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Original article

Post Ankle Sprain Injury Associated with Lateral Ligaments Tear Rehab Protocol

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Abstract

Introduction: Injury to the lower extremity joint injury is one of the most common consequences of accidents in recreation and sports. The incidence of ankle sprain after or during the rehabilitation of lateral ligament tear is popular however, little is known about the prevalence of post rehabilitation ankle sprain in Saudi Arabia. Therefore, the aim of this study was to assess the prevalence of post ankle sprain injury among patients who underwent lateral ligament tear rehab conservatively. ***Methodology:*** This is a cross sectional study among patients who underwent lateral ligament tear rehabilitation conservatively using self-reported questionnaire which was distributed using online means as WhatsApp or Facebook throughout Google sheets. The data was analyzed using the statistical package for the social science (SPSS) version 23.0. ***Results:*** In this study, we were able to collect data from 104 participants who applied to the inclusion criteria. Among the participants 43.3 % of the participants aged between 20 -30 years old and 70.2 % of the participants were males and 69.2 % were married. According to the participants, 16.3 % of the participants reported having ankle sprain injury after or during the rehabilitation while 6.7 % of them reported having ankle sprain injury during the rehabilitation. ***Conclusion:*** We found that 16.3 % of the patients reported having ankle sprain injury after or during the lateral ligament injuries rehabilitation. Patients reported full recovery after rehabilitation showed lower prevalence of post rehabilitation ankle sprain injury.

Introduction

Injury to the lower extremity joint injury is one of the most common consequences of accidents in recreation and sports [1]. Ligamentous ankle injuries are the most common sports trauma which are accounting for about 10 % to 30 % of all injuries in sports [2]. In a study conducted in 2010, one million individuals were treated in US emergency department for ankle sprain which cause high health care charges [3]. This type of injuries most occurred among sport-practicing individuals as they occur during plantar flexion, supination and inversion and thus are popular among soccer players, basketball, volleyball and all sports involve jumping and sidestepping [4,5] as well as some accidents that occurred in work or at home. Most of ankle injuries are sprains and only small percentage are caused by ankle ligament rupture [6]. These injuries located at the weaker lateral ligaments in up to 85 % and only 3-5 % are isolated deltoid ligament sprains [6,7].

After the initial assessment including history, physical and even radiographic evaluations, the acute treatment for ankle sprains started with anti-edema measures as protection, rest, ice, compression, anti-inflammatory, elevation and weight-bearing support using brace. Severe cases of injuries may require rigid immobilization for ten days which is followed by a transition to semi - rigid external constraints [8,9]. Surgical intervention should be restricted for those patients with high-demand injuries including professional athletes [10] and those with severe sprains among whom conservative treatment is failed with them [11]. After acute phase treatment of lateral ligament injuries, physical therapy usually started and focuses on muscle strengthening, neuromuscular training, and joint mobilization [9]. The main objective of the rehabilitation in patients with later ligament injuries is to restore the range of motion and proprioception of the injured ankle and to reinstate lower limn strength [1].

In a previous systematic revie conducted among 31 follow-up studies, the authors found that only 35 % to 85 % of the patients with lateral ligament tear showed full recovery withing the period of three years following the rehabilitation of ankle injury [12]. The same systematic review showed that 5-33 % of ankle injury patients stull experienced pain even after one year of rehabilitation [12]. Moreover, 33 % of the patients reported at least one re-sprain with the first three- years period relating to development of post-rehabilitation ankle sprain [13,14].

The high incidence of ligamentous ankle injuries requires clearly defined acute care and a broad knowledge of new methods in rehabilitation. In addition to rapid pain relief, the main objective of treatment is to quickly restore the range of motion of the ankle without any major loss of proprioception [15] thereby restoring full activity as soon as possible. The aim of this study is to assess the prevalence of post ankle sprain injury among patients who underwent lateral ligament tear rehab conservatively.

Methodology

Study design and setting

This is a cross sectional study among patients who underwent lateral ligament tear rehabilitation conservatively in order to assess the prevalence of post ankle sprain injury in Saudi Arabia.

