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Effect of Implementing Pre and Post-Operative Nursing Intervention on Nurses Performance for Caring of Children with Musculoskeletal trauma

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Abstract: **Musculoskeletal trauma is injuries and disorders that affect the human body's movement or musculoskeletal system such as muscles, tendons, ligaments, nerves, discs, blood vessels. Pediatric musculoskeletal trauma remains a significant cause of morbidity and mortality in children and teenagers. Nurses have fundamental role in caring children with musculoskeletal trauma. The aim of this study was to evaluate the effect of implementing pre and post-operative nursing intervention on nurses' performance caring for children with musculoskeletal trauma. Research design: A quasi experimental research design was utilized. Subjects and method: sixty nurses from Pediatric Surgical Orthopedic Department of Tanta Educational International Hospital and Pediatric Surgical Orthopedic and deformity Unit of Tanta Main University Hospital were included in this study. Three tools were used to collect data: Structured interview Schedule to assess socio demographic characteristic for the studied nurses, Nurses' knowledge about children with musculoskeletal trauma and Nursing intervention related to pre and post-operative care for children with musculoskeletal trauma by using observation check list. The results of present study revealed that the total score of nurses knowledge and practice were improved immediately and two weeks after nursing intervention. The study concluded that studied nurses who received nursing intervention had improved their level of knowledge and practice about caring of children with musculoskeletal trauma. The study recommended that designing procedure handout about pre and post-operative care for children with musculoskeletal trauma.**

Keywords: **children, musculoskeletal trauma, nursing intervention, nurses performance, pre and post-operative.**

I. INTRODUCTION

Musculoskeletal system consists of the specialized connective tissues of the articulated bony skeleton and the skeletal muscles that act as articulations. MSK system is made up of hard and soft tissues. The hard tissue includes bones and cartilages (articular cartilages), while the soft tissues are the muscles, tendons, synovial membranes, joints capsule and ligaments. [(1.2)] Human musculoskeletal system has a primary responsibility to interact with physical environment to produce normal movement. Skeletal system not only provides structural support but also ensures protection, works as storage of minerals and fats and helps in blood cell formation, skeletal muscle plays an important role in protecting

endoskeleton against injury, producing joint movements and locomotion. Skeletal muscle forms about 40% to 45% of total body weight. [3]

Orthopedic injuries in children have unique characteristics than adult due to the dynamic state of growth and development of children. Pediatric bones are less dense, have more elastic connective tissue and are penetrated by more vascular channels than adult bone. Pediatric ages are characterized by different stages of physical, cognitive and social development which caused different types of injuries across age groups. Different mechanisms of injury and fracture patterns are seen in children. The force of an impact is transmitted widely through a child's body resulting in multisystem injuries. [4,5]

Musculoskeletal trauma in pediatric may be intentional or unintentional. Intentional trauma is less frequent and of little occurrence but unintentional trauma caused by blunt trauma is the most common cause of pediatric trauma. The normal impulsiveness and curiosity of children combined with their lack of caution and love of energetic activities place them at high risk for accidental injury. Most musculoskeletal trauma is caused by falls, motor vehicle crashes, pedestrian and vehicle injuries. Child abuse is an extreme important cause of these injuries in both infants and young children .Musculoskeletal trauma has different types in children. Dislocation, fractures and muscles injury such as sprain, strain and laceration are the main types of trauma affect children. [6,7]

American Academy of Orthopedic Surgeons (AAOS) considers childhood musculoskeletal injuries as a major problem around the world. Pediatric musculoskeletal trauma remains a significant cause of morbidity and mortality in both children and teenagers. It affects 1 of every 3 to 4 children, and up to 22 million children sustain injuries each year. Childhood trauma differs little from trauma in adult .however, the child development stage affect many aspects of injury include the type of injury occurred and the physiological response to injury. [8]

These are the common types of human injuries that result from damage of musculoskeletal system due to a strenuous and repetitive activity. They are associated with variety of complaints, complications and deformities causing a big burden on the financial and health systems in all societies. Traumatic event is the most common cause of MSK injury resulting in fracture, dislocation and soft tissue injury such as strain and sprain. Fractures and dislocations are common among children due to the softness of child bone. Fractures are a common childhood injury and account for between 8% and 12% of all pediatric injuries. Traumatic fractures are the most common musculoskeletal trauma in children which is characterized by pain, tenderness on movement, swelling, discoloration, limited movement and numbness may also occur. [9]

Without proper treatment musculoskeletal injury in children can have long-term effects due to their effect on bone growth and function. Complication from growth plate injuries can cause stoppage of growth of the bone resulting in limb-length discrepancy, angular deformity or altered joint mechanics which cause permanent disabilities. The chronic recurring stresses are often termed overuse syndromes, but also include stress fractures which can lead to changes that affect the joints, causing early arthritic changes. But, if not managed correctly, they can result in complete fracture. [10]

