Effect of Early Activity Exercises and Proper Positioning on Occurrence of Joint Contractures Among Critically Ill Patients

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Abstract

Prolonged intensive care unit stay for two weeks or longer may predispose the patients to the occurrence of joint contractures. **The aim**: Evaluate effect of early activity exercises and proper positioning on occurrence of joint contractures among critically ill patients. **Quasi-experimental research design** was used to conduct this research. **Setting:** ICU at Sohag University Hospital**. Sample:** sixty patients, divided into study and control groups equally. **Methods and materials:** Tool I:Patient assessment sheet. Tool II: Joint flexibility and mobility assessment scales**.** Each patient in the study group received early activity exercises and proper positioning. The control group received hospital routine care. Both groups were monitored for development of joint contractures at 15th day. **Results:** There were statistically significant differences of joints angles regarding all directions of five major joints among study group at 1st and 15th day (p<0.000). **Conclusion:** Applying early activity exercises and proper positioning on critically ill patients in ICU have statistically significant positive effect to reduce occurrence of joint contractures.

Keywords: Critically ill patient, Early Activity, Joint Contractures & Proper Positioning.

Introduction

Critically ill patients are routinely exposed to long periods of immobility, which may results in increased length of stay in the ICU. Bed rest for the critical care patient can lead to complications such as pneumonia, pulmonary embolism, pressure ulcers, muscle atrophy, and joint contractures all of which can lead to an increased long of stay in the ICU **(Plis, 2009** & **Clavet et al., 2008)**.

Changes in the flexibility of joint may be related to decreased mobility or bed rest, factors common to patients admitted to ICU.**(Júnior et al., 2014)**. Flexibility refers to the ability to perform activities of daily living (ADLs), and any decrease in joint flexibility can promote functional decline and worsening of quality of life . **(Martinez et al., 2013).** Patients who spent 2 weeks or more in ICU may developed joint contractures which may lead to irreversible disability **(Clavet et al., 2015)**.

Contractures is used to describe an abnormal state of muscle shortening and joint fixation which can lead to structural changes within the joint. **(Wagner & Clevenger, 2010)**. Structures which can be involved in limiting joints movement, including changes in the articular structures (bone, cartilage, capsule) and non-articular structures (muscle, tendon, and skin). Joint contractures occur in patients of all ages, from newborns with congenital diseases, to the elderly specially those who have limited mobility such as Alzheimer's disease or Parkinson's patients, post injury and burns caused by scarred skin. **(Hammer 2007 & Frontera et al., 2015)**.

Patients diagnosed with joint contractures can be divided in three groups: multiple congenital contractures, contractures in association with chronic diseases or after trauma, and contractures resulting from prolonged immobility **(Wong et al., 2015)**.

Contractures can be temporary e.g. the morning stiffness after 8 hours of sleep in a curled up position. This stiffening can be corrected by stretching in the opposite direction as soon as we get up. Two to three weeks of immobilization will produce a much firmer contractures, and this is a frequent complication of bed rest or immobilization **(Nigam et al., 2009).**

Early mobilization refers to the application of physical activity within the first 2 to 5 days of critical illness or injury (**Cameron et al., 2015)**. Early exercise in critically ill ICU survivors enhanced recovery of functional exercise capacity, self-perceived functional status, and muscle force at hospital discharge **(Burtin et al., 2009)**. Maintaining correct body alignment when the patient is in bed is essential regardless of the position selected. The nurse helps the patient assume positions supine, lateral, and prone by using pillows **(Smeltzer et al., 2010)**.

Joint contractures can be prevented through early diagnosis and initiation of physical approaches such as early activity exercises and splinting before contractures are present or while contractures are

mild **(Skalsky et al., 2012)**. Early activity exercises helps to relieve muscle aches and joint stiffness and prevent contractures **(Shippee et al., 2012)**. Exercises can be performed independently by the patient or with assistance or can be received passively by a nurse (**Nugent and Vitale, 2014)**.

The critical care nurse has great role to prevent occurrence of joint contractures in ICU. Hence the present study aims to investigate the effect of implementing early activity exercises and proper positioning on occurrence of joint contractures among critically ill patients at Sohag university hospital.

Significance of the study

More than one-third incidence of developing a joint contractures in a large joint was documented for ICU patients with a hospital stay longer than 2 weeks **(Wong et al., 2015 & Clavet et al., 2015)**. Problem of joint contractures arises in ICU at Sohag university hospital because there is no policy to deal with patients who have limited mobility for prevention of occurrence of such problem So the current research is the first design to deal with the problem of joint contractures in ICU at Sohag University Hospital .

Aim of the Study

- Evaluate effect of early activity exercises and proper positioning on occurrence of joint contractures among critically ill patients in Intensive Care Unit at Sohag University Hospital .

Hypothesis: To fulfill the aim of the study the following research hypothesis were formulated:-

- The number of patients of study group who are received early activity exercises and proper positioning will be affected with joint contractures lesser than patients of the control group.