Subjects

This study included the participants according to the next criteria

Inclusion criteria:

- All patients with lateral ligament tear who underwent conservatively rehabilitation
- Both genders
- Older than 20 years
- Agree to participate in the study and complete the questionnaire

Exclusion criteria:

- Patients with other ankle injury other than lateral ligament tear
- Patients treated surgically or having surgical intervention at ankle injury
- Having fracture or other injury of the same ankle before having lateral ligament tear
- Younger than 20 years

Study tools and procedures

This study depended on self-reported questionnaire which was distributed using online means as WhatsApp or Facebook throughout Google sheets. The questionnaire is consisted of 18 questions starting with questions of "Did you have previous conservatively rehabilitation for lateral ligament tear before?", "Did you have a previous injury before this rehabilitation", "Did you have surgery for this injury" and consent state "Do you agree to participate in this study". These questions were used to apply the inclusion and exclusion criteria. After which, 76 participates were excluded because of not applied to the inclusion criteria. The questionnaire included questions about the demographic factors of the participants including age "20-30, 31-40, 41-50, >50 years", gender "male, female", marital status "single, married, other", Body mass index (BMI) "< 25 Kg/m2, > 25 Kg/m2", and monthly income "< 5,000, 5,000-10,000, > 10,000". Then the questionnaire included questions of the lateral ligament injury included the cause of the lateral ligament tear "Sports, home injuries, work injuries, other", injury grade "Mild, moderate or severe, I do not remember", did you complete the course of rehabilitation "yes, no", and what was the primary outcomes "full recovery, recovery with pain, not recovery" and then the questionnaire included questions about the reinjury including did you have ankle sprain injury after or during the rehabilitation "yes, no", did you have injury during the rehabilitation "yes, no", the duration between rehabilitation and injury "one week, 1-2 months, after 6 months", Ankle load during work " none to light, heavy", Ankle load during sport/hobby "none or light, heavy".

Statistical analysis

MS Excel was used for data entry while MS Word was used for showing the results. The data was analyzed using the statistical package for the social science (SPSS) version 23.0. with a data analysis expert's help. Frequency and percent were used for description of categorical variables and chi test and t test were used to assess the relation between ankle injury and demographic factors.

Ethical considerations

All participants were well informed before starting the questionnaire about the aim of the study and the importance of completing the questionnaire. No personal data as name or residency were collected form the participants. All data was stored in one computer with password with author and all data was used for the purpose of this study and will not published as raw data. All participants had to apply the contest before starting the questionnaire and each one had the ability to leave at any time however, only complete survey was collected.

Results

In this study, we were able to collect data from 104 participants who applied to the inclusion criteria. Among the participants 43.3 % of the participants aged between 20 -30 years old while 30.8 % were aged between 31-40 years old. Moreover, 70.2 % of the participants were males and 69.2 % were married. According to the BMI, 79.8 % of the participants were over 25 Kg/m2 and 62.5 % of the participants reported having monthly income of 5000 and 10000 SR (**Table 1**).

Table 1: The demographic factors of the participants (N=104)

Variable	Categories	Frequency	Percent
Age	20-30	45	43.3%
	31-40	32	30.8%
	41-50	17	16.3%
	> 50	10	9.6%
Gender	Male	73	70.2%
	Female	31	29.8%
Marital status	Single	22	21.2%
	Married	72	69.2%
	Other	10	9.6%
Body Mass Index	< 25 kg/m2	21	20.2%
	≥ 25 kg/m2	83	79.8%
Monthly income	< 5,000	22	21.2%
	5,000-10,000	65	62.5%
	> 10,000	17	16.3%

Moreover, 66.3 % of the participants reported that injury during sports was the cause of the lateral ligament tear followed by 17.3 % because of home injuries. Furthermore, 70.2 % of the participants reported having mild lateral ligament tear and 75 % of them reported completing the course of rehabilitation. According to the participants, 68.3 % were full recovery after rehabilitation while 20.0 % Recovery with pain and 11.5 % reported not recovery. After rehabilitation, 49 % of the participants reported that they had heavy load on ankle during work and 79.8 % had heavy load on ankle during sport or hobby (**Table 2**).

