Effect of Rehabilitative protocol on Functional Abilities and Health outcome for Patients with Ankle Open Reduction and Internal Fixation Surgery

Sanaa Mohamed Alaa Eldin, Professor
Medical-Surgical Nursing, Faculty of Nursing, Alexandria University

Alice Edward. Reizian ,Professor
Medical-Surgical Nursing, Faculty of Nursing, Alexandria University

Mohamed Hossam Ibrahim El-shafie, Professor
Orthopedic Surgery and Traumatology Department, Faculty of medicine, Alexandria University

Wafaa Hassan Ali Awad,* Assistant *professor
Medical-Surgical Nursing, Faculty of Nursing, Alexandria University

Manal Saeed Mohammed, Assistant lecturer
Medical-Surgical Nursing, Faculty of Nursing, Alexandria University

Abstract

Background: *Ankle fractures are considered the most common types of lower extremity bony injury in orthopedic practice and constitutes the most chief complaint in the emergency department.* ***Objective:*** *Evaluate the effect of rehabilitative protocol on health outcome and functional abilities for patients with ankle open reduction and internal fixation surgery.* ***Settings:*** *This study was conducted at inpatient and outpatient orthopedic clinics, El- Hadra University Hospital, Alexandria -University.* ***Subjects:*** *A convenience sample of 40 adult patients with ankle open reduction and internal fixation surgery. Subjects were assigned into two equal groups as follows; (control group & study group), which include 20 patients in each group.* ***Tools:*** *Three tools were used for data collection in this study. Three tools were developed by the researcher based on the review of recent related literature to collect the necessary data for this study; Tool I: ankle fracture patients sociodemographic and clinical data. Tool II: Observational check list for neurovascular and wound assessment to assess patient problem. Tool III: Ankle ability index for patients with ankle open reduction and internal fixation surgery.* ***Results:*** *The results of the present study concluded that more than half (55%) of the studied patients had a fair total level of knowledge, while (35%) had a good total level of knowledge regarding ankle fracture patients undergoing ORIF surgery Furthermore, study group patients had improvement regarding foot and ankle ability measure, range of motion exercise, skin and neurovascular assessment post rehabilitative exercise program.* ***Conclusion:*** *The results of the present study Showed improvement of both physical activity and functional ability level after the application of rehabilitation protocol.* ***Recommendations:*** *Providing copy of the rehabilitative protocol for patients with ORIF surgery in the trauma units and out patients clinic of orthopedic to be readily available for all patients with ankle fracture and further educational programs should be recommended and suggested for all health care workers especially newly recruited nurses should attend in-service training program about dealing with orthopedic patients.*

Keywords: Ankle fracture, Rehabilitative protocol, Functional abilities, Health outcome, Ankle open reduction and internal fixation surgery.

Introduction

Ankle is one of the strongest joint in the body, the lower end of the tibia and the fibula form a hinge joint that articulates with the talus making the ankle joints. Ankle fractures are the second most common orthopedic trauma presentation, accounting for about 10% of all fractures presenting at hospital Carter et al., (2019),which occur when one or both sides of an ankle are completely or partially broken due to twisting injuries, falls or injuries experienced during play, or sports American Academy of Orthopedic Surgeon, (2015).

In the light of this, open reduction and internal fixation surgery (ORIF) is a common procedure that performed by orthopedic surgeons to restore the joint's normal structure and biomechanics. Menon, (2018). ORIF is more beneficial as it allows early mobilization and rehabilitation with immediate physiologic range of motion. So, it increases the significance of adequate repair of all osseous and soft tissue components of the ankle joint to create a stable ankle mortise Timpano, n.d.(2012).

Nursing instructions and teaching on how to perform isometric exercise before cast removal and range of motion exercises, care of the cast, ambulation with crutches, and exercise restrictions are considered a cornerstone factor in the success of surgery as well as reducing the incidence of complications after surgery. Nursing Alliance for Quality of Care, (2013). Furthermore health outcomes for patients with ORIF surgery refer to; improved level of independency in performing activities of daily living, absence of complaints / or problems, and increase muscle strength, ROM exercise of the study subjects So, the aim of nursing rehabilitation protocol is to decrease patients' pain and ankle swelling, early ambulation , regain normal joint movement and strengthen the muscles around the ankle, assess for signs of complications and post-operative follow up schedules Mostafa & Osman,(2020).

Aims of the Study

This study aims to determine the effect of rehabilitative protocol on functional abilities and health outcome for patients with ankle open reduction and internal fixation surgery.