Patients and methods

Research design:

Quasi-experimental research design was utilized in this study .

Setting of the study:

This study was conducted in ICU (which contains 10 beds) at Sohag University Hospital.

Patients:

Purposive sample of 60 adults, males and females critically ill patients who recently admitted to intensive care unit and haemodynamically stable constituted the sample. The patients were assigned into two equal groups (study group and control group, 30 patients each) .

Inclusion criteria:

- Patients aged (18-60) years old admitted to ICU and susceptible to stay two weeks .
- Early administered patients to ICU and not transported from other unit.
- Patients with GCS (3-15)

Exclusion criteria

- Fever $\geq 38^{\circ}$.
- Patients who have inflammatory joint contracture related to chronic illness, such as diabetes, or old age were excluded from the present study.
- Length of stay is less than 2 weeks.
- Patients with quadriplegia, septic joints, acute thrombophlebitis, severe arthritic joint inflammation, recent trauma with possible hidden fractures or internal injuries, severe pain, and haemodynamically instability.

Tools

Two tools were used to collect data in the study after reviewing related literatures and adapted from **Ralph & Taylor (2014), Wagner & Clevenger (2010), Naved et al, (2011), Paul, (2012), & Paz & West (2014).**

First tool : "Patient assessment sheet": This tool was adopted by the researcher based on reviewing the relevant literature and used to assess the studied patients regard demographic and medical data as base line data. Reliability of this tool was done using Cronbach´s coefficient alpha score; it was 0.7420(95%). This tool included three parts:

Part one: patient characteristics :

This part includes demographic and clinical data of the patient as (age, sex, past medical history, diagnosis and date of admission).

Part two : " APACHE II score"

This tool adopted from **Naved et al., (2011),** It was designed to measure the severity of disease for adult patients admitted to ICU and it was utilized in the study to assess patient's haemodynamically stability so patients can included in the study. APACHE II consisted of the physiological variables which collected within the first 24 hours of ICU admission. APACHE II uses a point score based upon initial values of 12 routine physiologic measurements (internal temperature, heart rate, respiratory rate, oxygenation, arterial pH, sodium, potassium, creatinine, hematocrit, white blood cells and Glasgow coma score), takes account of the patient's age, chronic health condition and physiological variables.

Part three: Glasgow coma scale (GCS):

This part is adopted from (Paul, 2012). The aim of this scale was to measure level of consciousness of the patients. It consisted of three items eye, verbal and motor responses.

Tool two : Joint flexibility and mobility assessment scales

These scales were utilized by the researcher based on reviewing the relevant literature. Reliability of these scales were done using Cronbach´s coefficient alpha score; it was 0.7031(95%).

This tool included two parts

Part I : **functional mobility scale**:

This part is adopted from (**Ralph & Taylor, 2014**). The aim of this scale was to assess level of mobility of the patients. It consisted of five major items as show in the table:

" Functional mobility table"

score	Level
0 :	Completely independent .
1 :	Requires use of equipment or device .
2 :	Requires help, supervision, or teaching from another person .
3 :	Requires help from another person and equipment or device .
4 :	Dependent; doesn't participate in activity .

Part II : Joints flexibility assessment scale :

This part is adopted from **(Wagner & Clevenger, 2010) & (Paz and West, 2014).The aim of the scale was to assess flexibility of five major joints as show in the table**

"Joints angles table"

Joint	Direction	Joint angles
Elbow	**Flexion**	**0-150º**
	Extension	**0º**
Shoulder	**Flexion**	**0-180º**
	Extension	**0-60º**
	Abduction	**0-180º**
	Adduction	**40-50º**
	Internal rotation	**0-70º**
	External rotation	**0-90º**
Hip	**Flexion**	**0-120º**
	Extension	**0-30º**
	Abduction	**0-45º**
	Adduction	**0-30º**
Knee	**Flexion**	**0-135º**
	Extension	**0º**
Ankle	**Dorsiflexion**	**0-20º**
	Planter flexion	**0-50º**

Methods

This study was implemented throughout three phases

Preparatory phase

- An official permission, concerning conducting the study, was obtained from the hospital competent authorities in intensive care unit after explaining the objective and nature of the study .
- An approval was obtained from the local ethical committee and the study adopted common ethical principles in the clinical research.
- The tools were tested for content related validity by 5 jury specialists in the field of critical care medicine and critical care nursing from Assuit University and the necessary modifications were done.
- A pilot study was conducted on 10% of the study subjects to test the feasibility and applicability of the tools and time needed to collect the data. The tools were applicable and there was no modifications.
- Reliability of both tools was done using Cronbach´s coefficient alpha score; it was 0.7420 for Patient assessment sheet and 0.7031 for Joint flexibility and mobility assessment scales.

Ethical considerations

- Research proposal was approved from Ethical Committee in the Faculty of Nursing.
- There were no risk for study subject during application of the research.
- The study followed common ethical principles in clinical research.
- Written consent was obtained from patients or guidance that are willing to participate in the study , after explaining the nature and purpose of the study.
- Confidentiality and anonymity were assured.
- Study subject had the right to refuse to participate and/or withdraw from the study without any rational any time.
- Study subject privacy was considered during collection of data .

