

Efficacy of Educational Module for Nurses about "Safe Care of Patients under Treatment of Neuromuscular Blockade Agents" on Nurses performance and Patient's Clinical Outcomes

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Abstract

Background: Critical care nurses must understand the importance of neuromuscular blockade agent (NMBA) is used. **The study aimed** to evaluate the efficacy of educational module about patients receiving neuromuscular blockade agents on nurses' performance and patient's clinical outcomes. **Subjects and method:** All (50) nurses working in Intensive Care Unit and 30 patients under effect of treatment with (NMBA) in Anesthesia Care Unit at Tanta Emergency Hospital and El-Minshawy General Hospital. **Three tools** were used for data collection. Tool I: Nurse's Assessment Tool, two parts, part one: Nurse's Socio-demographic Assessment, part two Nurse's Knowledge Assessment. Tool II: Nurses Practice Observational Checklist. Tool III: Patient Undergoing Neuromuscular Blockade Agent observation checklist, three parts; part one: Biosocio demographic patient data, part two: lab investigation part three: Neuromuscular Blockade agent side effects Observational checklist for patient. **The Results** revealed that an improvement in the nurses' knowledge and practice and improvement of the patient clinical outcomes. **The study concluded** that nurse's improvement in their knowledge level and practices regarding safe administration of NMBAs and this improvement have positive effect on patient clinical outcomes. **Recommended:** It can be recommended that for prevention of NMBAs side effects as corneal ulceration six time safe care per day must be done, for hypotension and tachycardia measure blood pressure, pulse every one hour, for bed sores change position every one hour, for edematous limbs elevation of lower limbs 30c.as well as applying the educational module for nurses in continuing up to date education. **keywords:** safety care, corneal ulcer, critical care.

Introduction

Neuromuscular-blocking-agents (NMBAs) play an important role in the management of critically ill patients. They are commonly used to paralyze patients requiring intubation whether in an emergency as a life-saving intervention or for a scheduled surgery and procedure.

Their use is common in situations where patient paralysis is required like in surgical anesthesia and rapid sequence intubation (RSI). Other indications include the management of acute respiratory distress syndrome, increased intracranial and abdominal pressure, and prevention of shivering during therapeutic hypothermia.

(1-2) Neuromuscular-blocking agents are classified based on their chemical structures, mechanism of action (depolarizing and non-depolarizing), and pharmacokinetic properties including their duration of action (short, intermediate, and long acting). Depolarizing agents bind and activate nicotinic acetylcholine receptors causing persistent depolarization, which then render muscle fibers resistant to further cholinergic stimulation. (3) Succinylcholine is the only available depolarizing NMBA that is commonly used as the drug of choice for urgent intubation because of its quick onset and short duration. Non depolarizing NMBAs are highly ionized water-soluble compounds, which bind to acetylcholine receptor and act as competitive antagonists. (2,3). Non-depolarizing NMBAs can be divided into either amino-steroidal or benzyloquinolinium nucleus and vary in their onset and duration of action. NMBAs have a different variety of pharmacokinetic profiles that can be utilized depending the situation. For instance, rapid onset and short duration are of value in Rapid sequence intubation. In contrast, those with a longer duration are useful in surgeries. (4,5). Rapid sequence intubation is used to secure a definitive airway in critically ill patients who are unstable and uncooperative or may be at risk of aspiration. Their use has been associated with a lower prevalence of hypoxemia, and improved intubating conditions with fewer attempts. (6,7) However, several important contraindications to its use in critically ill patients with a history of malignant hyperthermia or hyperkalemia made clinicians to prefer rocuronium as a viable option for RSI. Allergy to aminosteroids is