Research hypotheses

- Patients with ankle open reduction and internal fixation surgery who receive rehabilitative protocol display improvement of functional ability than those patients who don't receive it.
- Patients with ankle open reduction and internal fixation surgery who receive rehabilitative protocol display improvement in heath outcome than those patients who don't receive it.

Materials and Method

Materials

Design: A quasi experimental research design was used to conduct this study.

Settings: This study was conducted in the Orthopedic Departments at El- Hadara Traumatology and Orthopedic University Hospital and the affiliated Outpatients Clinics. It contains 5 wards in each male / female unit with 120 beds. The outpatient clinics work every day from 8.30 am to 1pm.

Subjects: A convenience sample of 40 adult patients with ankle ORIF surgery, admitted to the above mentioned settings (aged from 21 to 60 years), able to communicate verbally and have no chronic disease as DM, DVT, venous insufficiency in lower extremities was included in this study. The sample was divided into two equal groups (control group & study group), 20 patients were included in each group. The sample size was calculated using power analysis (Epi-info7) program based on the following parameters: population size = 110/12months, expected frequency =50%, acceptance error =5%,

confidence coefficient =95%, design effect=1and power=80%. The exclusion criteria of the subjects are ankle fracture undergoing cast without surgery, associated injury in the distal end of tibia or contra- lateral lower limb, revision surgery for previously failed ankle surgery, and complicated ankle surgery.

Tools: In order to collect the necessary data for the study three tools were used:

First tool: Patient's knowledge A structured interview schedule which was designed by the researcher based on a review of relevant literature Mostafa & Osman, (2020), to collect data regarding sociodemographic data, clinical data and assess patient's knowledge about ankle fracture and open reduction and internal fixation surgery. It comprised of 33 questions and it translated in to Arabic and **consisted of three parts**:

Part I: Patients' socio-demographic: this part of the tools included age, gender, marital status, educational level, area of residence, income and occupation were obtained from patient.

Part II: Collection of patients clinical data: this part of the tool included assessment of patient's history of trauma it includes previous hospitalization, mode of trauma, date of fracture, date of surgery, type of fracture, site of fracture, type of surgery, previous musculoskeletal disorders, practiced any sport before, and other health problem.

Part III: patients' knowledge structured interview schedule: This part of the tool was developed by the researcher after reviewing the relevant literature. It was used to assess baseline knowledge of patients about ankle fracture, it included open and closed ended questions about the definition of ankle fracture, possible causes, signs & symptoms, methods of treatment, surgery, conservative treatment, types of exercise before cast removal and after cast removal, complications reported to the doctor and source of information if present. The patient's knowledge answers were scored on 3 points Likert scale and total score of every patient was summed up and converted into percent score as the following (Scoring below 50% was categorized as having poor knowledge level, 50-74% was categorized as having fair knowledge level, and 75% or more was categorized as having good knowledge level.

Second tool: observational check list for neurovascular and wound assessment to assess patient problem, it consisted of three parts, was classified as the following:

Part I: Skin and Neurovascular status of affected limb. The neurovascular assessment of the extremities performed to evaluate sensory and motor function ("neuro") and peripheral circulation ("vascular"). The components of the neurovascular assessment include skin condition, pulses, capillary refill, skin color, temperature, sensation, and motor function. Pain and edema are also assessed during this examination Schreiber, (2016). Moreover, wound assessment parameter which include: serous discharge or bleeding, erythema, purulent exudate, swelling, separation of deep tissues, bad odor, wound tenderness, hotness of skin, fever and peri-wound skin laceration.

Part II: ankle pain during activities assessment scale the numeric rating scale was developed by Sullivan et al., (2020) It was used by the researcher to assess level of patient's ankle pain during ADLs. It is a standardized linear scale, the score was ranged from 0-10 corresponding to degree of pain in the ankle, a score of (zero) means no pain, a score of (one up to three) means mild pain, a score of (four up to six) means moderate pain, a score of (seven up to nine) means severe pain. While (ten) denotes worst pain.

Part III: observational checklist for safe performance of assistive devices this tool was designed by the researcher based on a review of relevant literature yisha et al.,(2022) to assess patient's performance when using

assistive devices (walker, crutches and wheelchair). It includes data about walking, sitting down, standing up, going upstairs using a handrail, going upstairs without using a handrail and going down the stairs. A total score of every patient was summed up and converted into percent score. The percent score of this scale classified as the following (Scoring below 50% was categorized as having poor performance level, 50-74% was categorized as having fair performance level, and 75% or more was categorized as having good performance level.