Implementation phase

- Data collection took approximately a period of 6 months, from early January, 2016 to late of June, 2016. Data were started from the first day of patient admission to ICU and for 15 subsequent days for both study and control groups.

For control group

Patient assessment sheet was used for initial assessment and also for continuous monitoring of patients' hemodynamic stability during the study at 1st, 3rd, 10th, 15th day. Initial assessment for five major joints was done to assess joint flexibility using joints flexibility assessment scale through using universal goniometer to provide base line data about joints´ angles. Functional mobility scale also used to assess level of mobility of the patients. Patients received the routine hospital care including only positioning through right, left and sitting positions

without any consideration of proper alignment of the joints.

For study group, Patient assessment sheet was used for initial assessment and also for continuous monitoring of patients' hemodynamic stability during the study at 1st, 3rd, 10th, 15th day**.** Initial assessment for five major joints was done to assess joint flexibility using (joints flexibility assessment scale) through using universal goniometer to provide base line data about joints´ angles. Patients assessed for level of mobility (using functional mobility scale) to detect assistance needed to the patient. Patients were assessed for (pulse, respiration, and blood pressure) before, during, and after implementation of the activity exercises and proper positioning. Joints motion and directions were assessed using **universal goniometer** to measure the angles of the joint (using joints flexibility assessment scale).

Early activity exercises were applied 3 times per day for 15 days with 10 repetition of each movement **(Dammeyer. et al., 2013)**. Resting pulse, blood pressure, and respiration were taken before performing early activity exercises and proper positioning **(Moyet, 2010).** The limb was hold gently without direct gripping and support was given on either side of the joint . One hand was placed just above the joint to stabilize it, and the other hand below the joint to support it while it is move **(Collins, 2015)**. Movements were performed slowly and smoothly **(Docherty & Mccallum, 2009)**.Vital signs were taken immediately after activity followed by rest for 3 minutes and vital signs were taken again. Response were Evaluated to activity by comparing preactivity blood pressure, pulse, and respiration with post-activity results **(Moyet, 2010).**

Proper positioning was done through assessment of flexibility of patient's joints, paying special attention to the following area shoulder, wrist, fingers, hips, knees and feet. Footdrop was assessed by inspecting the feet by planter flexion. Position of the patients were changed every 2 hours. The patients were placed in a position that achieve proper standing using pillows, towels, waffle boots heel lift suspension boots . The patients were ensured that they were in prone or side lying with hip extended for the same amount of time spent in supine position or at a minimum 3 times/day for 1 hour. When head of bed (HOB) must be elevated 30 degrees, The patient's shoulders and arms were extended using pillows to support the position **(Swearingen, 2016).**

Pads were placed under the angles of the axillae and lateral aspects of the clavicles. The patients were ensured about spending time with hips in extension. When the patients were in the side-lying position, the lower leg was extended from the hip. When the patient can be placed in prone position, moving him or her to the end of the bed and allow the feet to rest between the mattress and footboard. When using adjunctive devices, skin was monitored. Exercises were done taking in account periods of uninterrupted rest between exercises/activities **(Swearingen, 2016)**.

Criteria for terminating the activity

The activity was discontinued if there was chest pain, vertigo, or confusion, decreased pulse rate, failure of systolic blood pressure to increase, decreased systolic blood pressure, increased diastolic blood pressure by 15 mmHg and decreased respiratory response. The intensity or duration of the activity were reduced if the pulse takes longer than 3 to 4 minutes to return to within 6 beats of the resting pulse and the respiratory rate increase is excessive after the activity **(Moyet, 2010)**.

Evaluation phase

On the 15th day, every patient of both study and control groups was evaluated for the presence of joint contractures of the five major joints: shoulder, elbow, hip, knee and ankle for both right and left side using a universal goniometer and to determine the effect of early activity exercises and proper positioning applied to the intervention group. The comparison of joints angles was done between 1st and 15th day for study group and also for control group. Finally the comparison was done between both groups at 15th day.

Statistical designs

All data were recorded in a special chart for every patient. The collected data were coded, analyzed and tabulated. Data entry and analysis were done using SPSS 22.0 statistical software package. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations for quantitative variables. Quantitative continuous data were compared using analysis of (T-test), (dependent t-test) is used in case of comparisons between joints angles at 1st and 15th for both study and control group. (Independent t- test) is used for comparison of joints angles at 15th day between study and control group. Using (chi-square test) for non-parametric data to determine significant .

Results

Table (1) : Comparison between the study & control groups as regard patient characteristics (n=60) .