Bone injuries have two types that include an acute injury in which violent forces are applied at one time, the second is chronic and results from recurrent stresses applied to the bone over a prolonged period of time. Musculoskeletal trauma most often results from road accidents and recreational activities. Traumatic injuries, especially those involving motor vehicles, are the leading cause of fatalities among children and teenagers. Road injuries also affected millions in this age group each year. In addition, falls and sports injuries constitute the largest group of injuries resulting in hospitalization or emergency department visits. [11,12]

The main aim of fracture management is realignment of the bone fragments through immobilization of affected part. Early management of fracture aimed to control hemorrhage, provide pain relief, and prevent ischemia-reperfusion injury, displacement or angulation of the fragments and movement that might interfere with union, remove foreign body and nonviable tissues and remove sources of contamination. [13]

Pediatric orthopedic nurses play an important role in caring for children with musculoskeletal trauma so appropriate assessment and management of pediatric trauma are essential to achieve positive patient outcomes and disability. Nursing assessment for traumatic injury begins with the primary assessment to save the life of the child, find any additional trauma and treat firstly. During secondary assessment, an extensive orthopedic exam is performed and establishes

definitive treatment. All extremities should be inspected and palpated for bleeding, deformity, crepitus, circulation, sensory, motor function and assessment of Signs and symptoms of injury, which include swelling, pain, bruising, rigidity, and diminished use of the affected limb. Perioperative nursing care is a systematic process with an organized interconnected step to provide care to child before, during and after the operation[14,15].

Acute pain after an orthopedic surgery is caused by significant skeletal muscle reconstruction or repair .It occurs secondary to inflammatory response that's caused neuropathic pain when nerves are affected. Effective post-operative pain management is a necessity which permits early mobilization and faster beginning of physiotherapy and enhances healing of wound. Successful management of surgical pain begins before the operation and continues during surgery and through postoperative period. It is achieved through a combination of pharmacological drug and non-pharmacological measure.[16])

Nurses have great responsibility regarding pain management in children This responsibilities include teaching the children and their family strategies to deal with the pain, applying the analgesic treatment plan, monitoring the results of treatment by using the same tool used before intervention and documenting pain management measure and its outcomes effectively. Nurses are responsible for documenting their activity related to pain assessment and management of post-operative pain in routine form. It provides comprehensive information on the patients' assessment and management practices. [17,18]

Nurses are responsible for the application of non–medication based strategies such as heat, cold, position change, simple massage, movement, bracing and communication with other members of the pain management team. The nurse coordinates many aspects of pain care both in the hospital setting and inside homes of the children. [19]

II. AIM OF THE STUDY ARTICLE

The aim of the study was to evaluate the effect of implementing pre and post-operative nursing intervention on nurses' performance for care of children with musculoskeletal trauma

III. SUBJECTS AND METHOD

A quasi experimental research design was used in the study. The study was conducted at Pediatric Surgical Orthopedic Department(PSOD) of Tanta Educational International Hospital , it's part of Surgical Department consist of three rooms, each room has three beds and Pediatric Surgical Orthopedic Department(PSOD) of Tanta Main University Hospital, its part from orthopedic department

Three tools were used to collect data:

Tool 1: Structured interview Schedule and Socio demographic characteristic for the nurses. It cover the Socio demographic characteristic for the studied nurses which include age, sex, residence, educational level, marital status, previous experience and training, year of experience **(sheet 1)**

Tool II: Nurses' knowledge about children with musculoskeletal trauma: It was developed by the researcher after reviewing of the related literatures to assess nurse's knowledge before and after implementing nursing intervention related to pre and immediate postoperative for children with musculoskeletal trauma . It was designed in MCQ form and it was revised by pediatric nursing experts. This tool was used at three points of times. The first time was prior to teaching intervention (pretest) then repeats it immediately after session and further two weeks after teaching intervention. The test was composed of 16 question that cover all knowledge items about musculoskeletal trauma.

Three level of scoring for questions were be used

Correct and complete answer was scored (2),

Correct and incomplete answer was scored (1)

Wrong answer or don't know was scored (0).

Total score for the factual knowledge was 0 to 32which result from multiplying total number of question, and then the result is divided by 100 to be converted into percentage. The total score less than or equal 19 was consider poor

knowledge, (20-23) was consider fair knowledge and (24-32) was consider good knowledge. This sheet was filled in clinical area by studied nurses in presence of researcher assistance

Total score of nurses' knowledge will be calculated as follows

- Less than 60% was considered poor knowledge.
- From 60- <75% was considered fair knowledge.
- From 75-100 % was considered good knowledge.

Tool III: Nursing intervention related to pre and post-operative care for Children with musculoskeletal trauma by using Observation check list This checklist was devised by modifying 3 checklists from Paul U. et al., Khadka S. et al and Vicky R et al . It was used and modified by the researcher to assess nurses' practices pre and post-operatively. This tool was used at three points of times. The first time was prior to nursing intervention then immediately after nursing intervention and further two weeks after nursing intervention.