Third tool: ankle ability index for patients with ankle open reduction and internal fixation surgery this tool was adopted by the researcher to evaluate outcome measures for patient after ORIF surgery, that was developed by Chou et al.,(2016) and Lovett & Martin.,(2014). It divided into three parts as follows:

Part I. foot and ankle ability measure this tool was adopted by the researchers from Foot and Ankle Ability Measure (FAAM) that was developed by Martin et al.,(2005) to provide information about person's functional abilities and activity of daily living. It includes data about patient's activities. The scores on each item are added together to get total item score. The percent score of this scale was classified as the following (0 % -< 20% was categorized as dependent, 20%-< 40% was categorized as needs to use equipment or devices & supervision, 40%-< 60% was categorized as needs supervision, 60-< 80% was categorized as needs to use equipment or devices and 80%-100% was categorized as independent.

Part II: muscle strength scale of the ankle this part was adopted from Karen et al., (2010), to assess muscle strength. It was including assessment of foot& ankle muscles for dorsiflexion, planter flexion, inversion and eversion. This scale ranges from (0-5) grade. as follows: 0 = no muscle contraction or paralysis, 1 = contraction felt but no limb movement, 2 = passive range of motion, 3 = active range of motion against gravity, 4 = full range of motion against some resistance, 5= full active range of motion full resistance.

Part III: range of motion of the affected ankle this part was measured by digital goniometer to measure range of motion of the affected ankle joint in performing dorsiflexion, planter flexion Konor et al., (2012) .

Method

This study was accomplished as follows: approval of the ethics committee of the faculty was obtained. An official letter was issued from the faculty of nursing, Alexandria University to El -Hadra University Hospital in Alexandria to obtain their permission to collect necessary data. An official permission was obtained from the directors and head of the departments of the selected hospital setting after explanation the aim of the study. The study tools were tested for content validity by 5 experts in the field of study. the necessary modifications were done accordingly. A pilot study was carried out on 10% of the study sample in order to test clarity, feasibility, and applicability of the research tools. Reliability of the developed tools were tested by using Alpha Cronbach's statistical test. The reliability coefficient value was (0.651) for tool (1), coefficient value for tool (2) was (0.725), and (0.830) for tool (3) in which all of them is acceptable. Data was collected by the researcher during the period from November 2021 to July 2022.

The study was conducted in four phases: Phase I: Patient’s assessment for both groups: the demographic, clinical data, and patient knowledge were assessed individually for each patient during preoperative period in orthopedic department.

Phase II: Planning phase based on the assessment phase, the nursing rehabilitative protocol for patients with ORIF surgery was prepared by the researcher for patients under the study based on review of related relevant literature Mostafa & Osman, (2020), to provide the patients with a booklet for

remembering the instructions and being a motivator for follow up after discharge.

Phase III: Implementing the rehabilitative protocol for patients with ORIF surgery was implemented individually for each patient in the above-mentioned settings in 4 sessions. During the interview the purpose of the study was explained to each participant of the study group, booklet was provided to each patient, information was explained through interactive discussions, given knowledge about simple information about (definition, causes, signs and symptoms, surgical treatment, post-surgery instruction), postoperative follow up and physical exercise demonstrations by researcher and re- demonstrations by patient

Phase IV: Evaluation phase for patients with ORIF surgery was be re-evaluated by the researcher after implementation of the nursing rehabilitative protocol 7-8 weeks post the surgery to re-evaluate the condition of the patient and ensure the patients master exercises, this is for the members of the control and study group by using tools.

Ethical considerations

A written informed patients' consent to participate in the study was obtained before data collection and after explanation of the aim of the study. Privacy of the study participants were asserted. Confidentiality of the subject data was asserted. and the researcher was emphasizing that participation in the study is entirely voluntary and withdrawal from the study will not affect the care provided.

Statistical Analysis

After data were collected the raw data were coded and transformed into coding sheets, so as to be suitable for computer feeding. Then, the data were entered into statistical package for social sciences files (SPSS package version 22). For qualitative variables, data were presented using numbers and percentage from total. On the other hand, Mean and standard deviation were used to present the quantitative variable (age).

Results

Table 1: presents the comparison between the control and study groups according to socio-demographic data. There was no significant differences between two groups regarding all variables.