the only absolute contraindication for rocuronium. Furthermore, its longer duration of action needs extreme caution in patients with anticipated difficult intubation. Rapid reversal of rocuronium may be achieved with sugammadex, a novel direct-reversal agent. (8-11) Incomplete recovery of the neuromuscular function also known as residual neuromuscular blockade (RNMB) is the most frequently observed complication in the post-anaesthesia care unit (PACU). RNMB may lead to impaired upper airway and respiratory muscle tone and coordination. Impaired airway and respiratory muscles function resulting from residual muscle paralysis may potentially increase the risk of aspiration, airway obstruction, hypoxia, difficulty coughing and breathing, impaired ventilation, and post-operative pulmonary complications. (12-16) A study by **Hayes et al (2016)** reported that TOF ratios <0.8 were observed in 39% of subjects who received rocuronium, 64% of vecuronium, and 52% of atracurium group. In a recent meta-analysis, the incidence of RNMB was 12% (TOF <0.7) and 41% (TOF <0.9) when intermediate acting used, where as it was higher in patients who received long acting muscle relaxant (35% and 72% when TOF <0.7 and <0.9 respectively) . (17-19) Knowledgeable critical care nurse is essential to the effective and safe use of neuromuscular blocking agents (NMBAs) in intensive care units (ICUs). The Institute for Safe Medication Practices considers NMBAs to be high-alert medications because of the robust historical documentation of harm associated with their use. Indeed, prolonged use of these agents contributes to an increased risk for corneal ulcers, skin breakdown, venous

thromboembolism, ventilator-associated pneumonia, and musculoskeletal debility.⁽²⁰⁻²¹⁾ Despite these previously documented risks, interest in the routine use of NMBAs among medical ICU patients has been renewed in the past several years. Specifically in patients with acute respiratory distress syndrome (ARDS), we now know that early continuous infusion of an NMBA improves oxygenation, inflammation, and mortality.⁽²²⁾

Nursing care of patient under treatment with neuromuscular drugs as controlling and observing temperatures. check temperature every 1 hour. If the oral temperature is below 36 degrees Fahrenheit or a cooling blanket is being used, the internal body temperature should be checked. NMBs paralyze muscle activity and decrease heat production. They may be used to control metabolic rate, prevent shivering and facilitate hypothermia. Inappropriate usage may lead to hypothermia due to reduced heat generation and an inability to shiver.^(23,24)

The nurse should protect the patient's cornea. Inquire about eye drops every two hours or as needed. Close the eyes constantly. Ointments that include lubricants may be all that's needed to keep eyelids closed and corneas moist. Avoid injuries to patients Joints and Limbs. It's important to keep spine and joints of patient in good alignment. Pillows may help the nurse to adjust while preserving lateral neck alignment and hip abduction of patient. Only a physical therapist should assist with passive range of motion exercises. Paralysis raises the risk of injury to the spine and joints because the muscles and ligaments protecting them are weakened. Due to a lack of muscular resistance.^(1,25,26) Protection against DVT

(Deep Vein Thrombosis). It is important to give patient anticoagulation medication for the prevention of DVT. Reduced venous return and an increased risk for thrombosis result from the paralysis of leg muscles, the vasodilatory effects of the medicine, and the patient's inability to move after administration of NMJ blockers.⁽²⁶⁾

Nursing care for the Lungs Maintain head of bed (HOB) elevation > 30 degrees as tolerated and provide oral care q 2 h and on needed as per protocol. At least once every six hours, suction utilizing the aided cough method. Provide rib cage support for aided coughing in the case of abdominal surgery or contraindication to diaphragmatic pressure. When the gag reflex is also paralyzed, oral secretions build up and the patient is at greater danger of aspiration. Paralysis of the diaphragm suppresses the cough reflex and ability to clear secretions.⁽²⁶⁾

Significance of the study: to minimize risks for patients, to promote the safe and effective use of NMBAs critical care nurses must have a keen understanding of the importance of its use and an appreciation for the factors that contribute to selection of patients, choice of agent, dose titration, and adverse effects. As being a nurse, I observed that most of nurses don't know the side effects of NMBAs as well as there was no study in nursing or may be lack of the study specifically was done focus in these issues. So evaluation of the efficacy of educational module about patients receiving neuromuscular blockade agents on patient's clinical outcomes as nurses play an important role in managing of these health problem.⁽¹⁾

Aim of the Study: The aim of this study was to Evaluate the efficacy of educational

module about patients receiving neuromuscular blockade agents on nurses' performance and patient's clinical outcomes

Research Hypotheses:

-Nurses who receive educational module about neuromuscular drugs will exhibit improvement in their knowledge and practice.