Scoring system for protocol of nursing intervention was as follows:

- Done correctly and complete will score (1)
- Done incorrect or not done well will score (0)

The total score of nursing intervention was calculated and classified as follows:

- Less than 75 was considered unsatisfactory.
- From 75-100 % was considered satisfactory

The total steps of nursing practice related to pre and post-operative care for children with musculoskeletal trauma equal 245. Less than 183 consider unsatisfactory level of practice, from 184to 245 consider satisfactory level of practice.

Part II:(a) Pain assessment by using Numerical rating scale developed by Young and Farrar (2001)[23,24] to assess post-operative pain intensity ,this scale line number from 0-10 to assign number from0–10 which 0 mean no pain and 10 mean sever pain.(sheet II)

Scoring system of pain rating scale is:

B) FLACC behavioral pain assessment scale , this scale consisted of five element such as face , leg , activity , cry/ vocalization and consolability. It was developed **by Kyle, Carman (2013)** [25] It was used for assessing behavioral responses of children toward post-operative pain**.**

Method: This study was approved by Research Ethical Committee REC of Faculty of Nursing at (TUH) 21-5-2019. An Approval for data collection was obtained from administrators responsible for Pediatric Surgical Orthopedic Department of Tanta Educational International Hospital and Pediatric Surgical Orthopedic and deformity Unit of Tanta Main University Hospital after explanation of the aim of the study. The tools were presented to a jury of five experts in the field of pediatric nursing to check content validity, clarity, relevance, comprehensiveness, understanding, applicability and ease for implementation. Content validity index was 94%. To assess **reliability**, the study tools were tested and the value of Cronbach's alpha coefficient was 0.891. **A pilot study** was carried out on 10% of nurses (6 nurses) to test the tools for its clarity, applicability, feasibility and the necessary modification was done. Pilot study was excluded from total sample of the study. Some questions were added and others were omitted Pilot study was excluded from total sample of the study.

Phases of the study: The study was conducted throughout four phases:

1-Assessment Phase: It was carried out by the researcher for all study subjects to collect baseline data of this study to assess nurses' knowledge related to pre and post-operative nursing intervention for children with musculoskeletal trauma **(Tool I,II).** The researcher was available two days per week in the previously mentioned setting to assess the actual nurses' practice before implementation of nursing intervention **(Tool III).** All nurses were observed during pre and post-operative nursing intervention for children with musculoskeletal trauma during morning shift.

2- Planning phase included the following steps:

Setting objectives of the content which was cover the reasons behind the implementation of the session. Content of knowledge section about musculoskeletal trauma consisted of definition , causes , types , clinical manifestation , treatment , pre and post-operative care , complication after surgery , discharge instruction about exercise , pain medication and follow up plan . The content of practice section related to pre-operative care for children with musculoskeletal trauma include the following procedure: physical assessment, perform laboratory investigation , measuring vital signs: heart and respiratory rate, nothing per mouth prior to surgery, administration of intravenous fluids, administration of blood transfusion if needed and administration of medication. The nursing procedure related to post-operative care include : physical assessment after operation ,monitoring vital signs, administration of intravenous fluids, performing skin care, administration of medication to reduce pain as ordered, performing catheter care if present , administration of nutrition planning and nurses give instruction when children discharge as pain medication, exercise driving the follow up plan

Preparation of the content which cover the reason behind application of the session, prepare of suitable media such as (lecture, video, power point and poster presentation). The educational intervention will be translated into Arabic. The studied nurses were divided into eight subgroups. Each of them contain seven nurses except two subgroup contain eight nurses. The educational intervention will be carried out for each subgroup.

3-Implementation phase

Nursing intervention was carried out for each group separately through conduction of successive sessions according to the actual need assessment of the studied nurses. The intervention was delivered to 6 sessions, two/week. The time of each session was about 30-45 minutes/session including periods of discussion according to the nurses' progress and feedback. A copy of the booklet was given to each nurse to facilitate recalling of knowledge and steps during the theoretical part of the program. Different methods and media of teaching were used including lectures, group discussion, demonstration and using audiovisual material such as laptop The data was collected over a period of six months from September to February.

Each group attended the following sessions:

The first session:-It will focus on definition, causes, clinical manifestation of musculoskeletal trauma, types of musculoskeletal trauma and complication of musculoskeletal trauma. **The second session**: Determine the immobilized children, priority of care of children with immobility, effect of immobility on different body system. **The third session**: Method of treatment of musculoskeletal trauma, complete Physical assessment to children and effect of musculoskeletal trauma on the all system. **The fourth session**: Preoperative nursing intervention for children with musculoskeletal trauma. **The fifth session:** Postoperative nursing intervention for children with musculoskeletal trauma and problems accompanying with the immobility child post-operative. **Sixth session: -**Assessment of pain by using Numerical rating scale to assess post-operative pain intensity and using FLACC behavioral pain scale for assessing behavioral responses of children toward post-operative pain.