Table 2: regarding the mode of trauma, less than half of control and study patients due to falling down. As regards the site of fractures, near than half of control and study patients had fractures in the fibula (lateral malleolus bone). Concerning the affected site, more than half of patients among both groups had fractures in the right ankle.

Table 3: demonstrates comparison between control and study group patients with ankle fracture related to total percentage of patient's knowledge regarding ankle fracture pre and post implementation of rehabilitative protocol. It was found that the study group patients showed marked improvement in their knowledge post 8 weeks after implementation of rehabilitative protocol 55% of studied patient had fair knowledge. Furthermore, it was observed that there were significant differences between control and study group patients post application of rehabilitative protocol p ($<0.001^{*}$) regarding knowledge.

Table 4: in relation to total score of skin and neurovascular assessment it showed that most of study group patients 80%, 90%, 95% respectively had normal in skin and neurovascular assessment post three, six, and eight weeks of post rehabilitative protocol implementation.

Table 5: regarding the total score of foot and ankle ability measure reveals highly statistically significant differences p ($<0.001^{*}$) was found between control and study patient pre exercise and eight weeks post rehabilitative protocol implementation.

Table 6: reveals comparison between both studied and control group patients as regards range of motion of the affected limb pre and post implementation of rehabilitative protocol. It was observed that the majority of studied patients had normal ankle dorsiflexion and planter flexion. Moreover, this table shows a high statistically significant differences between control and study group post eight weeks (P <0.001*) post implementation of protocol in relation to ankle dorsiflexion and planter flexion.

Discussion

The main findings of the current study revealed that: the present study revealed that less than half in the studied group among the age group of 30 to 40 years. In my opinion might be related to that this age group have an active lifestyle that increase risk of rotational injury where the ankle becomes twisted, turned or rolled while walking or running, This finding is in line with Loretta et al., (2018) who stated that the average age was(41) years.

According to gender, the present study reports that, more than half of control group and study group patients were males. A possible explanation that might account for this finding is the fact that ankle fracture is thought to be due to their high level of activity than women, male also work in hard occupation that can cause a heavy object falling on the foot or heavy machinery running over the ankle. This finding matches with Mostafa & Osman, (2020) who found that majority of patients 86.7% were male. More over Armando et al., (2018) who stated that the majority of their study was male.

In relation to educational level, it was found that the 30% of study group patient were illiterate. This could be contributed to the fact that lack of education and safety precaution knowledge can make people more risky to be exposed to fractures. Also, there was link between illiteracy, many incorrect practices and unhealthy. Mostafa & Osman ,(2020) illustrated that more than half of patients 64.7% were illiterate .

Regarding mode of trauma, about half of control group and study group patients fracture were due to falling down. The reason for this result could be that, faulty equipment, such as shoes that are too worn or not properly fitted, also, related to a high-force impact can contribute to stress fractures and falls. This is, to some extent, similar to the result of Kumar & Gopal,(2019) who reported that slip and fall accounted for 53% of the total number of patients and is the most common cause for injury, followed by road traffic accidents. In addition to Mostafa & Osman, (2020) found that more than half of control group patient had accident, while more than half of study group had falls**.**

As regards site of fractures, around half of control and study patients had fracture in lateral malleolus bone. This study finding might be related to take an unsuitable or uneven step that cause twist or roll the ankle in out word position so lateral malleolus bone are the most common type of ankle fracture. Elsoe et al.,(2018) agrees with this result and report that the most common type of fracture in all age groups were lateral malleolar fracture.

Concerning the affected site, more than half of patients among both control and study group had fracture in right ankle. This might be due to the right leg more dominant than left leg. This in line with Kumar & Gopal, (2019) who stated that a right sided predominance's of the fracture in 57% of patient.

In relation to patients knowledge about ankle fracture, the findings of the present study revealed that there was a high statistically significant improvement in the study group patients knowledge about definition, causes, signs & symptoms, methods of treatment, surgery, conservative management, types of exercise before cast removal and after removal of cast, complications or problems. This improvement increased especially after eight weeks. The high statistically significant (<0.001*) improvement post program implementation might be due to health instruction given to

patients about ankle fracture , (ORIF) surgery and treatment using different teaching strategies as lecture, discussion, using media as hand out including colored booklet. It also emphasized the importance of reinforcing patient's knowledge.

Drakos & Murphy, (2014) are in the agreement with current result who reported that majority of patients did not have knowledge about fracture and practice of exercises. **Furthermore ,** This finding is in line with Elmetwaly,(2021) who report that, improvement in total knowledge of the study group patients post guidelines implementation versus pre guidelines implementation.

