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ORIGINAL ARTICLE

The Outcome of Isolated Meniscal Root Avulsion Repair in Female Patients

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ABSTRACT

Background: *isolated meniscal root avulsion tears are common among women. Different treatment strategies are reported. The evaluation of surgical repair for isolated meniscal root avulsion is done with functional measures.*

Objective: *To assess the functional outcome of isolated meniscal root avulsion repair in females.*

Patients and methods:

This was a cross-sectional study, conducted at Tuymalik hospital and Shar hospital in Slemani, Kurdistan Region/ Iraq, from January, 10th, 2021 to January 10th, 2022, included 40 female cases older than 18 years, with medial or lateral meniscal root avulsion. After taking consent, all patients were clinically assessed preoperatively. The operations were done by one senior surgeon, all under spinal anesthesia. The Lysholm knee Questionnaire / Tegner Activity Scale used in pre and postoperative assessmnet of the patients.

Results: *The mean age of women with meniscal root avulsion was (45.7 years) and mean body mass index was (29.9 Kg/m2). Mean Lysholm score of women with isolated meniscal root avulsion after repair was (75.9) and mean IKDC score after surgical repair was (64.82). Mean activity level score for women after isolated meniscal root avulsion surgical repair was significantly higher than mean activity level before surgery ($p<0.001$). However, mean activity level score for women after isolated meniscal root avulsion surgical repair was significantly lower than mean activity level before injury ($p<0.001$).*

Conclusions: *The outcome of isolated meniscal root avulsion repair in female patients is good. The Lysholm and IKDC scores of women with isolated meniscal root avulsion are improved after surgical repair.*

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1. INTRODUCTION

Meniscal root tears (MRTs) are defined as radial tears within 1 cm of the meniscal root insertion, or an avulsion of the insertion of the meniscus. These injuries alter joint loading because of the failure of the meniscus to transform axial loads into hoop stresses, resulting in joint straining and degenerative changes in the knee. Meniscal root repair is indicated in patients without advanced osteoarthritis to regain joint congruence and loading and therefore to avoid the long-term effect of joint overloading (1). Meniscal root tears are less prevalent than meniscal body tears and are mostly unnoticed, are a group of meniscal injuries that frequently cause substantial knee joint disorders. The meniscus root attachment helps meniscal function by guarding the meniscus in place and making allowance for optimal shock-absorbing function in the knee. With root tears, meniscal extrusion often happens, and the transmission of circumferential hoop stresses is impaired. This changes knee biomechanics and kinematics and considerably raises tibiofemoral contact pressure, for the menisci to work suitably, the biomechanical integrity of each meniscus root on the tibial plateau must be taken into consideration (2–4). Lately, clinical studies have linked partial meniscectomy of meniscal tears, specifically tears that are located at the root, with meniscal extrusion and the rapid development of osteoarthritis in the affected compartment in most patients. Consequently, it is becoming increasingly recognized that meniscal root tears often require repair that attempts to regain the native structure and function of the meniscal root attachments (5). Meniscal root tears have recently obtained interest due to findings suggesting the link between such tears and rapid progression to osteoarthritis (6). Meniscal root tears are an increasingly frequent injury with a prevalence rate reported to be as high as 9.1% among all patients going through knee arthroscopy in one study (7). Moreover, meniscal root repairs are estimated to cause 10% to 21% of all arthroscopic meniscal surgeries (8). Root tears are a subset of meniscal injuries, which have become increasingly determined as the factor of significant joint pathology. Occurring on either the medial or lateral meniscus, root tears are defined as radial tears or avulsions at the posterior horn attachment to bone (9–12).

Root tears may also happen as osseous avulsion injuries, as already described by Weaver in 1935 (12,13). The aim of present study was to assess the functional outcome of isolated meniscal root avulsion repair in females.

2. METHODOLOGY

This is a cross-sectional study, which was accomplished at Tuymalik hospital as well as Shar hospital in Slemani, Kurdistan Region/ Iraq, from Jan 10th, 2021 to Jan 10th, 2022. We collected 40 cases, Inclusion criteria were; medial or lateral meniscal root avulsion, patients ages were more than 18 years old, and all were females..

Besides that any previous traumas like ligamentous injuries, fractures, any kinds of knee infections and rheomatological diseases were excluded from the study. After taking consent, all patients were examined clinically preoperatively for any pain or mechanical symptoms.

