and used wrist restraint type. About 40%, 74% and 63% respectively their physical restraint is released every 2hr, duration of physical restraint depend on patient's condition and Gauze and dressing were used for physical restraint.

Table 4: clarified that there were a highly statistically significant difference regarding patients' vital signs, ABG, circulation, and Hydration between before and during and after physical restraint (p<0.01).

Table 5: displayed that there were a statistically significant between before, during, and after physical restraint regarding unarousable, very sedated, sedated, agitated, very agitated and dangerously agitated (p= <0.01).

Table 6: illustrated that there were a positive correlation between physiological parameters and total score of physical restraint (before, during and after).

Table (1): Number and percentages distribution of personal characteristics of studied nurses (N=50).

Items	No.	%
Age group / years		
• 20 -< 30 years	10	20.0
• -< 40 years	27	54.0
• 40 -< 50 years 30	12	24.0
• 50 years and more	1	2.0
Mean ± SD = 35 ± 5.3		
gender:		
• Male	27	54.0
• Female	23	46.0
Level of education:		
• Bachelor's degree of nursing	23	46.0
• Technical institute of nursing	18	36.0
• Technical diploma of nursing	9	18.0
Workplace:		
• Neurological ICU	11	22.0
• Medical ICU	14	28.0
• Chest ICU	15	30.0
• Anesthesia ICU	10	20.0
Attended training courses about physical restraint:		
• No	50	
• Yes	0	100.0
		0.0
Years of studied nurse's experience in ICU		
• Less than a year	10	20.0
• 1 to less than 5 years	16	32.0
• 5 to less than 10 years	20	40.0
• 10 years and more	4	8.00

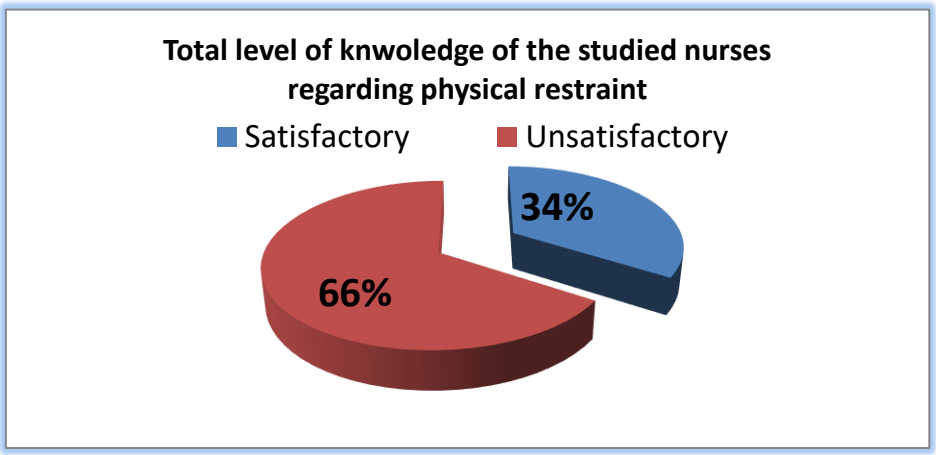

Figure 1: Total level of knowledge of the studied nurses regarding physical restraint (N=100).

Table 2: Relation between total studied nurses' knowledge level regarding physical restraint and their personal characteristics.

Items	Total nurses' knowledge				P-value
	Satisfactory		Unsatisfactory		
	N(17)	%	N(33)	%	
Age group / years					
• 20 -< 30	7	41.2	3	9.1	**0.007****
• 30 -< 40	4	23.5	23	69.7	
• 40 -< 50	6	35.3	6	18.2	
• 50 and more	0	0.0	1	3.0	
gender:					
• Male	6	35.3	21	63.6	**0.057***
• Female	11	64.7	12	36.4	
Level of education:					
• Bachelor of nursing	6	35.3	17	51.5	**0.530**
• Technical institute of nursing	7	41.2	11	33.3	
• Technical diploma of nursing	4	23.5	5	15.2	
Workplace:					
• Neurological ICU	3	17.6	8	24.2	**0.853**
• Medical ICU	6	35.3	8	24.2	
• Chest ICU	5	29.4	10	30.3	
• Anesthesia ICU	3	17.6	7	21.2	
Years of experience in ICU:					
• Less than a year	7	41.2	3	9.1	**0.036***
• 1 to less than 5 years	4	23.5	12	36.4	
• Five to less than 10 years.	6	35.3	14	42.4	
• 10 years and more	0	0.0	4	12.1	