As regard neurovascular assessment, total score of skin and neurovascular assessment it showed that most of study group patients had normal in skin and neurovascular assessment post three, six, and eight weeks of post rehabilitative protocol implementation. This might be due to the effect of the application of the rehabilitation program which included isometric exercises and exercises post cast removal that were demonstrated to the patient by the investigator, this increases blood supply to the affected ankle and improve of neurovascular assessment. This finding was supported by Mostafa & Osman, (2020) who illustrated that in his study the highest percentages of study group had normal skin and neurovascular assessment post guidelines implementation.

In relation to ankle ability index the results of the present study revealed that there was an improvement of functional ability of study patient able to perform activity of daily but need supervision. The patient's ability to master their activities improved as a result of pain reduction, which improved ankle muscles strength and range of motion of the affected ankle. These findings are attributed to adherence of the studied patients to the instructions provided by the researcher to perform self-care activities or due to incorporating home exercises regularly into their daily living. This was congruent with the findings of Elmetwaly,(2021) who reported that a statistically significant improvement in physical activity and functional ability post application of instructional guidelines of pott`s fracture.

Concerning range of motion of the affected ankle the results of the present study revealed that there are improvement in flexion and extension of an affected ankle of study patient had full motion during planter flexion and dorsiflexion, with a statistically significant difference between control and study group post seven and eight weeks from protocol implementation p ($<0.001^{*}$). This result may be due to the continuous application of exercises by studied patients as instructed by the researcher and demonstrated by the colored booklet which was distributed to each patient as continuous ankle exercise improves circulation, increases flexibility, prevents ankle joint stiffness, improves range of motion of affected ankle and improves overall physical conditioning.

Smeeing et al., (2020) agree with this study results, who explained that early mobilization and exercises would reduce hospital stay, speed up return to work and sport practice, and promote early ROM recovery without resulting in an increase in complications**.**

Conclusion

Based upon the findings of the current study, it could be concluded that more than half of the studied patients had a fair total level of knowledge regarding ankle fracture patients undergoing ORIF surgery. Furthermore, study patients had improvement regarding foot and ankle ability measure, range of motion exercise, skin and neurovascular assessment post implementation of rehabilitative protocol than the control group.

Recommendations

In line with the findings of the study, the following recommendations are made:

- Providing copy of the rehabilitative protocol for patients with ankle ORIF surgery in the

trauma units and out patients ‘clinic of orthopedic to be readily available for all patients with ankle fracture.

- Further educational programs should be recommended and suggested for all health care workers especially newly recruited nurses should attend in-service training program about dealing with orthopedic patients.
- Periodic scientific meetings among physicians, nurses, and family must be conducted to discuss patient's problems and establish a comprehensive plan to meet needs of patients with ankle fracture undergoing to ORIF surgery.

Table (1): Comparison between the control and study groups according to socio-demographic data.

	Socio-demographic	Control (n = 20)		Study (n = 20)		χ^2	P
		No.	%	No.	%		
1	**Age in years**						
	20 < 30	3	15.0	2	10.0	4.264	^{MC}p= 0.221
	30 < 40	6	30.0	4	20.0		
	40 < 50	3	15.0	9	45.0		
	50 – 60	8	40.0	5	25.0		
2	**Sex**						
	Male	13	65.0	11	55.0	0.417	0.519
	Female	7	35.0	9	45.0		
3	**Level of education**						
	Illiterate	2	10.0	6	30.0	8.057	^{MC}p= 0.141
	Read and write	7	35.0	1	5.0		
	Basic education	3	15.0	3	15.0		
	Secondary	4	20.0	4	20.0		
	Technical	2	10.0	5	25.0		
	University	2	10.0	1	5.0		

χ^2: Chi square test MC: Monte Carlo FE: Fisher Exact p: p value for comparing between the two studied groups

Table (2): Frequency distribution of patients with ankle fracture of both control and study group according to clinical data.