Variables	Study group N=30		Control group N=30		Significance Test
Age "years."	**N**	**%**	**N**	**%**	
Mean ±S.D	40.3 ± 15.474		34.633 ± 14.822		
18-30	10	33.33	15	50.00	P = 0.266
30-50	9	30.00	8	26.67	
50-60	11	36.67	7	23.33	
Sex					
Male	21	70.00	19	63.33	
Female	9	30.00	11	36.37	P = 0.37
Past medical histor					
Cardiac disorder	0	0.0	1	3.33	
Renal disease	5	16.67	3	10	
Diabetes mellitus	6	20.00	3	10	P = 0.1
Hepatic disorder	2	6.67	0	0.0	
No past history	17	56.67	23	76.67	
APACHE II score					
1st day	22.4 ± 4.7		24.9 ± 5.1		P = 0.321

*(independent t-test) (chi-square, T-test) * p<0.05significant p >0.05 non-significant*

Table (2): Comparison between the study & control groups in relation to joint angles of the shoulder (n=60)

Joint	Direction		Study group			Control group			T-test P 1st ###	T-test P 15th ####
			1st	**15th**	**T-test P #**	**1st**	**15th**	**T-test P ##**		
Shoulder joint	Flexion	Rt	178.2 ± 2.31	178.2 ±2.31	**0.000***	178 ± 2.27	175.57 ±4.34	**0.021***	0.737	**0.005***
		Lt	178 ± 2.23	178 ± 2.23	**0.000***	178 ±2.18	175.57 ±4.34	0.278	0.1.000	**0.010***
	Extension	Rt	53.3 ± 3.12	53.23 ± 3.10	**0.000***	53.63 ±3.43	49.97 ±5.06	0.050	0.696	**0.004***
		Lt	54.3 ± 3.49	53.63 ± 3.99	**0.000***	53.47 ±3.23	49.97 ±5.06	0.055	0.0.342	**0.001***
	Abduction	Rt	178.9 ±1.79	178.9 ± 1.79	**0.000***	178.67 ±1.89	176.70 ±3.88	**0.017***	0.626	**0.007***
		Lt	178.9 ±1.79	178.83 ± 1.78	**0.000***	178.53 ±2.08	176.03 ±4.12	0.722	0.0.467	**0.001***
	Adduction	Rt	44.6 ±1.71	44.6 ± 1.71	**0.000***	44.97 ±2.03	44.60 ±2.38	0.080	0.452	0.095
		Lt	44.1 ± 2.20	44.1 ± 2.20	**0.000***	45.26 ±1.85	44.43 ±2.53	**0.023***	0.030	0.588
	Internal rotation	Rt	68.9 ±1.78	68.9 ± 1.78	**0.000***	68.73±1.76	67.70 ±3.66	0.083	0.717	0.112
		Lt	68.67 ±1.90	68.67 ± 1.90	**0.000***	68.47 ±1.87	67.70 ±3.66	0.990	0.363	0.133
	External rotation	Rt	89.5 ±1.53	89.5 ±1.53	**0.000***	89.17 ±1.78	88.67 ±2.15	**0.002***	0.440	0.089
		Lt	89.27 ±1.11	89.27 ± 1.11	**0.000***	89.10 ±1.78	88.43 ±2.66	0.053	0.605	0.122

*Rt: right, Lt : left (Dependent t-test, Independent T-test) * p<0.05significant p >0.05 non-significant*
 # significance between 1st & 15th day for study group . ##: significance between 1st & 15th day for control group .
###: significance between study &control group at 1st day . ####: significance between study &control group at 15th day .

Table (3): Comparison between both study & control groups in relation to joints angles of the elbow (n=60).

Joint	Direction		Study group			Control group			T-test P 1st###	T-test P 15th ####
			1st	15th	T-test P#	1st	15th	T-test P##		
Elbw joint	Flexion	Rt	149.2 ±1.69	149.20 ±1.69	**0.000***	148.67 ±2.00	141.17 ±5.42	0.329	0.270	**0.000***
		Lt	149.4 ±1.22	149.40 ±1.22	**0.000***	149.23 ±1.22	141.00 ±5.42	0.296	1.000	**0.000***
	Extension	Rt	0.30 ±0 .92	0.37 ± .96	**0.000***	0.43 ±1.14	4.83 ±4.63	0.850	0.785	**0.000***
		Lt	0.50 ±1.04	0.53 ±1.04	**0.000***	0.57 ±1.07	4.80 ±4.30	0.766	0.808	**0.000***

*(Dependent t-test, Independent T-test) * p<0.05significant p >0.05 non-significant Rt: right, Lt : left*
 # significance between 1st & 15th day for study group . ##: significance between 1st & 15th day for control group .
###: significance between study &control group at 1st day .####: significance between study &control group at 15th day .

Table (4): Comparison between both study & control groups in relation to joints angles of the hip (n=60).