p>0.05 no significant, * P<0.05 significant, ** P<0.001 highly significant

Table 3: Number and percentages distribution of the studied patient's characteristic form (N=100)

Items	No.	%
Patient's Age:		
• 20<40	23	23.0
• 40<60	35	35.0
• >60	42	**42.0**
Mean ± SD = 49 ± 7.3		
Gender:		
• Male	54	**54.0**
• Female	46	46.0
ICU Unit:		
• Neurological ICU	30	**30.0**
• Anesthesia ICU	19	19.0
• Medical ICU	30	30.0
• Respiratory ICU	21	21.0
Duration of stay:		
• Less than month	51	**51.0**
• One month	29	29.0
• More than one month	20	20.0
Items	**No.**	**%**
Indication for physical restraint:		
• Agitation	24	24.0
• Unconscious	48	**48.0**
• Patient who receive sedation	28	28.0
Types of physical restraint:		
• Wrist restraint	48	**48.0**
• Upper limp restraint	27	27.0
• Lower limp restraint	21	21.0
• Abdominal restraint	4	4.0
Physical restraint is released:		
• Every 2 hours	40	**40.0**
• Every 4 hours	19	19.0
• Every 8 hours	3	3.0
• Not released	38	38.0
Duration of physical restraint:		
• 2 hours	24	24.0
• >2-4 hours	2	2.0
• Depend on patient's condition	74	**74.0**
Types of material used for physical restraint:		
• Roll of gauze	30	30.0
• Special restraint	7	7.0
• Gauze and dressing	63	**63.0**

Table 4: Patient's physiological parameter at before during and after physical restraint (N=100).

Physiological parameters		Before		During		After		p-value 1	p-value 2	P-value 3
		Normal	Abnormal	Normal	Abnormal	Normal	Abnormal			
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)			
Vital signs	Respiratory rate	20(20.0)	80(80.0)	80(80.0)	20(20.0)	50(50.0)	50(50.0)	**0.001****	**0.001****	**0.001****
	Heart rate	45(45.0)	55(55.0)	77(77.0)	23(23.0)	56(56.0)	44(44.0)	**0.001****	**0.049***	**0.001****
	Blood pressure	30(30.0)	70(70.0)	67(67.0)	33(33.0)	61(61.0)	39(39.0)	**0.001****	**0.002****	**0.001****
	Temperature	13(13.0)	87(87.0)	60(60.0)	40(40.0)	57(57.0)	43(43.0)	**0.001****	**0.001****	**0.001****
Arterial Blood	PH	82(82.0)	18(18.0)	91(91.0)	9(9.0)	82(82.0)	18(18.0)	**0.034***	**NA**	**0.050***
	Pco2	73(73.0)	27(27.0)	95(95.0)	5(5.0)	93(93.0)	7(7.0)	**0.001****	**0.001****	**0.001****
	Po2	57(57.0)	43(43.0)	95(95.0)	5(5.0)	65(65.0)	35(35.0)	**0.001****	**0.157**	**0.001****
	Hco3	63(63.0)	37(37.0)	69(69.0)	31(31.0)	70(70.0)	30(30.0)	**0.005****	**0.001****	**0.002****
	O2 sat	79(79.0)	21(21.0)	83(83.0)	17(17.0)	83(83.0)	17(17.0)	**0.014****	**0.014****	**0.018****
Hydration	Output	30(30.0)	70(70.0)	84(84.0)	16(16.0)	84(84.0)	16(16.0)	**0.001****	**0.001****	**0.001****
	Fluid balance	28(28.0)	72(72.0)	73(73.0)	27(27.0)	59(59.0)	41(41.0)	**0.001****	**0.001****	**0.001****
	Central Venous Pressure(CVP)	19(19.0)	81(81.0)	92(92.0)	8(8.0)	49(49.0)	51(51.0)	**0.001****	**0.001****	**0.001****
Circ	Capillary refill	54(54.0)	46(46.0)	76(76.0)	24(24.0)	57(57.0)	43(43.0)	**0.004****	**0.697**	**0.008****