	Collection of clinical data	Control (n = 20)		Study (n = 20)		χ^2	P
		No.	%	No.	%		
1	Mode of trauma?						
	Car accidents	8	40.0	6	30.0	2.881	^{MC}p= 0.499
	Fall from height	2	10.0	0	0.0		
	Pathological condition	1	5.0	1	5.0		
	Falling down	9	45.0	13	65.0		
2	Site of fracture?						
	Talus	6	30.0	4	20.0	1.402	^{MC}p= 0.776
	Tibia (Medial malleolus)	2	10.0	4	20.0		
	Fibula (Lateral malleolus)	9	45.0	10	50.0		
	Potts	3	15.0	2	10.0		
3	Affected Side						
	Right	13	65.0	15	75.0	0.476	0.490
	Left	7	35.0	5	25.0		

χ^2: Chi square test MC: Monte Carlo p: p value for comparing between the two studied groups

Table (3): Comparison between control and study group patients with ankle fracture related to total percentage of patient's knowledge regarding ankle fracture pre and post rehabilitative protocol application.

Part III: Patient knowledge structured interview schedule:	Control Group (n = 20)						Study Group (n = 20)						$\chi^2(p_1)$	$\chi^2(p_2)$	$\chi^2(p_3)$
	Before surgery		One week post – surgery		8 weeks post-surgery		Before surgery		One week post – surgery		8 weeks post-surgery				
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%			
Overall knowledge															
Poor (<50%)	20	100.0	20	100.0	20	100.0	18	90.0	2	10.0	2	10.0	2.105	36.302*	35.765*
Fair (50% – 75%)	0	0.0	0	0.0	0	0.0	2	10.0	15	75.0	11	55.0	(^{FE}p=	(<0.001*)	(<0.001*)
Good (>75%)	0	0.0	0	0.0	0	0.0	0	0.0	3	15.0	7	35.0	0.487)		
Fr(p_0)	–						**30.448*(<0.001*)**								

χ^2: Chi square test MC: Monte Carlo FE: Fisher Exact *: Statistically significant at $p \leq 0.05$ Fr: Friedman test,
p_0: p value for comparing between the three studied periods in each other group. p_1: p value for comparing between Control Group and Study Group in before
p_2: p value for comparing between Control Group and Study Group in one-week post –surgery p3: p value for comparing between Control Group and Study Group in 6 weeks post –surgery p_4: p value for comparing between Control Group and Study Group in 8 weeks post –surgery.

Table (4): The comparison between both study and control group patients as regards their neurovascular assessment pre and post rehabilitative protocol.

Q	Skin and neurovascular status of affected limb	Control Group (n = 20)										Study Group (n = 20)										$\chi^2(p_1)$	$\chi^2(p_2)$	$\chi^2(p_3)$	$\chi^2(p_4)$	$\chi^2(p_5)$
		Before surgery		One week post – surgery		3 weeks post-surgery		6 weeks post-surgery		8 weeks post-surgery		Before surgery		One week post – surgery		3 weeks post-surgery		6 weeks post-surgery		8 weeks post-surgery						
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%					
	Total score																									
	Normal (<50%)	13	65.0	9	45.0	10	50.0	9	45.0	13	65.0	12	60.0	7	35.0	16	80.0	18	90.0	19	95.0	0.107	0.417	3.956*	9.231*	5.625*
	Abnormal (≥50%)	7	35.0	11	55.0	10	50.0	11	55.0	7	35.0	8	40.0	13	65.0	4	20.0	2	10.0	1	5.0	(0.744)	(0.519)	(0.047*)	(0.002*)	(^{FE}p= 0.044*)

χ^2: **Chi square test** MC: **Monte Carlo** FE**: Fisher Exact** *: Statistically significant at $p \leq 0.05$
p_1: p value for comparing between **Control Group** and **Study Group** in **Before surgery** p_2: p value for comparing between **Control Group** and **Study Group** in **One week**
p_3: p value for comparing between **Control Group** and **Study Group** in **3 weeks** p_4: p value for comparing between **Control Group** and **Study Group** in **6 weeks**
p_4: p value for comparing between **Control Group** and **Study Group** in **8 week**

Table (5): Comparison between both study and control group patients as regards their foot and ankle ability measure pre and post rehabilitative protocol.