Joint	Direction		Study group			Control group			T-test P value 1st ###	T-test P value 15th ####
			1st	15th h	T-test P #	1st	15th	T-test P ##		
Hip joint	Flexion	Rt	119 ±1.70	119 ±1.70	**0.000***	119.17 ± 1.63	115.97 ±4.27	0.720	0.692	**0.001***
		Lt	119.10 ±1.16	119.10 ±1.16	**0.000***	119.03 ±1.16	115.20 ±4.35	0.752	0.824	**0.000***
	Extension	Rt	27.90 ±2.24	27.90 ±2.24	**0.000***	27.87 ±2.16	23.90 ±4.66	0.194	0.954	**0.000***
		Lt	28.10 ±2.06	28..10 ±2.06	**0.000***	28 ± 2.03	23.2 ±4.41	0.429	0.850	**0.000***
	Abduction	Rt	44.40 ±1.04	44.37 ±1.03	**0.000***	44.5 ±0.94	42.37 ±3.93	0.335	0.697	**0.009***
		Lt	44.50 ±0.82	44.37 ±1.16	**0.000***	44.50 ±0.82	41.60 ±4.40	0.420	0.1.000	**0.002***
	Addu ction	Rt	28 ±1.93	27.97 ±1.90	**0.000***	28.17 ±1.88	26.47 ±3.68	0.565	0.736	**0.052**
		Lt	28.30 ±1.64	28.27 ±1.66	**0.000***	28.30 ±1.64	26.20 ±3.57	0.532	1.000	**0.006***

*(Dependent t-test, Independent T-test) * p<0.05significant*
p >0.05 non-significant Rt: right, Lt : left
 # significance between 1st & 15th day for study group . ##: significance between 1st & 15th day for control group .
###: significance between study &control group at 1st day . ####: significance between study &control group at 15th day .

Table (5) : Comparison between both study & control groups in relation to joints angles of the knee (n=60).

Joint	Direction		Study group			Control group			T-test P 1st ###	T-test P 15th ####
			1st	15th	T-test P #	1st	15th	T-test P value ##		
Knee joint	Flexion	Rt	134.5 ± 1.78	134.5 ± 1.78	**0.000***	134.27 ± 1.96	127.77 ± 4.72	0.046	0.631	**0.031***
		Lt	134.33 ± 1.95	134.33 ± 1.95	**0.000***	134.43 ± 1.79	129.27 ± 5.12	0.463	0.886	**0.027***

Joint	Direction		Study group			Control group			T-test P 1st ###	T-test P 15th ####
			1st	15th	T-test P #	1st	15th	T-test P value ##		
	Extension	Rt	0.60 ± 1.30	0.67 ± 1.21	**0.000***	0.57 ± 1.22	6.00 ± 4.85	0.481	0.919	**0.000***
		Lt	0.90 ± 1.47	0.90 ± 1.5	**0.000***	0.97 ± 1.47	6.10 ± 4.40	0.657	0.861	**0.000***

*(Dependent t-test, Independent T-test) * p<0.05significant*
p >0.05 non-significant Rt: right, Lt : left
 # significance between 1st & 15th day for study group . ##: significance between 1st & 15th day for control group .
###: significance between study &control group at 1st day . ####: significance between study &control group at 15th day .

Table (6) : Comparison between both study & control groups in relation to joints angles the ankle (n=60).

Joint	Direction		Study group			Control group			T-test P 1st ###	T-test P 15th ####
			1st	15th	T-test P#	1st	15th	T-test P#		
Ankle joint	Dorsiflexion	Rt	10.13 ±3.10	9. 8 ± 2.4	**0.000***	10.23 ±2.73	7.23 ±2.38	0.134	0.655	**0.000***
		Lt	10.02 ±3.10	9.00 ±3.82	**0.000***	10.5 ±3.30	7.16 ±2.42	0.268	0.762	**0.000***
	Planter flexion	Rt	48.83 ±1.84	48.83 ±1.84	**0.000***	48.9 ±1.84	45.66 ±4.95	0.290	0.828	**0.001***
		Lt	49 ±1.70	49 ±1.72	**0.000***	48.8 ±1.74	45.4 ±5	0.246	0.655	**0.001***

*(Dependent t-test, Independent T-test) * p<0.05significant*
p >0.05 non-significant Rt: right, Lt : left
 # significance between 1st & 15th day for study group . ##: significance between 1st & 15th day for control group .
###: significance between study & control group at 1st day . ####: significance between study & control group at 15th day

Table (7) : correlation between age and most common direction of range of motion affected with joint contractures at right and left side regarding study and control groups.

Variables	Study group		P value	Control group		P value
Age "years."	N	%		N	%	
Shoulder	**Lt extension (2)**			**Rt extension (16)**		
18-30	**1**	**50**		**7**	**43.75**	
30-50	**1**	**50**		**5**	**31.25**	
50-60	**0**	**0**	**0.351**	**4**	**25**	**0.104**
Elbow	**Rt extension (2)**			**Lt extension (17)**		
18-30	**2**	**100**		**6**	**35.29**	
30-50	**0**	**0**		**6**	**35.29**	
50-60	**0**	**0**	**0.316**	**5**	**29.42**	**0.351**
Hip	**Rt abduction (1)**			**Rt extension (12**		
18-30	**0**	**0**		**5**	**41.67**	
30-50	**0**	**0**		**3**	**25**	
50-60	**1**	**100**	**0.351**	**4**	**33.33**	**0.649**
Knee	**Lt extension (3)**			**Lt extension (16)**		
18-30	**1**	**33.33**		**5**	**31.25**	
30-50	**2**	**66.67**		**5**	**31.25**	
50-60	**0**	**0**	**0.684**	**6**	**37.5**	**0.351**