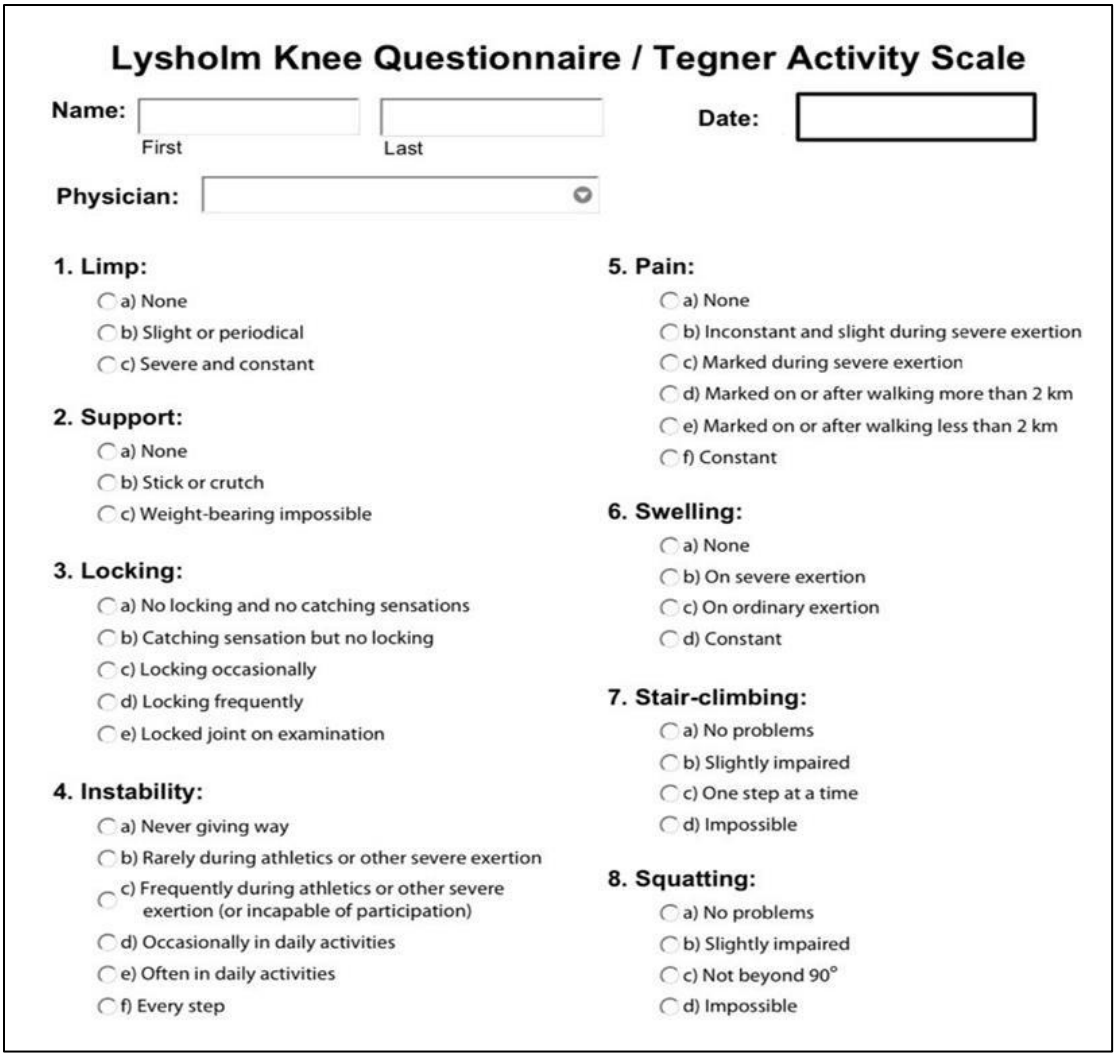
Surgical Procedure:

The operations were done by one senior surgeon, all under spinal anesthesia, and the patients were placed in a supine position and tourniquet applied. After marking 2 stab skin incisions on the medial and lateral joint lines as a gate to go inside the knee through the anterolateral and antero-medial portals, checking for ligaments and other parts of meniscus done, avulsed root re-attached to its origin by using the hand piece scorpion, re-check for rigid reattachment were done, videos and images took in the operation, with inserting knee brace post operatively.