4-Evaluation Phase: Reevaluation of nurses' knowledge and practice was carried out using the same assessment tools immediately after (post-test) and two week after implementation of nursing intervention (follow-up) and these were compared to pre-test levels.

Statistical analysis: The collected data were organized, tabulated and statistically analyzed using SPSS software statistical computer package version 26. For quantitative data, the range, mean and standard deviation were calculated. For qualitative data, comparison was done using Chi-square test (χ^2). For comparison between means of two variables in a group, paired samples t-test was used. For comparison between means for variables during three periods of intervention in a group, or for more than two variables, the F-value of analysis of variance (ANOVA) was calculated. Correlation between variables was evaluated using Pearson and Spearman's correlation coefficient r. A significance was adopted at $P<0.05$ for interpretation of results of tests of significance (*). Also, a highly significance was adopted at $P<0.01$ for interpretation of results of tests of significance (**).[26]

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IV. RESULT

Table (1): Socio-demographic characteristics of studied nurses. it was observed that more than one third (38.3%) of studied nurses aged more than 40 years while 1.7% of them range from (35-40) years old with mean age of 32.57± 8.27 years. Regarding their sex, all studied nurses were female and majority (85%) was married. This table also reveals that more than half of studied nurses (55%) had nursing diploma. It was observed that two third of studied nurse (65%) were from rural area. Regarding years of experience in orthopedic department, near to half (43.3%) of studied nurses had 20years of experience in orthopedic field.

This table also reveals that all studied nurses don't attend any conferences related to musculoskeletal trauma

Figure(1):-Total level of studied nurses' knowledge about musculoskeletal trauma. This figure illustrates that 3.3% of studied nurses had good level of knowledge before implementation of nursing intervention compared to 96.7% and 88.3 % of them immediately and two week after implementation of nursing intervention respectively. This table also shows that more than half (56.7%) of studied nurses had fair level of knowledge before implementation of nursing intervention compared to 3.3% and 11.7% immediately and two week after implementation of nursing intervention respectively

Table (2): Total practice level of care for children with musculoskeletal trauma. It was found that all of the studied nurse had unsatisfactory level of practice before implementation of nursing intervention compared to 96.7% of them had satisfactory level of practice immediately after implementation of nursing intervention a while 95% of them had satisfactory level of practice two weeks after implementation of nursing intervention.

Concerning statistical significant difference, it was observed that there was highly statistical significant differences in their practice before and immediately after implementation of nursing intervention, before and two weeks after implementation of nursing intervention, immediately and two weeks after implementation of nursing intervention with X^2 90.7, 103.98, 130.89 respectively and P = (0.000) for each .

Table (3): correlation between total score of nurses' knowledge about musculoskeletal trauma and their total practice score**.** It was found that there were a positive correlation between total knowledge scores of the studied nurses and total practice scores of nursing intervention for children with musculoskeletal trauma before, immediately after and two week after implementation of nursing intervention with r=0.149, r=0.136, r=0.116, respectively.

This table also shows that half of studied nurse (56.7%) had unsatisfactory level of practice with fair level of knowledge before implementation of nursing intervention while majority of studied nurse (93.3%) had satisfactory level of practice with good level of knowledge immediately after nursing intervention compared to majority (83.3%) of studied nurses had satisfactory level of practice with good level of knowledge.

Table (4): Effect of socio-demographic characteristics of the studied nurses on their total knowledge mean score about musculoskeletal trauma. It was found that, there was a significant relation between nurses' socio-demographic data as age, educational level, place of residence and years of experience and total knowledge scores.

Regarding studied nurses age , It was found that studied nurses aged less than 25 years their knowledge before implementation of nursing intervention had M S (20.80±2.95 compared to MS (32.00±0.52, 29.00±3.95) immediately and two weeks after implement of intervention. Regarding educational level, it was observed that technician nurses knowledge had MS (30.59±2.24, 27.33±3.42) immediately after and two weeks after implement of intervention respectively compared to MS (19.70±2.53) before implementation of nursing intervention**.**

Concerning place of residence, urban nurses knowledge had MS (31.38±1.07, 26.82±3.66) immediately and two weeks after implement of intervention respectively compared to MS (20.18±2.39) before implementation of nursing intervention. This table also shows that single nurse knowledge had MS (31.75±0.50- 26.76±3.56) immediately and two weeks after implement of intervention respectively compared with MS (20.00±0.00) before implementation of nursing intervention. The same table shows that nurses less than 5 years of experience had improved their total level of knowledge immediately and two weeks after nursing intervention than before with MS (32.00±0.00- 28.00±5.66) respectively compared with MS (20.46±2.23) before implementation of nursing intervention

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Table (5): Effect of socio-demographic characteristics of the studied nurses on their total practice mean score of care for children with musculoskeletal trauma. It was found that, there was a significant relation between nurses' socio-demographic data as age, educational level and years of experience and their total practice scores.