Cochran's Q: Related-Samples Nonparametric Test

(P<0.01) highly statistical significant difference (* P<0.05) statistical significant difference (p>0.05) no statistical significant difference**

(NA) Not applicable

p-value (1) before and during p-value (2) before and after p-value (3) before, during and after

Table 5: Patient's agitation level before, during and after physical restraint.

Agitation level	Before		During		After		p-value1	p-value2	P-value 3
	N (100)	(%)	N (100)	(%)	N (100)	(%)			
Unarousable									
• Yes	40	40.0	40	40.0	67	67.0	**NA**	**0.001****	**0.001****
• No	60	60.0	60	60.0	33	33.0			
Very sedated									
• Yes	4	4.0	9	9.0	20	20.0	**0.225**	**0.001****	**0.001****
• No	96	96.0	91	91.0	80	80.0			
Sedated									
• Yes	0	0.0	21	21.0	0	0.0	**0.001****	**NA**	**0.001****
• No	100.0	100.0	79	79.0	100.0	100.0			
Calm and cooperative	3	3.0	3	3.0	3	3.0	**NA**	**NA**	**NA**
• Yes	97	97.0	97	97.0	97	97.0			
• No									
Agitated									
• Yes	10	10.0	23	23.0	10	10.0	**0.001****	**NA**	**0.001****
• No	90	90.0	77	77.0	90	90.0			
Very agitated									
• Yes	33	33.0	0	0.0	0	0.0	**0.001****	**0.001****	**0.001****
• No	67	67.0	100.0	100.0	100.0	100.0			
Dangerously agitated	10	10.0	4	4.0	0	0.0	**0.050***	**0.001****	**0.004****
• Yes	90	90.0	96	96.0	100.0	100.0			
• No									

Cochran's Q: Related-Samples Nonparametric Test
**** P<0.01 highly significant, * P<0.05 significant, p>0.05 not significant**
(NA) Not applicable
P_1=before and during p_2=before and after p_3= before, during and after

Table (6): Correlation between total score of patient's physiological parameters and total score of physical restraint (before, during and after).

Physical restraint	Total score of patient's physiological parameters	
	r-test	p-value
Before	.406	.026*
During	.499	.005**
After	.589	0.001**

Discussion

Physical restraints (PR) are widely used, particularly in the care of critically ill patients, to ensure their safety and to protect them from fall, injury and/or unintended harm ***Perez et al., (2021).*** However, applying PR is often considered unsafe and unacceptable therefore, accreditation standards, guidelines and legislation recommend minimization of PR use. However, in some situations, it can become a necessity for the safety of the patient and caregivers ***Wang et al., (2023)***. So the current study result aimed to assess the relationship between physical restraints and physiological parameters among critically ill patients.

Regarding to age of the studied nurses, the current study result showed that, more than half of nurses their age ranged between (30-<40) years. This result was contrasted with ***Jyothi et al., (2022)*** who applied study entitled" Use of restraints in patient care; knowledge and perception of nurses and nurse interns: A cross sectional study in south India." and showed that more than two third of the study sample aged between 20-30 years old.

Regarding to gender of the studied nurses, the present study result presented that more than half of the studied nurses were male. The present study result was agreed with ***Almomani et al., (2021)*** who conducted study

entitled "Nurses' knowledge and practices of physical restraints in intensive care units" and showed that more than half of them were male.

Concerning to level of education less than half of them had bachelor's degree of nursing and less than one third of studied nurses worked at chest ICU. This result was agreed with ***Lee et al., (2021)*** who conducted study entitled " The knowledge, practice and attitudes of nurses regarding physical restraint: survey results from psychiatric inpatient settings." and showed that less than half of sample had a bachelor degree in nursing.