Then we compared preoperative with postoperative measurements, we followed up them for 1 year to see if there is any mechanical symptoms or any instability by filling the Lysholm Knee Questionnaire / Tegner Activity Scale, and to assess clinical improvement in the form of pain score, limping, locking, swelling and any kinds of instability.

Tools of the study:

The tools used in the current study included the Lysholm knee Questionnaire / Tegner Activity Scale (Figure 1) (14,15), and some instruments that demonstrated in the following figures



Lysholm Knee Questionnaire / Tegner Activity Scale

Name: First Last **Date:**

Physician:

1. Limp:
- a) None
- b) Slight or periodical
- c) Severe and constant

2. Support:
- a) None
- b) Stick or crutch
- c) Weight-bearing impossible

3. Locking:
- a) No locking and no catching sensations
- b) Catching sensation but no locking
- c) Locking occasionally
- d) Locking frequently
- e) Locked joint on examination

4. Instability:
- a) Never giving way
- b) Rarely during athletics or other severe exertion
- c) Frequently during athletics or other severe exertion (or incapable of participation)
- d) Occasionally in daily activities
- e) Often in daily activities
- f) Every step

5. Pain:
- a) None
- b) Inconstant and slight during severe exertion
- c) Marked during severe exertion
- d) Marked on or after walking more than 2 km
- e) Marked on or after walking less than 2 km
- f) Constant

6. Swelling:
- a) None
- b) On severe exertion
- c) On ordinary exertion
- d) Constant

7. Stair-climbing:
- a) No problems
- b) Slightly impaired
- c) One step at a time
- d) Impossible

8. Squatting:
- a) No problems
- b) Slightly impaired
- c) Not beyond 90°
- d) Impossible

Figure 1. Lysholm knee Questionnaire / Tegner Activity Scale (adopted from Briggs et al.(14,15)

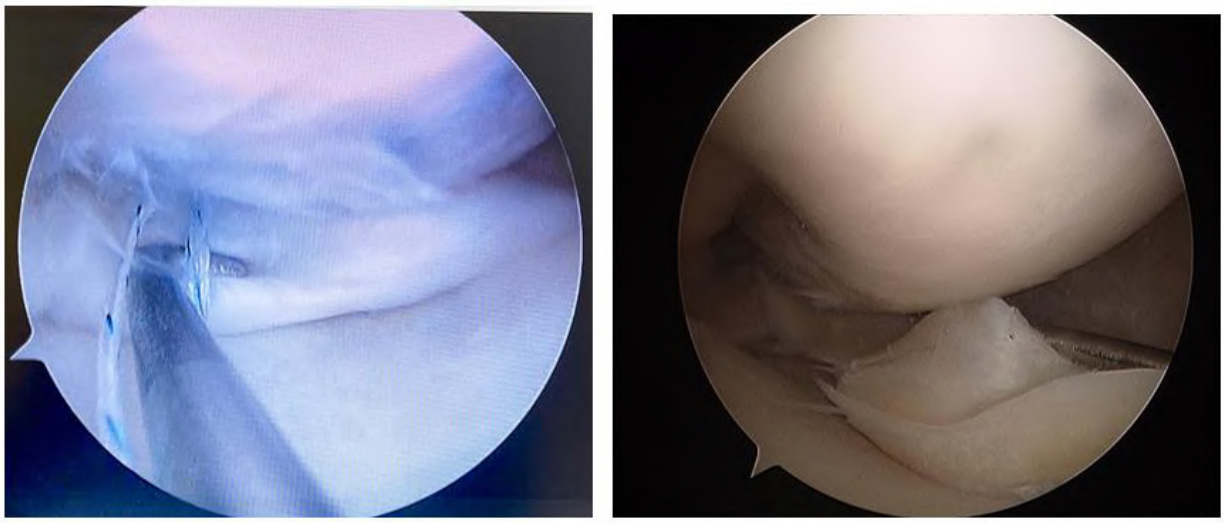


Figure 2. Root tears

Figure 3. Entry Portals to the Knee (applied in one case of the studied group)

Figure 4. Our Scope Screen (the scope system used in the study)