-Patient undergoing neuromuscular blockade and receiving care post implementation of educational module for nurses will exhibit improvement of their clinical outcomes by minimizing the side effect of neuromuscular drugs.

Research Design:

A quasi-experimental research design was used in the current study.

Setting:

The study was conducted in Anesthesia Care Unit at Tanta Emergency Hospital affiliated to ministry of high education. And Critical care unit at El-Minshawy General Hospital affiliated to Ministry of Health.

Subjects:

- (50) nurses, (25) from each hospital working in Intensive Care Unit during the time of study.
- Thirty patients randomly selected under effect of treatment with neuromuscular blocking agent were divided into two group 15 patients in each. group (1) control group was received routine hospital care. Group (2) study group was intervened by the researcher and under treatment of hospital care.

Tools of study: Three tools were used in the study

Tool (1): Nurse's Assessment Tool:

This tool consisted of two parts was developed by the researcher after review of related literature^(1,2,3).

Part one: Nurse's Socio-demographic Assessment. This part was used to assess nurse's sociodemographic data such as nurse code, age, sex, level of education, job, and years of experience, training courses, topics of training courses.

Part two: Nurse's Knowledge Assessment. It contains closed questions and this part was developed by the researcher after extensive review of related literatures. It was used to assess nurses' knowledge regarding neuro muscular blocking agent such as definition, types of neuromuscular drugs, side effect, indication and contraindication, safe care. **The scoring system for knowledge was included: -**

The Correct and complete answer was scored (2), The Correct and incomplete answer was scored (1), The incorrect or did not know answer was scored (0)

The total score of knowledge items were calculated and equal 52 and classified as follow:

High level of knowledge equal or more than 75%, Moderate within 65-74% was considered, low level of knowledge Less than 65%.

Tool (II): Nurses Practice Observational Checklist

This tool was be developed by the researcher after review of related literature.^(1,2,3). It was used to assess nurses' practice when caring for critically ill patients in Intensive Care Unit who receive neuromuscular blockade agent. It included initial assessment of critically ill patients on admission, assessment every shift, neurological assessment, methods of assessment, and routine nursing care for critically ill patients on ventilator who receive neuromuscular drugs.

The scoring system for practice was included: -

The Correct and complete answer was scored (2), The Correct and incomplete answer was scored (1), The incorrect or did not know answer was scored (0)

The total score of practice items were calculated and equal 78 and classified as follow:

High level of knowledge equal or more than 75%, Moderate within 65-74% was considered, low level of knowledge Less than 65%. **Tool (III): Patient Undergoing Neuromuscular Blockade Agent observation checklist**

Part one: Biosocial demographic patient data Which included patient name, age, sex, job, marital status, educational level.

Part two: lab investigation. These included electrolytes as (Na, K), arterial blood gases (ABG), liver function, renal function.