Variables	Study group		P value	Control group		P value
Age "years."	N	%		N	%	
Ankle	Rt dorsiflexion (4)			Rt dorsiflexion (21)		
18-30	1	25		6	28.57	
30-50	1	25		8	38.1	
50-60	2	50	0.351	7	33.33	0.649

** p<0.05significance* *(person correlation)*

Table (8) : Correlation between GCS and most common direction of range of motion affected with joint contractures at right and left side regarding study and control group.

Variables	Study group		P value	Control group		P value
GCS	N	%		N	%	
Shoulder	Lt extension (2)			Rt extension (16)		
Mild	0	0		2	12.5	
Moderate	0	0		3	18.75	
Severe	2	100	0.067	11	68.75	0.021*
Elbow	Rt extension (2)			Lt extension (17)		
Mild	0	0		2	11.8	
Moderate	0	0		5	29.4	
Severe	2	100	0.049*	10	58.8	0.015*
Hip	Rt abduction (1)			Rt extension (12)		
Mild	0	0		0	0	
Moderate	0	0		3	25	0.012*
Severe	1	100	0.049*	9	75	
Knee	Lt extension (3)			Lt extension (16)		
Mild	0	0		3	18.75	
Moderate	0	0		5	31.25	
Severe	3	100	0.049*	8	50	0.031*
Ankle	Rt dorsiflexion (4)			Rt dorsiflexion (21)		
Mild	0	0		3	14.29	
Moderate	1	25		3	14.29	
Severe	3	75	0.044*	15	71.42	0.008*

** p<0.05significance* *(sperman correlation)*

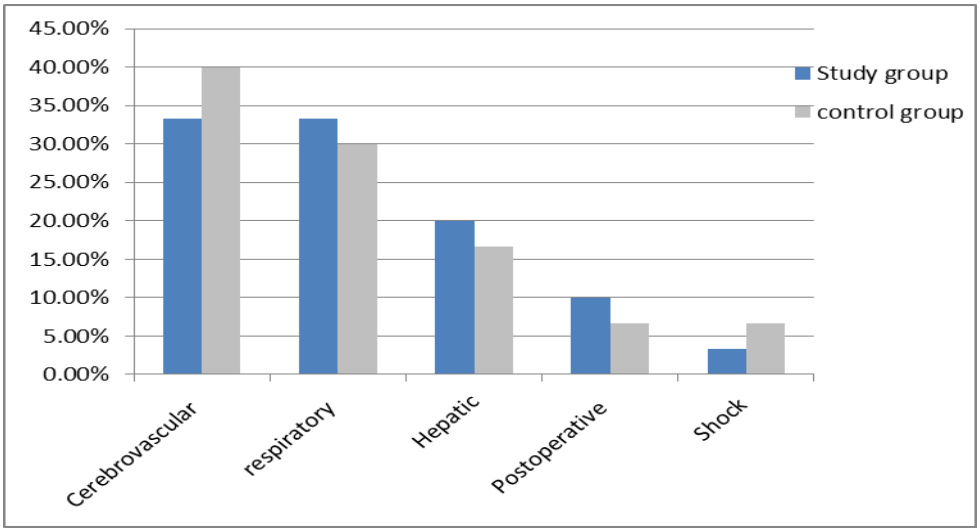

Figure (1) comparison between study and control groups as regard diagnosis.

Table (1): shows comparison between the study & control groups as regard patient characteristics . Regarding age It noticed that the mean age in study group was (40.3 ± 15.474) years and (34.633 ± 14.822) years in control group with no statistical differences between both groups (P>0.05). . Regarding gender It noticed that (70%) were males while (30%) of patients were females in study group and (63.33%) of patients were males and (36.37%)of patients were females in control group.

Regarding presence of past medical history , It was noticed that highest percentage of both groups did not report any past medical history it was (56.67%) for study group and (76.67%) for control group .

Regarding APACHE II score the table indicated that there was no statistical significance difference between study and control groups at 1st day with mean value (22.4 ± 4.7&24.9 ± 5.1) respectively (P>0.05).

Table (2): Represents comparison between both study & control groups in relation to joint angles of the shoulder. This table showed that there were statistical significant differences concerning joint angles between 1st and 15th day regarding all directions right and left side of the study group (p<0.000). Regarding comparison between study and control groups at 1st day there were no statistical significant differences concerning joints angles at all directions (p>0.05). Regarding comparison between study and control groups at 15th day there were statistical significant differences at Rt. flexion, Lt. flexion, Rt. extension, Lt. extension , Rt. abduction and Lt. abduction and with (p<0.005), (p<0.010), (p<0.004), (p<0.001), (p<0.007), (p<0.001), respectively.