Regarding studied nurses age , it was found that practice of studied nurses aged more than 40years had MS (121.43±10.69) ,(223.40±24.87) immediately after and two weeks after implement of intervention respectively compared to MS (221.09±13.73) before implementation of nursing intervention with no statistical significant difference was observed. As regards educational level, it observed that practice of diploma nursing had MS (218.58±16.74, 219.85±20.13) immediately and two weeks after implement of intervention respectively compared with MS (116.30±13.36**)** before implementation of nursing intervention. This table also illustrates that practice of studied nurses more than 20years of experience had MS (221.63±9.56, 220.50±16.26) immediately after and two weeks after implement of intervention respectively compared to MS(116.82±15.7**)** before implementation of nursing intervention.

TABLE I: Percentage distribution of the studied nurses' related to socio-demographic characteristics

Socio-demographic characteristics	**(n=60)**	
	No	**%**
Age (in years)		
< 25	11	18.3
(25-< 30)	20	33.3
(30-< 35)	1	1.7
(35-< 40)	5	8.3
≥ 40	23	38.3
Range	**(20-45)**	
Mean ± SD	**32.57±8.27**	
Educational level		
Diploma of secondary nursing school	33	55.0
Technician institute of health	27	45.0
Place of residence		
Rural	39	65.0
Urban	21	35.0
Marital status		
Single	4	6.7
Divorced	5	8.3
Married	51	85.0
Attendance of related courses		
Yes	0	0.00
No	60	100.00
Years of experience		
< 5	24	40.0
(5-< 10)	8	13.3
(15-< 20)	2	3.3
≥ 20	26	43.3
Range	**(0-27)**	
Mean ± SD	**12.18±10.11**	

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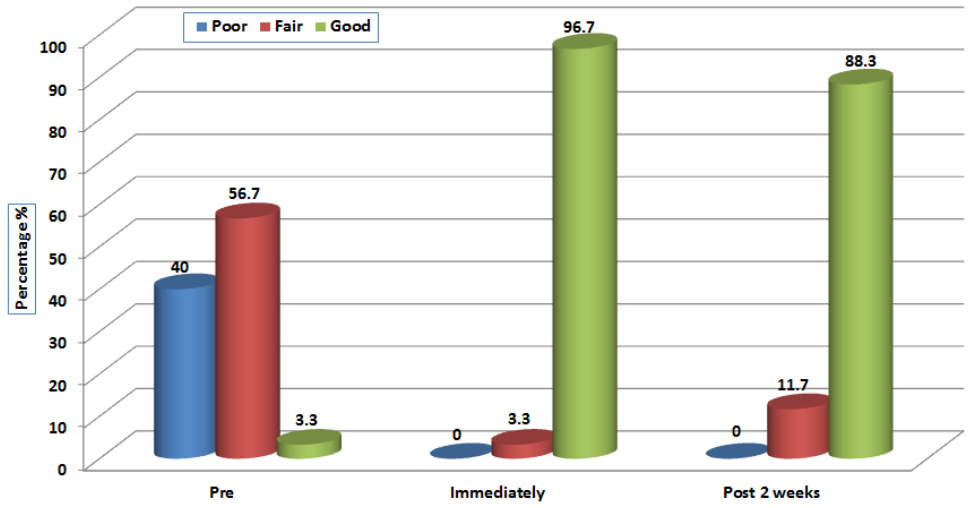

Fig: (1): Total knowledge level among studied nurses about musculoskeletal trauma.

Table (2): Percentage distribution of the studied nurses related to their total practice level of care for children with musculoskeletal trauma

Total practice level	(n=60)						χ^2 P
	Pre		Immediately		After two weeks		
	No	%	No	%	No	%	
▪ Unsatisfactory	60	100.0	2	3.3	3	5.0	**159.26**
▪ Satisfactory	0	0.0	58	96.7	57	95.0	**0.000***
Range	**(83-152)**		**(180-239)**		**(166-243)**		**F=926.70**
Mean ± SD	**115.37±15.49**		**218.70±14.51**		**218.72±15.52**		**P=0.000***
χ^2P	**144.21**		**150.98**		**165.6**		
	P1= 0.000*		**P2= 0.000***		**P3= 0.000***		

*** Significant at level P<0.05**

P1: Before and immediately after implementation of nursing intervention.

P2: Before and two weeks after implementation of nursing intervention.