Part three: Neuromuscular Blockade agent side effects Observational checklist for patient:

This tool was developed by the researcher after reviewing the relevant literatures

1-Hypotension

depending on the decrease in systolic blood pressure (SBP) ⁽²⁷⁾:

Normal (SBP >100 mmHg)	Allocated score 4
Mild (SBP 80-90 mmHg)	Allocated score 3
Moderate (SBP 75-80 mmHg)	Allocated score 2
Severe (SBP <75 mmHg)	Allocated score 1
None equal to (0)	Allocated score 0

2- Tachycardia

The heart beats too fast, above 100 bpm. Items was calculated and classified by the researcher as follow:

Normal (60-100 b/m)	Allocated score 4
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Mild (100 – 110 b/m)	Allocated score 3
Moderate (110 – 120 b/m)	Allocated score 2
Sever (120 – 130 b/m)	Allocated score 1
None equal to (0)	Allocated score 0

3-Corneal ulcer

Corneal ulcer was scored as follow:

There is no ulcer. Allocated score 2

There is ulcer. Allocated score 1

4- Edema

This outcome was assessed and adopted according to technique (the depth gauge for edema by (Brodevicz KG and others) 2009 ⁽²⁸⁾. the depth gauge that developed was a simple and reliable method for evaluating pitting edema and was translated into Arabic by the researcher.

Grade 0 no clinical edema Grade 1: Immediate rebound with 2-millimeter (mm) pit. Grade 2: Less than 15-second rebound with 3 to 4 mm pit.

Grade 3: Rebound greater than 15 seconds but less than 60 seconds with 5 to 6 mm pit. Grade 4: Rebound between 2 to 3 minutes with an 8 mm pit.

Scoring system of edema as follow:

Grade 0	Allocated score 5
Grade 1	Allocated score 4
Grade 2	Allocated score 3
Grade 3	Allocated score 2
Grade 4	Allocated score 1

5- Skin breakdown: -

This outcome defined by the National Pressure Ulcer Advisory Panel (NPUAP,

1989). It was revised and adopted in 2016 to measure degree of bed sore it was reliable method and was translated into Arabic by the researcher⁽²⁹⁾.

Stage I - Non-blanchable erythema of intact skin in individuals with darker skin – Discoloration – Warmth – Edema – Induration or hardness - allocated score **5**

Stage II - Partial-thickness skin loss involving epidermis/dermis or both Superficial – Abrasion, blister or shallow crater - allocated score **4**

Stage III - Full-thickness skin loss involving damage to or necrosis of subcutaneous tissue extends into but not through the fascia Presents as a deep crater with or without undermining - allocated score **3**

Stage IV - Full-thickness damage Undermining and sinus tracts, Extensive destruction or damage to muscle, bone - allocated score **2**

Stage V- Black eschar or tough slough, Unable to determine the extent of damage underneath - allocated score **1**

Method of data collection:

1-Administrative process:

Official permission to conduct the study was obtained from the director of Trauma and Emergency Unit at Tanta Emergency Hospital affiliated to ministry of high education and El-Minshawy General Hospital affiliated to Ministry of Health to obtain their approval and cooperation during the study.

2-Ethical and legal considerations:

The nature of the study would not cause any harm or pain to the entire sample. Written consents were obtained from nurses and patient's family to participate in the study after explaining the aim of the study. And also, their right to withdraw from the study at any time without

providing a reason. This study was approved by ethical committees of faculty of medicine in 8-2018 and faculty of nursing in 6-2018.

3-Content validity: The tools were presented to a jury of five experts in the field of Medical Surgical Nursing to check content validity clarity, relevance, comprehensiveness, understanding, applicability, and ease for implementation. The content validity index was 98.0%.

4- Reliability of the developed tools used was tested through internal consistency. The value of Cronbach's alpha coefficient was 0.990

5- Educational module was developed by the researcher based on literature review and the results of pretest evaluation for nurses of back ground information about NMBs.

- Educational module was developed by using four phases:

-Assessment phase:

It was done by the researcher for all study subjects to assess the studied patients for both groups (control and study) to collect base line data by using tools (III). The researcher also met nurses to explain the purpose and the educational intervention of the study to gain their cooperation after taking permission from related authorities. During the initial interview, the purpose of the study and the procedures were explained and the written consent were obtained from the participants and assess nurses' socio-demographic data and knowledge regarding neuromuscular drug. A pretest was carried out individually for each nurse and knowledge sheet was filled by the nurses within 30 minutes (tool I).