As regard to attend training courses about physical restraint, the current study result showed that, none of nurses had previous training regarding physical restraint. This result goes in the same line with ***Fawzy et al., (2021)*** who applied study entitled "Effectiveness of An Educational program on Critical Care Nurses Performance and Patients Outcomes Regarding Physical Restraint" and mentioned that, the majority of the studied nurses not previous training courses regarding physical restraint.

As regard to years of experience in ICU, the current study result mentioned that two fifths of studied nurses had (5-<10) years' experience in ICU. The present study result disagree with ***Almomani et al., (2021)*** who presented that less than three quarters of them had 3 years or less of ICU experience.

Regarding total nurses' knowledge level regarding physical restraint the present study result demonstrated that more than one third of studied nurses had a satisfactory knowledge level regarding physical restraint and two thirds of them had unsatisfactory knowledge.

From the researcher point of view this limitation of nurses' knowledge at this critical area might be as a result of lack of refreshment of the nurses' knowledge. Moreover, the nurses in Egypt are not used the independent self-learning. Another cause for lack of knowledge is nurses' exhaustion due to increased work load which may hinder their ability to read and update their knowledge.

The present study result in accordance with ***Rabeh et al., (2023)*** who applied study entitled "Assessment of Nurses' Performance Regarding Physical Restraining in Intensive Care Units." and found that, two third of studied nurses had unsatisfactory level of general knowledge regarding physical restraint.

Also this result was agreed with ***Woldekirkos et al., (2021)*** who conducted study entitled "Knowledge, Attitude, and Practice of Nurses Working in the Adult Intensive-Care Unit and Associated Factors towards the Use of Physical Restraint in Federally Administered Hospitals in Addis Ababa, Ethiopia" and mentioned that, highly percentage of the studied nurses had a poor level of knowledge toward the application of physical restraints among critical ill patients.

While this result was disagree with **Jyothi et al., (2022*)*** who mentioned that, more than half of the nurses had average level of knowledge regarding physical restraints.

Regarding to relation between total nurses' knowledge level regarding physical restraint and personal characteristics the present study result revealed that there was a statistically significant relation between total nurses' knowledge level and nurses' age, gender and years of experience in ICU, (p-value 0.007, 0.057 and 0.036 respectively at P<0.05). While, there were no statistically significant relation between nurses' knowledge and their level of education and workplace (0.530 and 0.835 respectively at P>0.05).

The current study result in the same line with ***Lee et al., (2021)*** who found that a significant association was found between years of clinical experience and knowledge and practice scores of nurses, while this result was disagree with ***Woldekirkos et al., (2021)*** who mentioned that, demographical characteristics such as gender, working year, and education levels were not significantly associated with knowledge, attitudes, and practices ($P > 0.05$).

Regarding to age of the studied patients, the current study result illustrated that more than two fifths of studied patient were less than 60 years age. This may be due to advanced age is one of the main factors causing patients‟ agitation and consequently putting them into the risk of pulling the life support devices and catheters or harming themselves and others.

This result was supported with ***Sharifi et al., (2021)*** who applied study entitled "Use of physical restraint in hospital patients: A descriptive study in a tertiary hospital in South Africa" and stated that half of their patients `age was 50 years old and more.

Regarding to gender of the studied patients, the current study result showed that,

more than half of them were male. This result was accordance with ***Thomann et al., (2021)*** who applied study entitled "Restrain use in the acute-care hospital setting: Across-sectional multi -centre study" who reported that more than half of the studied patients were male.

About less than one third of patients admitted at neurological ICU and medical ICU. Also more than half of them at ICU less than one month. this result was agree with ***Tripathy et al., (2020)*** who applied study entitled " Post traumatic stress symptoms, anxiety, and depression in patients after intensive care unit " and found that less than one third of the studied patients admitted at neurological ICU.