P3: Immediately after and Two weeks after implementation of nursing intervention

Table (3): Correlation between total score of nurse's knowledge about musculoskeletal trauma and their total practice score

Total Knowledge Level	(n=60) Total practice level				χ^2 P	r P
	Unsatisfactory		Satisfactory			
	N	%	N	%		
Pre						
▪ Poor (n=24)	24	40.0	0	0.0		0.149
▪ Fair (n=34)	34	56.7	0	0.0	-	0.256
▪ Good (n=2)	2	3.3	0	0.0		
Immediately						
▪ Fair (n=2)	0	0.0	2	3.3	FE	0.136
▪ Good (n=58)	2	3.3	56	93.3	1.00	0.300
Post 2 weeks						
▪ Fair (n=7)	0	0.0	7	11.7	FE	0.116
▪ Good (n=53)	3	5.0	50	83.3	1.00	0.376

r: Pearson' correlation coefficient

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Table (4): Relation between socio-demographic characteristics of the studied nurses on their total practice mean score of care for children with musculoskeletal trauma.

Characteristics	The studied nurses (n=60) Total knowledge score Mean ± SD		
	Pre	**Immediately**	**Post 2 weeks**
Age (in years)			
▪ < 25	**20.80±2.95**	**32.00±0.00**	**29.00±3.95**
▪ (25-< 30)	20.17±2.21	31.55±2.54	28.85±3.30
▪ (30-< 35)	19.20±1.54	30.30±0.00	27.85±0.00
▪ (35-< 40)	18.82±3.89	31.00±2.24	28.20±3.90
▪ ≥ 40	15.00±0.00	30.13±3.07	25.57±3.00
t , P	1.858 , 0.131	0.755 , 0.559	2.073, 0.097
r , P	0.237 , 0.006	-0.134 , 0.308	-0.112,0.393
Educational level			
▪ Diploma	19.41±2.53	30.52±2.74	25.91±3.45
▪ Technician	**19.70±2.60**	**30.59±2.24**	**27.33±3.42**
t , P	0.188 , 0.666	0.014 , 0.906	2.552, 0.116
r , P	0.129 , 0.025	0.253 , 0.051	0.248, 0.056
Place of residence			
▪ Rural	18.43±2.50	30.10±2.93	**26.05±3.66**
▪ Urban	**20.18±2.39**	**31.38±1.07**	26.82±3.14
t , P	**7.078 , 0.010***	3.712 , 0.059	0.669, 0.417
Marital status			
▪ Single	**20.00±0.00**	**31.75±0.50**	**26.25±3.30**
▪ Divorced	16.00±0.00	30.80±1.79	26.20±2.49
▪ Married	19.80±2.57	30.43±2.65	**24.76±3.56**
t , P	**4.723 , 0.013***	0.532 , 0.591	0.995, 0.376
Years of experience			
▪ < 5	20.46±2.92	32.92±2.39	28.00±3.60
▪ (5-< 10)	19.50±1.41	30.38±0.74	27.75±3.96
▪ (15-< 20)	18.75±2.83	**30.00±0.00**	**26.00±5.66**
▪ ≥ 20	**18.00±2.23**	30.15±2.99	25.88±3.14
t , P	2.274 , 0.090	0.611 , 0.611	0.767, 0.518
r , P	**0.260 , 0.044***	0.121 , 0.357	0.108, 0.412

r: Pearson' and Spearman' correlation coefficient

* Significant at level P<0.05.

Table (5): Relation between socio-demographic characteristics of the studied nurses on their total practice mean score of care for children with musculoskeletal trauma.

Characteristics	Total practice score Mean ± SD		
	Pre	**Immediately**	**Post 2 weeks**
Age (in years)			
▪ < 25	106.09±18.57	213.55±4.11	219.55±10.16
▪ (25-< 30)	115.95±16.11	218.15±7.25	216.80±15.43
▪ (30-< 35)	88.00±0.00	221.00±0.00	217.91±18.17
▪ (35-< 40)	111.00±12.49	220.52±21.41	203.00±0.00
▪ ≥ 40	**121.43±10.69**	**223.40±24.87**	**221.09±13.73**
t , P	**3.158 , 0.021***	0.406 , 0.804	0.491 , 0.742
r , P	**0.277 , 0.032***	-0.106 , 0.420	0.135 , 0.302
Educational level			
▪ Diploma	116.30±13.36	218.58±16.74	219.85±20.13
▪ Technician	114.22±17.96	218.85±11.53	217.30±6.66

t , P	0.265 , 0.609	0.005 , 0.942	0.397 , 0.531
r , P	-0.081 , 0.537	-0.104 , 0.431	-0.143 , 0.275
Place of residence			
▪ Rural	113.00±13.69	217.85±14.79	218.18±16.82
▪ Urban	116.64±16.41	220.29±14.18	219.67±13.09
t , P	0.751 , 0.390	0.382 , 0.539	0.123 , 0.727
Marital status			
▪ Single	100.00±12.49	218.22±14.37	212.75±1.71
▪ Divorced	112.80±7.79	216.40±20.50	218.78±15.60
▪ Married	116.82±15.72	227.75±3.78	222.60±21.34
t , P	2.367 , 0.103	0.865 , 0.426	0.444 , 0.644
Years of experience			
▪ < 5	110.17±18.08	218.88±12.27	214.92±4.70
▪ (5-< 10)	116.25±16.49	217.00±2.83	221.88±8.77
▪ (15-< 20)	119.00±4.24	217.77±18.13	220.00±22.12
▪ ≥ 20	119.62±11.94	221.63±9.56	220.50±16.26
t , P	1.652 , 0.188	0.148 , 0.931	0.919 , 0.438
r, P	**0.288 , 0.025***	-0.075 , 0.569	0.152 , 0.247

r: Pearson' and Spearman' correlation coefficient

* Significant at level P<0.05.