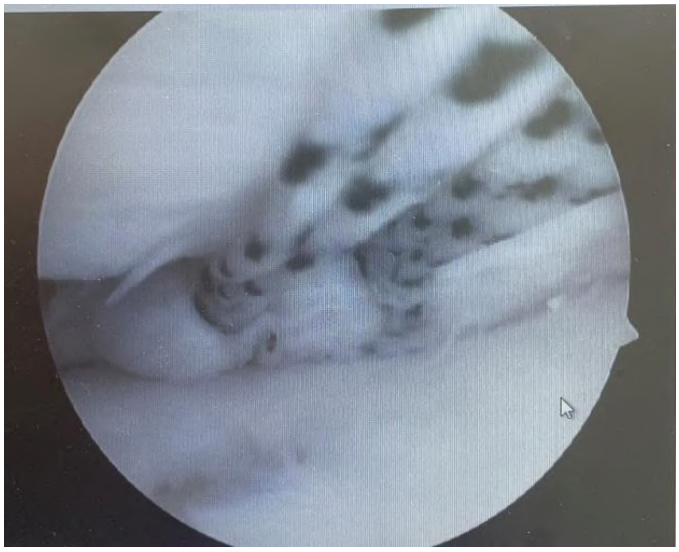


Figure 5. Two loops of Fiber wire around an avulsed root

Figure 6. Scorpion Suture Passer (used in the current study)

3. RESULTS

This study included forty women with isolated meniscal root avulsion presented with mean age of (45.7 years) ranged between 28-66 years; 25% of women were in age group <40 years, 42.5% of them were in age group 40-49 years and 32.5% of them were in age of 50 years and more. Mean body mass index of women with isolated meniscal root avulsion was (29.9 Kg/m^2); 42.5% of women were overweight and 50% of them were obese. Left side meniscal root avulsion reported in 67.5% (**Table 1**). Mean Lysholm score of women with isolated meniscal root avulsion after repair was (75.9); 20% of women had poor Lysholm score, 50% of women had fair Lysholm score, 20% of women had good Lysholm score and 10% of women had excellent Lysholm score after surgical repair. Mean activity level score before injury was (4.5), while after injury was (3.1) and after surgery was (4.1). Mean IKDC score after surgical repair of isolated meniscal root avulsion was (64.82), (**Table 2)** from other point of view, among the studied group, Lysholm score classification revealed that 4 excellent, 8 good , 20 fair and 8 poor classification, (**Figure7**). The mean activity level score for women after isolated meniscal root avulsion injury was significantly lower than mean activity level before injury ($p<0.001$). Mean activity level score for women after isolated meniscal root

avulsion surgical repair was significantly higher than mean activity level before surgery (p<0.001). However, mean activity level score for women after isolated meniscal root avulsion surgical repair was significantly lower than mean activity level before injury (p<0.001) (**Table 3**). The mean Lysholm score was significantly lower with advancing age of women (p=0.03). No significant difference in mean IKDC score across the age groups of women (p=0.5). (***Table 4***) Mean Lysholm score was significantly decreased with increased body mass index (p=0.05). No significant difference in the mean IKDC score across BMI categories, (p=0.5) (**Table 5**). The means of Lysholm and IKDC scores were not significantly different the two sides where the isolated meniscal root avulsion found (p=0.2, p=0.19, respectively) (**Table 6**). There was a strong positive significant correlation between Lysholm score and IKDC score among women with isolated meniscal root avulsion (r=0.76, p<0.001) as shown in (**Figure 8**).

Table 1. General characteristics of women with isolated meniscal root avulsion.

Variable		**No.**	**%**
Age (year)	<40 years	10	25.0
	40-49 years	17	42.5
	≥50 years	13	32.5
	Mean (SD)	45.7 (8.2)	-
	Range	28 – 66	-
Body mass index (BMI)*	Normal	3	7.5
	Overweight	17	42.5
	Obese	20	50.0
Side	Right	13	32.5
	Left	27	67.5
Total		40	100.0
Mean BMI (SD): 29.9 (3.5) Kg/m^2 SD: standard deviation			

Table 2. Evaluation measures of isolated meniscal root avulsion.