-- Planning phase:

Educational module was developed by the researcher about neuromuscular blockade

agents by conducting 8 sessions for (3-4) weeks. Each session was last (30-40 minutes). to facilitate the nurses, understand according to nurses' education needs and expected outcomes criteria were formulated. Different methods and materials for educational intervention were used including PowerPoint presentations, small lectures, and group discussion.

-- Implementation phase:

The researcher met the study nurses individually before implementation of educational module to observe nurses' practice in their respective wards during the three shifts every hour for two hours and document in the tool.

- Evaluation phase:

-Evaluate nurses' knowledge, practice after implementation of teaching module by using tool (I) part (II), tool (II).

-Patients was evaluated by using tool (III) to observe patients side effect three times as follow-on admission then after one week then after two weeks

Results

Table (1): This table illustrates that about three quarters (76.0%) of the studied nurses in youth age, with mean age 31.96 ± 4.819 . Regarding sex, the majority (92.0%) of the studied nurses were female. As regards educational level, it was noticed that more than half of studied nurses (53.0%) had bachelor degree. In relation to years of experience, more than half (54.0%) had more than 5 to 10 years' experience, more than one quarter of them (26.0%) had 5 years' experience, with mean score was 8.36 ± 4.153 . related to training courses, half of the studied nurses (50.0%) not take training courses. More than one quarter (28.0%) of them take covid-19 prevention course online.

Figure (1): This figure clarifies that all of the studied nurses (100.0%) had low knowledge regarding neuro muscular blocking agent before the educational module, while all of them (100.0%) had high knowledge after the educational module.

Figure (2): This figure presents that the majority of the studied nurses (98.0%) had low practice level before the educational module, while all of them (100.0%) had high practice level after implementation of teaching session using the educational module.

Figure (3): This figure shows that the most (80.0%) of patient of the control group had mild severity during admission while 60.0% of them had moderate severity after one week and two weeks without a statistically significant difference where ($\chi^2 = 9.168$ at P value = 0.057). Also, illustrates 40.0% of the patient of the study group had mild severity, compared with the most (86.7%) and all of them (100.0%) after one week and two weeks respectively.

Table (1): Percent distribution of socio-demographic data of the studied nurses according to years of experiences, number of training course and topics of training course.

Socio-demographic characteristic	The studied nurses (n=50)	
	No.	%
Age years:		
18 - 28	9	18.0
>28 - 38	38	76.0
>38 - 48	3	6.0
Range	20– 43	
Mean ± SD	31.96 ± 4.819	
Sex		
Male	4	8.0
Female	46	92.0
Education level:		
Technical Diplom	13	26.0
Bachelor Degree	26	52.0
Master Degree	11	22.0
Years of experience		
5 years	13	26.0
>5 – 10 years	27	54.0
>10 – 15 years	7	14.0
> 15 years	3	6.0
Range	2– 21	
Mean ± SD	8.36 ± 4.153	
Number of training courses		
0	25	50.0
1 – 3	20	40.0
4 - 7	5	10.0
Topics of training course #		
No courses	25	50.0
Intensive care unit course(theoretical)	9	18.0
Infection control diploma	2	4.0
Infection control course(theoretical)	8	16.0
Quality course	3	6.0
Human Resource Development	10	20.0
Patient safety(theoretical)	6	12.0
Basic life support(theoretical)	8	16.0
Covid-19 prevention (online)	14	28.0