Foot and Ankle ability measure	Control Group (n = 20)				Study Group (n = 20)				$\chi^2(p_1)$	$\chi^2(p_2)$
	Pre exercise 6 weeks post-surgery		Post 8weeks		Pre exercise 6 weeks post-surgery		Post 8 weeks			
	No.	%	No.	%	No.	%	No.	%		
Foot and Ankle ability measure										
Unable to perform dependent	20	100.0	15	75.0	20	100.0	0	0.0		
Needs to use equipment or devices & supervision	0	0.0	3	15.0	0	0.0	0	0.0		35.687*
Needs Supervision	0	0.0	2	10.0	0	0.0	14	70.0	–	(^{MC}p
Needs to use equipment or devices	0	0.0	0	0.0	0	0.0	6	30.0		<0.001*)
Full self-care independent	0	0.0	0	0.0	0	0.0	0	0.0		

χ^2: Chi square test MC: Monte Carlo Z: Wilcoxon signed ranks test *: Statistically significant at $p \leq 0.05$

p_1: p value for comparing between Control and Study in pre exercise 6 weeks p_2: p value for comparing between Control and Study in post 8 wee

Table (6): Comparison between both study and control group patients as regards range of motion of the affected limb pre and post rehabilitative protocol.

Range of motion	Control Group (n = 20)						Study Group (n = 20)						$\chi^2(p_1)$	$\chi^2(p_2)$	$\chi^2(p_3)$
	Pre exercise 6 weeks post-surgery		Post 7 weeks		Post 8 weeks		Pre exercise 6 weeks post-surgery		Post 7 weeks		Post 8 weeks				
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%			
Operated ankle Dorsiflexion															
No motion	3	15.0	9	45.0	2	0.0	5	25.0	4	20.0	3	0.0	0.625	6.325*	22.260*
Motion with limitation	17	85.0	10	50.0	16	35.0	15	75.0	9	45.0	2	10.0	(^{FE}p=	(0.030*)	(^{MC}p=
Full motion	0	0.0	1	5.0	2	15.0	0	0.0	7	35.0	15	90.0	0.695)		<0.001*)
Fr (p_0)	**3.60 (0.165)**						**4.571 (0.102)**								
Operated ankle Planter flexion															
No motion	8	40.0	7	35.0	8	40.0	6	30.0	3	15.0	4	20.0			
Motion with limitation	12	60.0	12	60.0	11	55.0	14	70.0	8	40.0	2	10.0	0.440	8.800*	18.831*
Full motion	0	0.0	1	5.0	1	5.0	0	0.0	9	45.0	14	70.0	(0.507)	(0.012*)	(^{MC}p
Fr (p0)	**0.667 (0.717)**						**2.000 (0.368)**								<0.001*)

χ^2: Chi square test MC: Monte Carlo Fr: Friedman test *: Statistically significant at $p \leq 0.0$

References:

- Armando, M., Christian, C., Luigi, S., Massimo, I., (2018): Postoperative Complications and Reoperation Rates Following Open Reduction and Internal Fixation of Ankle Fracture, Joints.2018 May 21;6(2):110-115. doi: 10.1055/s-0038-1653949. PMID: 30051108; PMCID: PMC6059857.

- American Academy of Orthopedic Surgeon. (2015). Fractures. Retrieved January 26, 2022 https://www.aaos.org/

- Carter, T. H., Oliver, W. M., Graham, C., Duckworth, A. D., & White, T. O. (2019). Medial malleolus: Operative or Non-operative (MOON) trial protocol - A prospective randomised controlled trial of operative versus non-operative management of associated medial malleolus fractures in unstable fractures of the ankle. Trials, 20(1), 1–9. https://doi.org/10.1186/s13063-019-3642-7.

- Chou ,R., Gordon, DB., de Leon-Casasola ,OA., Rosenberg ,JM., Bickler ,S., Brennan, T. (2016).Management of postoperative pain: a clinical practice guideline from the American Pain Society, the American Society of Regional Anesthesia and Pain Medicine, and the American Society of Anesthesiologists' Committee on Regional Anesthesia, Ex- ecutive Committee, and Administrative Council. Journal Pain 2016 Feb;17(2):131-57. doi: 10.1016/j.jpain.2015.12.008. Erratum in: J Pain. 2016 Apr;17(4):508-10. Dosage error in article text. PMID: 26827847.

- Drakos, M., & Murphy, C. (2014). Bracing versus casting in ankle fractures. Physical Sports medecine, Nov;42(4):60-70. doi: 10.3810/psm.2014.11.2092. PMID: 25419889

- ELmetwaly, A. (2021). Instructional Guidelines for Patients with Pott's Fracture to Improve Physical Activity and Functional Ability. Mansoura Nursing Journal, 8(2), 161-174. doi: 10.21608/mnj.2021.213088.

- Elsoe R., Ostgaard S.E., Larsen, P.(2018). Population-based epidemiology of 9767 ankle fractures. Foot Ankle Surg. 2018;24:34–39. doi: 10.1016/ j.fas.2016.11.002.