Concerning patient's current physical restraint data the present study result reported that less than half of patients were unconscious and used wrist restraint type. About two fifths of them their physical restraint is released every 2 hr, less than three quarters of them duration of physical restraint depend on patient's condition and less than two thirds of them gauze and dressing were material used for physical restraint. The present study result in the same line with ***Ertugrul & Ozden, (2020)*** who reported that, highly percentage of the studied patients were placed on wrists restraint type, more than two thirds of them was a roll of gauze were material used for physical restrain.

The present study result disagree with ***Gu et al., (2019)*** who conducted study entitled " Investigating influencing factors of physical restraint use in China intensive care units" and founded that, some kind of physical restraint was applied, more than half of the studied patients used bilateral upper limb restraints, less than half of the patients were continuously restrained for more than 24 h. Also contrast with ***Maiden et al., (2021)*** who reported that, less than one fifth of the studied patients total duration of physical restraint during study day >0–6 h. This may be due to PR depend on patient's condition.

As regard to patient's physiological parameter related to physical restraint, the current study result clarified that there were highly statistically significant difference regarding patients' vital signs, ABG, circulation, and Hydration between before and during (p-value 1) and after physical restraint ($p<0.01$) and before, during, and after physical restraint (p-value3). This result was accordance with ***Fawzy et al., (2021)*** who found that there was a statistical significant difference patients outcomes regarding physical restraint. This result is contrasted with ***Gu et al. (2019)*** who showed that most of the studied patients not occur any changes observed in general condition of patients after application of physical restraints.

Regarding agitation level before, during and after physical restraint the present study result displayed that there were statistically significant between before and during, and after regarding unarousable, very sedated, sedated, agitated, very agitated and dangerously agitated ($p <0.01$). The present study result in the same line with ***Kisacik & Cosgun, (2019)*** who reported that, low percentage of the studied patients become agitated after restrain while highly percentage of them become Calming – introversion after PR. While this result was contrast with ***Smithard & Randhawa, (2022)*** who conducted study entitled "Physical Restraint in the Critical Care Unit" and mentioned that, patients that were restrained suffered more agitation.

Regarding correlation between total score of patient's physiological parameters and total score of physical restraint (before, during and after), the present study result revealed that there were a positive correlation between physiological parameters and total score of physical restraint (before, during and after). This result is supported with ***Chou et al. (2020)*** who applied study entitled "The adverse effects of physical restraint use among older adult patients admitted to the internal medicine wards: a hospital-based retrospective cohort study" and founded that physical restraint use was strongly associated with poorer discharge outcomes, such as greater functional decline and higher mortality rate.

This result also is in the same line with ***Franks et al. (2021)*** who conducted study entitled ″Physical restraints and post-traumatic stress disorder in survivors of critical illness″ and revealed that PR is associated with PTSD in ICU survivors and is associated with delirium and longer duration of mechanical ventilation.

Conclusion

Based on the results of the present study and research question, the study concluded that:

Two thirds of the studied nurses had unsatisfactory knowledge regarding physical restraint. Concerning physiological parameters related to physical restraint, the result of the current study revealed that there was a highly statistically significant difference regarding patients' vital signs, circulation, ABG, hydration, skin and elimination among before, during and after physical restraint.

Also there was a statistically significant difference regarding pain before, during and after physical restraint. Regarding agitation level before, during and after physical restraint the present study result displayed that there was a statistically significant difference before, during, and after physical restraint. Furthermore, there was a positive correlation between total score of patient's physiological parameters and total score of physical restraint (before, during and after).

Recommendations

In the light of the results of the present study the following recommendations are suggested:

1. Reduce the use of physical restraint as the latest possible solution to control restless patient and create an environment free from physical restraints.
2. Proper planning is conducted for reducing the use of physical restraints and its complications through increasing the knowledge and attitude of nurses in the area of physical restraint of patients and related affective factors.
3. In-service training programs based on best practice guidelines for nurses working in ICU to improve nurses' practice regarding use of physical restraint and emphasizing the importance of procedure.
4. Develop appropriate protocols and instruments based on the best scientific evidence to assist the multidisciplinary team in evaluating the patient regarding physical restraint use.
5. Replicate the study by increasing the size of the sample.

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