Table 2: The characteristics of the injury of lateral ligament tear and rehabilitation

Item	Variables	Frequency	Percent
Cause of the lateral ligament tear	Sports	69	66.3%
	Home injuries	18	17.3%
	Work injuries	3	2.9%
	Other	14	13.5%
Injury grade	Mild	73	70.2%
	Moderate or severe	21	20.2%
	I do not remember	10	9.6%
Did you complete the course of rehabilitation	Yes	78	75.0%
	No	26	25.0%
What was the primary outcomes	Full recovery	71	68.3%
	Recovery with pain	21	20.2%
	Not recovery	12	11.5%
Ankle load during work	None to light	53	51.0%
	Heavy	51	49.0%
Ankle load during sport/hobby	None to light	21	20.2%
	Heavy	83	79.8%

According to the participants, 16.3 % of the participants reported having ankle sprain injury after or during the rehabilitation while 6.7 % of them reported having ankle sprain injury during the rehabilitation (Figure 1). Moreover, 41.2 % of those reported injuries reported having them during the first one week of the rehabilitation while 11.8 % during the first two months and 47.1 % during the first six months.

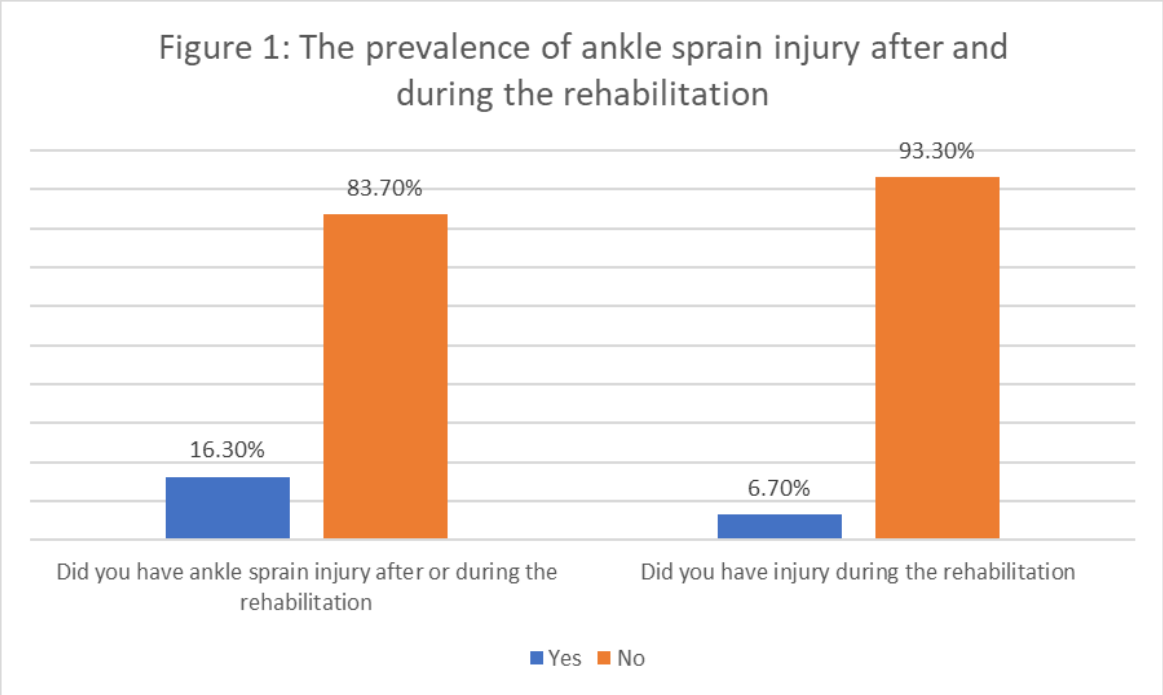

Figure 1: The prevalence of ankle sprain injury after and during the rehabilitation