- Karen ,M., Burke, Priscilla, T. L., Elaine ,M.B., Linda, E. (2010).Medical Surgical Nursing,3rd ed., United State of America, Pearson Prentc Hall; 1010-11.

- Konor, M. M., Morton, S., Eckerson, J. M., & Grindstaff, T. L. (2012). Reliability of three measures of ankle dorsiflexion range of motion. International Journal of Sports Physical Therapy, 7(3), 279–287. http://www.ncbi.nlm.nih.gov/pubmed/22666642%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC3362988.

- Kumar, D. G. A., & Gopal, D. V. (2019). A study of functional outcome of closed ankle fractures treated by open reduction and internal fixation. International Journal of Orthopaedics Sciences, 5(4), 1076–1081. https://doi.org/10.22271/ortho.2019.v5.i4r.1837

- Loretta, B., Emily, L., Ariel, A., Rosanna, D., Sophia, E., Anderson, B., Alex, H., Kenneth, J., (2018). Postoperative Pain After Surgical Treatment of Ankle Fractures: A Prospective Study JAAOS Global Resarch Review, 2018 Sep 25;2(9): 0-21. doi: 10.5435/JAAOSGlobal-D-18-00021. PMID: 30465035; PMCID: PMC6226297.

- Lovett ,R.W., Martin, E.G. (2014). certain aspects of infantile paralysis and description of amethod of muscle testing.JAMA;66:29-733. https://www.semanticscholar.org/paper/CERTAIN-ASPECTS-OF-INFANTILE-PARALYSIS%3A-WITH-A-OF-A-Lovett-Martin/c0c1cbdcb14106b0a2e8abe7e3c8ef4368953c3a.

- Menon, J. (2018). Surgical Management of Dysphagia. Textbook of Laryngology, April, 348–348. https://doi.org/10.5005/jp/books/13074_37.

- Martin, R., Irrgang, J., Burdett, R., Conti, S. (2005) .Van Swearingen, J: Evidence of Validity for the Foot and Ankle Ability Measure. Foot and Ankle Internet 2005 Nov;26(11):968-83. doi: 10.1177/107110070502601113. PMID: 16309613.

- Mostafa, N., Osman, A. (2020). Effect of Applying Postoperative Nursing Instructions 0nAnkle Open Reduction Internal Fixation Surgery Patients. Assiut Scientific Nursing Journal, 8(23), 86–95. https://doi.org/10.21608/asnj.2020.47999.1065.

- Nursing Alliance for Quality of Care (NAQC), (2013): Fostering successful patient and family engagement, American nurse, Vol 9, pp (2):1-4. https://www.nursingworld.org/~4aa949/globalassets/naqc/naqc_patientengagementwhitepaper.pdf.

- Smeeing, D.P.J., Houwert, R.M., Briet, J.P., Groenwold, R.H.H., Lansink, K.W.W., Leenen, L.P.H., van der Zwaal, P., Hoogendoorn, J.M., van Heijl, M., Verleisdonk, E.J., et al.(2020). Weight-Bearing or Non-Weight-Bearing after Surgical Treatment of Ankle Fractures: A Multicenter Randomized Controlled Trial. Europen. Journal. Trauma Emergency. Surgery. 2020 Feb;46(1):121-130. doi: 10.1007/s00068-018-1016-6. Epub 2018 Sep 24. PMID: 30251154; PMCID: PMC7026225.

- Schreiber,M.(2016).Neurovascular assessment:an essential nursing focus.Medical Surgical Nursing, 2016 Jan-Feb;25(1):55-7. PMID: 27044130.

- Sullivan, J., Pappas, E., Burns, J. (2020). Role of mechanical factors in the clinical presentation of planter heel pain: Implication for management. Foot, (Edinb). 2020 Mar;42:101636. doi: 10.1016/j.foot.2019.08.007. Epub 2019 Sep 3. PMID: 31731071.

- Timpano, E. D. (n.d.). Anatomic Considerations for Ankle Fractures. 2012;45(6):112–140.

- Yisha, Z., Bashir, Danae, M., Dinkel, Iraklis ,I., Pipinos, Jason ,M., Johanning, Sara, A. (2022).Patient Compliance With Wearing Lower Limb Assistive Devices. A Scoping Review,Journal of Manipulative and Physiological Therapeutics, 45 (2), 114-126. https://doi.org/10.1016/j.jmpt.2022.04.003.