V. DISCUSSION

Musculoskeletal trauma is injuries and disorders that affect the human body's movement or musculoskeletal system such as muscles, tendons, ligaments, nerves, discs and blood vessels. Traumatic bone injury is considered as a common injury among children. It occurs when the human body exposed to the trauma or accident. Fractures of the extremities bones, ligamentous injuries, joint injuries and soft tissue are major categories of musculoskeletal trauma which have great burdens on children's health. Each type requires knowledge and expertise to be appropriately managed in a timely fashion. The management of musculoskeletal trauma includes immobilization, cast application or by internal or external fixation, placement of metal pins, a plate and screw and surgical operation in some cases[27].

Regarding socio demographic characteristic, the result of present study revealed that all of the studied nurses were female. This can be explained by the female dominance in nursing profession. About two thirds of them were from rural areas. The result of current study was in the same line with **Rasheed(2019)** who found that near two thirds of studied nurse (65%) were female and observed that females were the dominant gender for nurses[28]. **Also, Seliman et al (2014)** were in same line with this study. They found that all nurses were females [29].

Concerning attendance of training courses, the finding of present study illustrated that all studied nurses didn't attend any courses related to orthopedic trauma nursing. This result can be explained by the lack of administrative support, increasing work load and lack of motivation. This result was supported with **Wahba et al (2017)** who found that all of the studied nurses didn't attend any courses related to internal fixation and cast application[30]. Also, **El Enein et al (2012)** were in same line with the current study, they found that the majority of their studied nurses had no training sessions towards fracture care [31].

The current study revealed that more than half of the studied nurses had fair level of knowledge before the implementation of nursing intervention. This may be attributed to the lack of in-service educational program about musculoskeletal trauma , the absence of an accurate source for acquiring knowledge , the lack of training courses and of the limited availability of manual booklets for pre and post-operative nursing intervention for children with musculoskeletal trauma in pediatrics.

In contrast, immediately after implementation of nursing intervention, nurses' total score of their knowledge had improved as the majority of them had good score. This may be attributed to the use of multiple teaching methods, the development of nursing intervention based on nurses' needs, the clarity and simplicity of its content, using attractive audiovisual aids, simple language and frequent repetition to fix the knowledge.

Furthermore, two weeks after the implementation of nursing intervention, this percentage of their knowledge decreases as most of the studied nurses had good scores of knowledge. This indicated that the improvement in knowledge was partially lost two weeks after the implementation of nursing intervention. This might be explained by the fact that knowledge retention is usually affected by time.

The result of our current study was in agreement with **Shehab (2020)** who found that nurses' mean score level of knowledge has improved immediately after the implementation of intervention and the mean score decreased after two weeks and after one month. Such lack of the total knowledge after two weeks due to the fact that the retained knowledge reduces by time [(32)]. Also **Cook et al. (2013**) were in same line with this result and found that mean scores of the nurses' knowledge before completing the educational module was low while they increased immediately and one month after the implementation of educational modules [(33)]. **Seliman (2014)** agreed with result of the current study, he reported an improvement in nurses' knowledge scores after the implementation of the program with a highly significant statistical differences[(29)].

Regarding of the acquisition of skill performance, the current study shows that the studied nurse's level of practice was unsatisfactory before the application of nursing intervention. This may be attributed to the shortage of nursing staff, the increasing work load , the lack of nurses' evaluation against standards of children' care, the lack of periodic evaluation of nursing practice from the nursing supervisors and head nurses to detect strength and weakness points to work on them and the refusal of some nurses to change their practice.

On other hand, there was an improvement in the total level of nurses' practice immediately and two weeks after the implementation of nursing intervention than before. This improvement may be attributed to the combination between both the theoretical part and the practical training element of the intervention that was effective. Regular training and the education of all pediatric orthopedic nurses provide them by up-to-date notes for pre-operative and post-operative procedures that provide nurses with the essential knowledge and skills and improve their level of practice.

The result of the current study was supported with **Seliman et al (2014)** who found that a highly statistical significant difference in total practice among pre- protocol, immediately post, and two months following the protocol implementation [(29)].

The result of the present study revealed that there was a positive correlation between total knowledge scores and total practice scores of the studied nurses before, immediately after and two weeks after the implementation of nursing intervention for children with musculoskeletal trauma. From researcher point of view, nurses need adequate and specific knowledge to provide effective and skillful care, nurses' practice and their quality of care based on accurate and professional knowledge.