In table 3, we showed the relation between demographic factors and the ankle sprain injury after or during the rehabilitation. The results showed that age is a significant factor in the recurrent injury where younger participants were more likely to get injury after or during the rehabilitation (20 % of age categories of 20-30 year compared with 10 % of age category of older than 50 years), (P=0.001). Moreover, we did not find any significant difference between the two genders in the prevalence of ankle sprain injury after or during the rehabilitation (P=0.88 and 0.862). Higher prevalence of ankle sprain injury was found among single participants and those who has BMI lower than 25 Kg/m2 and those with monthly income lower than 5000 SR significantly (P=0.012, 0.002 and 0.000). According to the cause of the lateral ligament tear, we found that the highest prevalence of ankle sprain injury was found among those indicated that work injury was the cause of lateral ligament tear (P=0.000). Moreover, we found that 52.3 % of the patients with moderate or severe injury reported ankle sprain injury compared with 2.7 % of those with mild injury (P=0.000). Completing the rehabilitation course is another significant factor where 50.0 % of those reported not completing the course showed ankle sprain injury compared with 5.1 % of those completing the course (P=0.000).

Table 3: The relation between demographic factors and the ankle sprain injury after or during the rehabilitation

Variables	Did you have ankle sprain injury after or during the rehabilitation					Did you have injury during the rehabilitation				
	Yes		No		P-value	Yes		No		P-value
	N	N %	N	N %		N	N %	N	N %	

Age	20-30	9	20.00	36	80.00	0.001*	4	8.9	41	91.1	0.032*
	31-40	5	15.60	27	84.40		2	6.3	30	93.7	
	41-50	2	11.80	15	88.20		1	5.9	16	94.1	
	> 50	1	10.00	9	90.00		0	0	10	100	
Gender	Male	12	16.40	61	83.60	0.88	5	6.8	68	93.2	0.862
	Female	5	16.10	26	83.90		2	6.5	29	93.5	
Marital status	Single	5	22.70	17	77.30	0.012*	2	9.1	20	90.9	0.000*
	Married	11	15.30	61	84.70		4	5.6	68	94.4	
	Other	1	10.00	9	90.00		1	10	9	90	
Body Mass Index	< 25 kg/m2	5	23.80	16	76.20	0.002*	2	9.5	19	90.5	0.000*
	≥ 25 kg/m2	12	14.50	71	85.50		5	6	78	94	
Monthly income	< 5,000	6	27.30	16	72.70	0.000*	3	13.7	19	86.3	0.000*
	5,000-10,000	9	13.90	56	86.10		3	4.6	62	95.4	
	> 10,000	2	11.80	15	88.20		1	5.9	16	94.1	
Cause of the lateral ligament tear	Sports	11	15.90	58	84.10	0.000*	5	7.2	64	92.8	0.000*
	Home injuries	3	16.70	15	83.30		1	5.6	17	94.4	
	Work injuries	1	33.30	2	66.70		1	33.3	2	66.7	
	Other	3	21.40	11	78.60		0	0	14	100	
Injury grade	Mild	2	2.70	71	97.30	0.000*	1	1.4	72	98.6	0.000*
	Moderate or severe	11	52.30	10	47.70		6	28.6	15	71.4	
	I do not remember	1	10.00	9	90.00		0	0	10	100	
Completing course of rehabilitation	Yes	4	5.10	74	94.90	0.000*	1	1.3	77	98.7	0.000*
	No	13	50.00	13	50.00		6	23.1	20	76.9	
What was the primary outcomes	Full recovery	1	1.40	70	98.60	0.000*	0	0	71	100	0.000*
	Recovery with pain	11	52.40	10	47.60		2	9.5	19	90.5	
	Not recovery	5	41.70	7	58.30		5	41.6	7	58.4	

Discussion

Ankle sprains are one of the commonest medical conditions among individuals who are considered highly physically active as those participating in team sports, court and heavy works [16]. Reinjury of the same injury or other injury in the same ankle is problematic in those in high-risk sports and works [17]. Among all injuries of sports-related orthopaedic emergency visits, ankle injuries account for about 14 % [18] where the lateral ankle sprain being the most common of these injuries [16]. After a lateral ligamentous injury, it is difficult to predict precisely when the patients could return to sports or work. Moreover, residual disability of ankle joints sprains in often caused because of the inadequate rehabilitation program and early return to work or sport [19]. In this study, we aimed to assess the prevalence of post ankle sprain injury among patients who underwent lateral ligament tear rehab conservatively.