Table (3): Represents comparison between both study & control groups in relation to joint angles of the elbow. This table showed that there were statistical significant differences concerning joint angles between 1st and 15th day regarding all directions right and left side of the study group (p<0.000). Regarding comparison between study and control groups at 1st day there were no statistical significant differences concerning joints angles at all directions (p>0.05). Statistical Significant differences were found between study and control groups at 15th day regarding all directions right and left side (p<0.000).

Table (4): Represents comparison between both study & control groups in relation to joint angles of the hip. The table showed that there were statistical significant differences concerning joint angles between 1st and 15th day regarding all directions right and left side of the study group (p<0.000). Regarding comparison between study and control groups at 1st day there were no statistical significant differences concerning joints angles at all directions (p>0.05). Statistical Significant differences were found between study and control groups at 15th day regarding Rt. flexion, Lt. flexion, Rt. extension, Lt. extension , Rt. abduction and Lt. abduction and Lt. adduction with (p<0.001), (p<0.000),(p<0.000),(p<0.000),(p<0.009), (p<0.002),(p<0.006) respectively.

Table (5) : Represents comparison between both study & control groups in relation to joint angles of the knee. This table showed that there were statistical significant differences concerning joints angles between 1st and 15th day regarding all directions right and left side of the study group (p<0.000). Regarding comparison between study and control groups at 1st day there were no statistical significant differences concerning joints angles at all directions (p>0.05). Significant statistical differences were found between study and control groups at 15th day regarding Rt. flexion, Lt. flexion, Rt. extension, Lt. extension, with (p<0.031), (p<0.027),(p<0.000), (p<0.000) respectively.

Table (6) : Represents comparison between both study & control groups in relation to joint angles of the ankle. This table showed that there were statistical significant differences concerning joint angles between 1st and 15th day regarding all directions right and left of the study group (p<0.000). Regarding comparison between study and control groups at 1st day there were no statistical significant differences concerning joints angles at all directions (p>0.05). Statistical significant differences were found between study and control groups at 15th day regarding Rt. dorsiflexion, Lt. dorsiflexion, Rt. planter flexion, Lt. planter flexion, with (p<0.000), (p<0.000),(p<0.001), (p<0.001) respectively.

Table (7): shows that there was no correlation between age and occurrence of joint contractures at both study and control groups.

Table (8) : showed that there was correlation between conscious level and occurrence of joint contractures at both study and control groups.

Figure (1) : Represents comparison between the study & control groups as regard diagnosis. The table showed that (33.33%) of patients in study group and (40%) of patients in control group with cerebrovascular accidents, (33.33%) in study group and (30%) in control group with respiratory diseases, (20%) in study group and (16.66%) in control group were hepatic patients, (10%) in study group and (6.67%) in control group with postoperative complications, (3.33%) in study group and (6.67%) of control group with shock .

Discussion

The musculoskeletal system has many important functions as it provides protection for vital organs including the brain, heart and lungs ; provides a sturdy framework to support body structures; and makes mobility possible. muscles and tendons hold the bones together and joints allow the body to move and there are many several functions **(Smeltzer et al., 2010)**.

Early physical activity and mobilization are essential in the prevention, attenuation or reversion of physical deconditioning related to critical illness. implemented depending on the stage of critical illness **(Gosselink et al., 2011)**.

Contractures are understood as an alteration in viscoelastic properties of the periarticular connective tissue where the muscles potentially lead to a reduction in the joints angles, or an increased resistance to passive joint movement, which in turn reduces joint flexibility and mobility. Contractures lead to impairments with far-ranging consequences on activities. **(Offenbacher et al., 2013)**. **Hence** The present study aims to investigate the effect of early activity exercises and proper positioning on occurrence of joint contractures among critically ill patients at Sohag university hospital.

Regarding the patient characteristics, The current study showed that mean (SD) of study group's **age** was (40.3 ± 15.474**)** and that of control group was (34.633 ± 14.822) with no statistical significant differences between both groups. **Clavet, Hebert, Fergusson & Trudel (2008)** in their study of 155 patient which was conducted to collect data on the presence of any risk factors for joint contractures in the shoulders, elbows, hips, knees and ankles among the patients admitted to the ICU, indicated that mean (SD) of age at admission was 59.6(15.5).

Regarding gender: The present study revealed that two thirds of the study and the control groups were males with no statistical significant differences between both groups. **Sackley et al., (2008)** illustrated in their study which measures the prevalence of joint contractures, pressure sores, painful shoulder, other pain, falls, and depression in the year after a severely disabling stroke that (57%) out of 122 patients were males.

Concerning reasons for Admission (Diagnosis): The present study revealed different percentage related to the reason for admission in intensive care unit for both study and control groups as follows: the highest percentage was cerebrovascular accidents, followed by respiratory diseases, hepatic disorders, postoperative complications and a shock respectively. This contradicts **Clavet, Hebert, Fergusson and Trudel (2008)** who indicated that diagnoses at admission were acute or chronic respiratory disease, followed by cancer, neurologic or vascular disease and sepsis respectively.