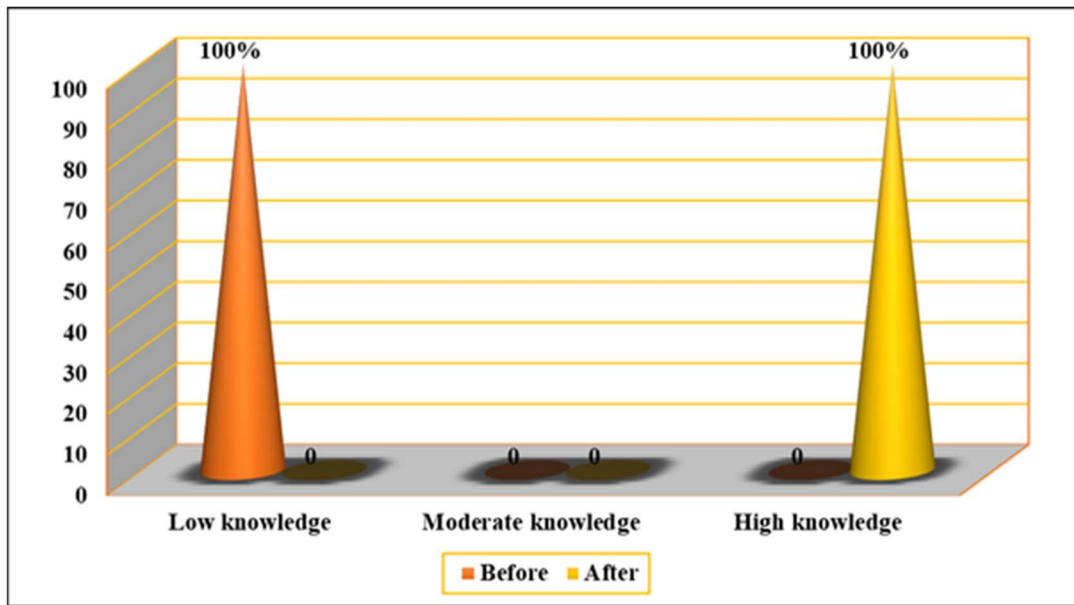


Figure (1): Levels of total nurses’ knowledge regarding neuro muscular blocking agent

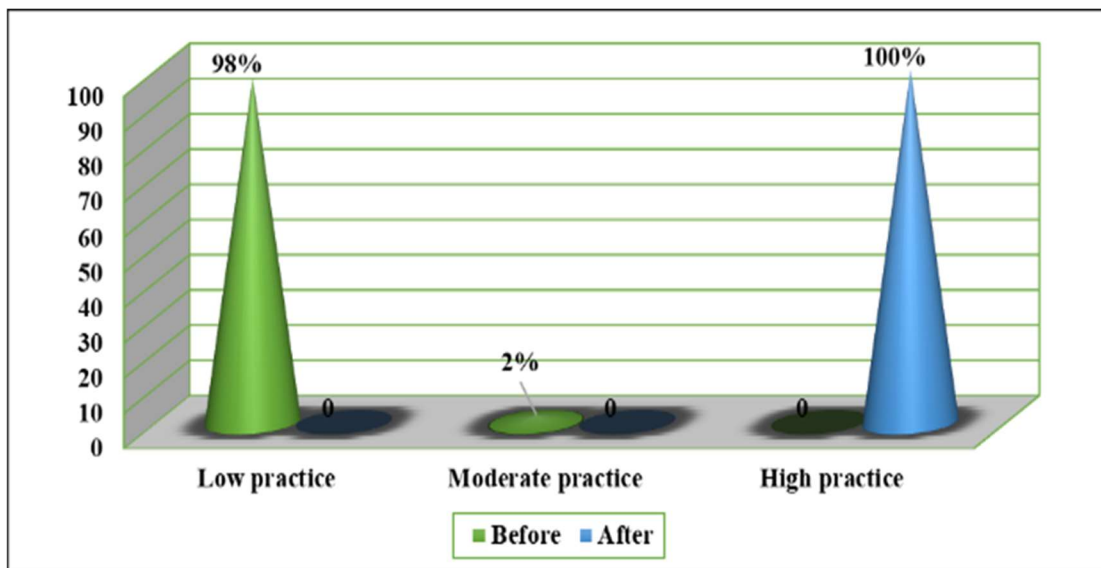


Figure (2): Levels of total nurses’ practice scores regarding caring critically ill patient under neuromuscular blockade agent