The results of this study showed that the general characteristics of patients with lateral ligament injury included younger participants of younger than 40 years old. This is similar to previous study conducted by Adhitya I et al., who showing the mean age of patients with lateral ligament injuries was 27.5 years old (SD=6.6) [20]. Moreover, most of the participants were males and among body mass index of higher than 25 Kg/m2. This is similar to the results of Adhitya I et al who found that 89.3 % the patients with lateral ligament injuries were males [20]. This difference between the two genders could be because of the morphology of the knee joint between sexes which had an important role in the risk of injury. The investigation of muscle size and mass difference between the two genders [21]. Females has a 30 % smaller muscle size of knee flexor and 25 % of knee extensor compared with male however females have larger vastus lateral and biceps femoris which underlined as a trigger for decreased knee joint stability to lead the incidence of ankle injuries [22].

The results of our study showed that 16.3 % of the patients reported having ankle sprain injury after or during the rehabilitation for lateral ligament tear. In a previous study conducted by Middelkoop M et al, the authors found that the prevalence of ankle sprains in 3 months follow-up of patients with lateral ligament tear rehabilitation was 24 % and 28 % at 6-month follow-up [23]. However, other studies showed higher prevalence of ankle strain including study of Holme et al, who showed a prevalence of 29 % [24] and study of Wester et al, who showed a prevalence of 54 % [25]. In our study, we found that 68.3 % of the participants reported full recovery after rehabilitation. This is in line with the results of other studies including the study of Middelkoop M who reported that 49 % of the patients were considered recovered [23]. Moreover, another systematic review showed that 36 % and 85 % of the patients are considered recovered after 2 weeks to 36 months follow-up after ankle sprain injuries [12]. The wide recovery range found in the different studies could be related to the definition of recovery. A widely used and accepted definition of recovery would therefore be very useful for future studies.

Moreover, our results showed that ankle sprain injury after or during lateral ligament rehabilitation is more prevalent in younger patients which is similar to the results of previous studies [13,26,27]. The younger patients can hasten the results of physical therapy after the injury, which makes them rush back to play or hard work, while the older ones will have a greater desire to rest and not rush into the results of treatment. Our results confirm this idea, as 49% of patients indicated that they put pressure on the knee greatly during work and 79.8% during sports. Moreover, our study showed no differences between the two genders considering the ankle sprain after or during the lateral ligament rehabilitation which is similar to previous study [23,28]. Other factors causing the higher prevalence of ankle sprain injuries after or during lateral ligament rehabilitation are monthly income of lower than 5000 SR, moderate or severe lateral ligament injury, not completing the course of the rehabilitation and those who did not have full recovery at rehabilitation.

This study had some limitations. One of these limitations is depending on self-reported questionnaire which may lead to some personal bias. Moreover, another limitation is the presence of some questions which need to recall some information from history which may cause some recall bias. Finally, the study depended on patients' reports of having sprain injury without clinical assessment. Therefore, there is a need for more investigation that depending on clinical assessment of patients.

In conclusion, we found that 16.3 % of the patients reported having ankle sprain injury after or during the lateral ligament injuries

rehabilitation. Patients reported full recovery after rehabilitation showed lower prevalence of post rehabilitation ankle sprain injury, thus there is a need to develop the rehabilitation program to ensure the full recovery for patients with lateral ligament injuries.

Ethics approval and consent to participate

All participants were well informed before starting the questionnaire about the aim of the study and the importance of completing the questionnaire. No personal data as name or residency were collected form the participants. All participants had to apply the contest before starting the questionnaire and each one had the ability to leave at any time however, only complete survey was collected. The study had been conducted after having approval from the ethics committee of university.

List of abbreviations

BMI: Body Mass Index
SD: Standard deviation
SR: Saudi Riyal

Data Availability

Data is available for access after communication with the main author at *Alhelemh@gmail.com*

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper

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Authors' contributions

AA was responsible for preparing the questionnaire throughout deep research in the previous literature. All authors were responsible for data collection. MA was responsible for data analysis and interruption. FA was responsible for conducting the literature review and design of the study. All authors read and approved the final manuscript.

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