Regarding **APACHE II score:** The present study showed that mean value was (22.4 ± 4.7) for study group and (24.9 ± 5.1) for control group, while **Clavet, Hebert, Fergusson & Trudel (2008)** showed that mean (SD) was (20.6 ±7.4).

Regarding application of early activity exercises and proper positioning, regarding joints angles at 1st day, there were no significant statistical differences between both study and control groups. This indicated that patients in both groups had normal joints angles at admission.

There were a significant statistical differences between joints angels of the shoulder, elbow, hip, knee and ankle of the study group at 1st and 15th day regarding all the directions "right and left" ($p<0.000$) while significance indicating the effectiveness of early activity exercises and proper positioning on preventing of joint contractures . On the other hand the control group showed deterioration in joints angles and occurrence of joint contractures at all directions.

Regarding the **studied Directions; Hebert ,Fergusson & Trudel (2008),** stated that 2 directions of movement only for each joint, except the ankle, data were collected for dorsiflexion only, the number and percentage of the affected joint with joint contractures showed as shoulder flexion and abduction 24 (11%), elbow flexion and extension 76(36 %), hip flexion and extension 30(14%), knee flexion and extension 31(15%) and ankle dorsiflexion 51(24%). **Junior, Martinez & Neto (2014)** stated that reduction of joint angles in 22 patients in three joints (knee and elbow and ankle) was approximately 62% and 69% in the ankles, 5.4% and 6.1% in the knees, and 8% and 7.9% in the elbows, on the right and left sides, respectively.

The current study assessed the occurrence of joint contractures in all directions of the five major joints (flexion, extension, abduction, adduction, internal rotation and external rotation). The most affected direction of all joints was " extension " with different percentage of each joint, except ankle where the most affected direction was dorsiflexion . The present study showed that the joint, that affected with contractures most, was ankle, followed by elbow, shoulder, knee and hip respectively.

In the current study the most affected joint with contractures was ankle. While in cohort study, **Hamzah, Bahari, Abdullah & Mazlan (2015)** included 70 patients, but only 46 patients completed the study. Twenty-eight patients suffered from severe brain injury, whilst 18 suffered from moderate brain injury. Out of 46 patients, there were 13 (28%) developed ankle contractures at the end of the study

period for the total duration of assessment (3 months). **In Sackley et al., (2008)** study of 122 stroke survivors, one of the complications recorded was ankle contractures. The number and percentage of ankle contractures were 53 (43%) at the end of 3 months, 50 (56%) at the end of 6 months and 89 (73%) at the end of 12 months.

The current study indicated that in the study group, the number and percentage of patient who were affected with joint contractures was less than those of the control group which didn't receive them. **Gerlash and Hegner (2014)** indicated that early activity exercises is a technique used to prevent formation of contractures. Also **Clement (2012)** showed that early activity exercises and keeping the body in proper alignment are proper techniques to prevent joint contractures. Results of the present study matches **Sackley et al., (2008)** study which showed that early activity exercises prevents joints flexibility loss and the goal is to cycle the limbs through all possible directions with normal joint mobility through flexion and extension exercises while performing 5 – 10 flexions and extensions at least three times a day.

Nigam, Knight & Jones (2009) agree with the results of the current study and mentioned that contractures may be prevented through proper positioning and body alignment. Performing exercises at least once every eight hours is the key of prevention. Concerning the application of early activity exercises and proper positioning, the current study showed that there were statistically significant differences of joints angles regarding all directions of the five major joints of study group between the 1st and the 15th days ($p< 0.000$). On the other hand, the control group was affected with joint contractures with no statistically significant differences of joints angles regarding all directions of the five major joints of study group between the 1st and the 15th days ($p> 0.05$). .

Regarding loss of joints angles using a universal goniometer in both control and study groups is (0º-15º) degrees; this was compatible with **Gerlash & Hegner (2014),** who indicated that loss of flexibility at the first stage of joint contractures development within two weeks were (0º-15º) degrees .

Regarding relationship between age and most common direction affected with joint contractures of every joint: The present study showed that there was no correlation between age and the occurrence of joint contractures. This completely agreed with the study of **Wagner et al., (2008)** which indicated that age was not correlated with contractures.

Regarding relationship between GCS and most common direction affected with joint contractures of every joint, the current study indicated that there was correlation between (GCS) and the occurrence of joint contractures which indicated strong relation between both variables. **Clavet et al., (2011)** suggested that immobility or even inactivity may be a prime causal candidate in the course of contractures development.

Conclusion

Based on the findings of the present study, applying early activity exercises and proper positioning on critically ill patients in ICU have statistically significant positive effect to reduce occurrence of joint contractures.

Recommendations

- Longitudinal study to evaluate early activity exercises and proper positioning on joint contractures and mobility of critically ill patients
- Equip ICU with simple illustrated booklet about early activity exercises and proper positioning of patient for preventing occurrence of joint contractures.
- Repeat this research on a large probability sample size and different governmental hospital for generalization.

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