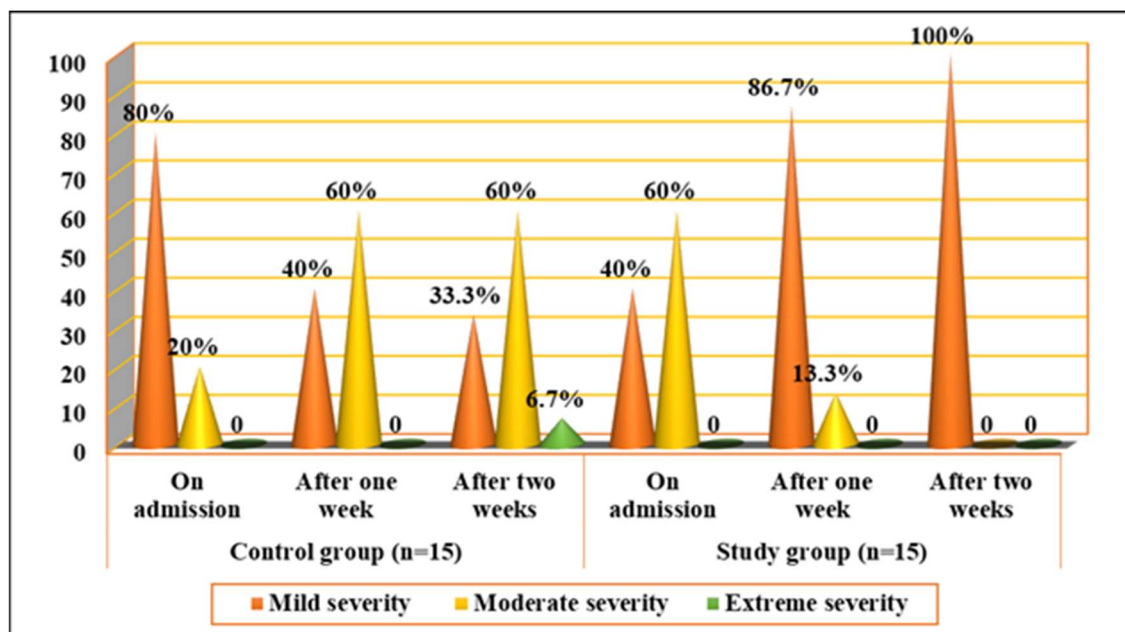


Figure (3): levels of neuromuscular blockade agent side effects severity of the studied patient after the educational module about safety implementation nursing care for nurses

Discussion

The study findings revealed that two third of the studied nurses in youth age, more than one quarter of them had 5 years' experience, and half of them not take training courses. This result was in in an agreement with Kattan (2019) (30) who study results showed that, the majority studied nurses, aged twenty-eight–forty years, and had no previous experience in anesthesia, and most of them not take informal training. It was noticed from the present result that about two thirds of the studied nurses didn't know or had incorrect answer about definition, types and methods of administration of neuromuscular drug before the educational module compared with the majority of them had correct and complete answered after the educational module. This may be attributed to the lack of in-service training programs and absence of related booklet about neuromuscular drug which help nurses to

get the required knowledge whenever they need. this result was in matching with Erin et al., (2019) (31) who study results showed that the majority of nurses had incorrect response regarding the answer of definition, types and methods of administration of neuromuscular drug. Also, the current study revealed that two thirds of the studied nurses didn't know or had incorrect answer about side effect of neuromuscular non depolarizing blockade agents before the educational module compared with the majority of them answered correct and complete after the educational module, with a statistically very significant This may be explained that half of them hadn't previous training program in how to deal with neuromuscular drug. This result was in an agreement with Erin et al., (2019) (31) who revealed that approximately one third of respondents were unfamiliar with side effect and contraindications of neuromuscular non