The result of the current study was in agreement with **Yousef et al (2019)**, they found that skills can be easily improved, especially if they are linked with their relevant scientific base of knowledge. They also recommended that educational programs should be organized according to the needs of nurses for continuous evaluation [(34)].

Concerning relation between nurses' knowledge and their personal characteristics, The present study revealed that there were statistically significant relation between nurses' level of knowledge and their age &years of experiences. It was clear that all nurses aged 40 years and above with more years of experience had poor level of knowledge compared to nurses aged less than 25years with less years of experiences. This finding may be explained in the light of the fact that young aged nurses have fresh knowledge and still remember what they had studied in their academic institution unlike older nurses, better learning abilities, motivation and enthusiasm. Also, they have received different teaching methods which were supported with the new technology.

On the other hand**, Sobh et al. (2018)** were against the result of this study. They found a positive relation between nurses' knowledge and their age &years of experiences. They clarified that older nurses accommodated themselves to the routine work and gained their knowledge through their practice and work with patients [(35)].

Education levels of nurses are considered as an important factor which affect the level of knowledge among the studied nurses. The current study revealed that there was a significant relation between nurses' level of knowledge and their educational level. It was clear that the majority of nurses who were graduated in the technician institute of nursing had an

improvement in their knowledge immediately after and two weeks after the implementation of nursing intervention. This may be attributed to the fact that technician nurses have an opportunity to advance their knowledge and improve their career through continues learning and teaching. In addition, technician nurses gained their knowledge from updating their curriculum. **Shelton (2011)** agreed with this study and stated that high education provides nurses with more information [(36)].

The current study showed that there is a positive correlation between nurses' age& years of experience and their level of practice. It was observed that nurses more than 40 years with their increased years of experience, have an improvement in their level of practice immediately after and two weeks after the implementation of nursing intervention . This may be attributed to the fact that older nurses with more years of experience may be exposed to different situations in orthopedic surgery that require proper nursing care and so they demonstrate better practice than nurses with few years of experience.

The result of this current study **was in same direction with Mokhtar et al (2017)** who reported that new nurses had a lack of the experience to provide effective nursing care for patients and nurses' performance was based on work experience and qualifications [(37)]. In addition**, Mohamed et al (2018)** results were matched with the result of the current study; they noticed that there was a significant relationship between nurses' level of performance and nurses' age. Nurse's age, ranges from 30-40 years, demonstrates a higher level of competency in their practice [(38)]. On the other hand, **Morika (2019)** results were contrasted with the result of our current study, he found that there was no significant relationship between the age of nurses and their level of practice [(39)].

Qualifications of nurses have a great effect on their profession. It gives them an opportunity to extend their knowledge , improve their level of practice which affects the level of care provided and improves patient safety. Delivering safe and effective patient's care requires a highly educated nursing staff to ensure minimizing the risks to patient [(37)]. Regarding the relation between the educational level of nurses and their performance, this study showed that the students of nursing diploma had an improvement in their total mean score of practice immediately after and two weeks after the implementation of nursing intervention than before. This may be due to the fact that diploma nurses have graduated while they are younger and the early time of recruitment which has increased their years of experience. **Abdul Rahman et al (2015)** supported the result of this current study, they found that the level of nurse education has no significant impact on both the quality of care and the patient safety [(40)].

American Association of Colleges of Nursing (2019) was against the result of this study, it believed that education has a significant impact on the knowledge and the competencies of the nurse clinician. Clinicians with Bachelor of Science in Nursing (BSN) are well-prepared to meet the demands placed on today's nurse. They have skills in critical thinking, leadership, case management and health promotion and they have the ability to work in different inpatient and outpatient settings [(41)].

VI. CONCLUSION

Based on the findings of the present study, it can be concluded that there was a significant improvement in the mean scores of total level of knowledge and mean scores of total level of practice immediately after and two week after implementation of the nursing intervention among the studied nurses in relation to pre and post-operative nursing intervention for children with musculoskeletal trauma.

Also there was a positive correlation between total knowledge scores among the studied nurses and total practice scores of nursing intervention for children with musculoskeletal trauma.

VII. RECOMMENDATIONS

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

1. Designing methodology gift about pre and operative nursing care consideration for youngsters with musculoskeletal injury

2. Special instructional meetings ought to be assigned and introduced to all muscular medical caretakers that incorporate explicit preparing programs identified with pre-employable a post-usable consideration of musculoskeletal injury in pediatric

3. Development of nursing strategy for legitimate documentation of all nursing care give to children to confirm responsibility

4. Improve and update nurses' information and aptitudes about musculoskeletal injury through going to meetings and workshops.

5. Developing arrangement of periodical attendant's assessment to decide techniques for refreshing their insight and improving their training.

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