depolarizing blockade agents. The current study clarified that all of the studied nurses had low knowledge regarding neuro muscular blocking agent before the educational module, while all of them had high knowledge after the educational module, with a statistically significant. This may be due to absence of in-service training program department in the hospital and increased work load, the majority of them had correct and complete answer after guidelines application. This enhancement in nurses, knowledge could be attributed to the program content which was developed based on nurses, needs, its clarity and simplicity. This result was in an agreement with **Lohman (2020)** ⁽³²⁾ who found that after completing the educational module, a positive change was noted in all nurse's knowledge in the post-test survey results therefore the results are statistically significant. Moreover, the current study revealed that the majority of the studied nurses had low practice level before the educational module, while all of them had high practice level after implementation of teaching session using the educational module, with a statistically significant. Inadequate nurses' practice may be related to the fact that, nurses were not supplied with enough information and training about neuromuscular drug administration. On the contrary, after implementation of teaching session all of nurses' practices were good. The finding was congruent with **Hernandez (2022)** ⁽³³⁾ who cited that, nursing practice improved after receiving the educational program and they attributed that, this change to increased nurses' knowledge. Moreover, the current study revealed that there was positive correlation with a statistically significant difference between total nurses' knowledge related to

neuromuscular blockade agent after the educational module and total patient side effect severity score of the study group after two weeks. This improvement might be related to the fact that, the most of nurses were young, as their age between twenty-five to thirty five years and liable to learn and acquired knowledge through the practice guidelines program. Nurses need specific information to fill the gap between the nurses' perceived knowledge and their actual knowledge. This can be applied by educational programs designed to promote the recognition of these errors. The present result was in an agreement with **Michael (2020)** ⁽³⁴⁾ who demonstrated highly statistically significant relationship between nurses' knowledge related to neuromuscular blockade agent and, total patient side effect severity. ⁽³⁴⁾

Conclusion

Nurses achieved an improvement in their knowledge level about neuro muscular blocking agents and practices regarding safety care of critically ill patient in intensive care units under neuromuscular blockade agent. There was a statistically significant difference for nurses' knowledge and practice level before and after the implementation of educational module about safe care of patients under treatment of neuromuscular blockade agents on patients clinical outcomes. Post implementation of educational module for nurses Patient undergoing neuromuscular blockade and receiving care show improvement of their clinical outcomes by minimizing the side effect of neuromuscular drugs.

Recommendations: Based on the findings of the current study, the recommendations are:

- 1- For prevention of corneal ulceration as aside effects of NMBAs safe eye care must be performed six times daily at intensive care unit.
- 2- For prevention of hypotension and tachycardia post administration of NMBAs follow up measurement of blood pressure and pulse every one hour and documentation must be performed by nurses.
- 3- For improvement and prevention of patients lower limb edema wearing elastic stocking, elevation of edematous limbs 30 degree and commitment of nurses to measure cvp every six hours must be documented in ICU.
- 4- For prevention of skin breakdown (pressure ulcer) Change position to patient under treatment neuromuscular drugs every one hour upon admission until discharge to avoid occurrence of bedsores and record that in patient file.
- 5- Safe administration of neuromuscular drugs for preparation and resolution as prescribed instructions.
- 6- Perform test for nurses every 6 months to assess level of safety care practices for patient under treatment neuromuscular drugs.
- 7- Educational module designed and implemented about safe care of patients under treatment of neuromuscular blockade agents in specialized program to educate and training on it for all nursing staff in intensive care units to enhance their knowledge and increasing their skills.
- 8- Coordination between hospitals of Ministry of health with higher education nursing faculties to improve continuing nurses' education

Recommendations for future research

- 1- Bundle of safety care for patient undergoing neuromuscular blockade agent.
- 2- Evidence based guidelines for intensive care nurses about safety care for patient undergoing neuromuscular blockade agent.

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