Variable		Mean	SD
Lysholm score	Limb	3.9	1.4
	Support	3.8	1.7
	Locking	10.2	4.0
	Instability	19.7	4.3
	Pain	20.6	5.3
	Swelling	6.9	2.9
	Stair-climbing	6.7	3.1
	Squatting	4	1.3
	Lysholm score	75.9	17.3
Activity scores	Activity level before injury	4.5	0.9
	Activity level after injury	3.1	0.8
	Activity level after surgery	4.1	0.6
IKDC score		64.82	6.45
Total		40	100.0

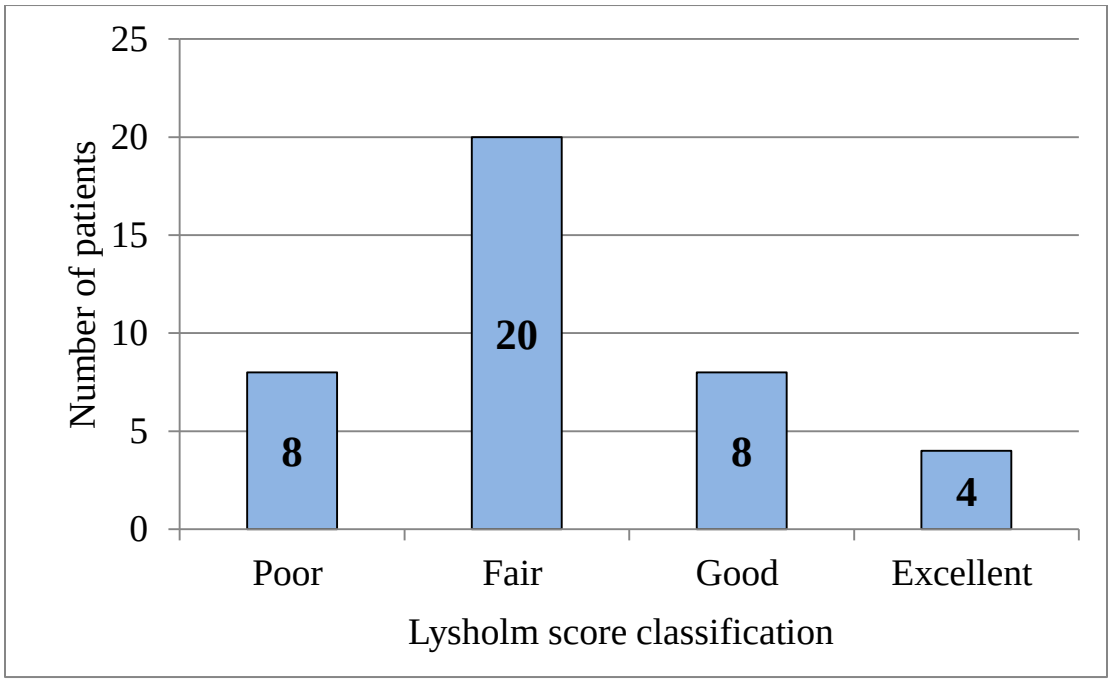


Figure 7. Lysholm score classification of the studied group.

Table 3. Activity level score distribution in different timelines of isolated meniscal root avulsion repair.

Activity level	Mean ± SD
Before injury	4.5 ± 0.9
After injury (before surgery)	3.1 ± 0.8
After surgery	4.1 ± 0.6
In All Pairwise comparisons, P. value is significant <0.001	

Table 4. Comparison of meniscal injury evaluation measures according to age of patients

Age (year)	Lysholm score	IKDC score
<40	80.7±10.1	66.3±6
40-49	80.1±15.7	65.3±6.4
≥50	65.6±19	63.5±6.3
P. value	0.030 significant	0.500 not significant

Table 5. Comparison of meniscal injury evaluation measures according to BMI of the patients

Body mass index	Lysholm score (Mean ± SD)	IKDC score (Mean ± SD)
Normal	94.6±9.2	71.2±2
Overweight	77.7±17.5	64.5±6.8
Obese	70.8±15.2	64.4±5.8
P. value	0.050 significant	0.200 not significant

Table 6. Comparison of meniscal injury evaluation measures according to injury side

Side	Lysholm score	IKDC score
Right	70.6±17.9	63.1±8.2
Left	77.9±16.1	65.9±4.9
P. value	0.200 not significant	0.190 not significant

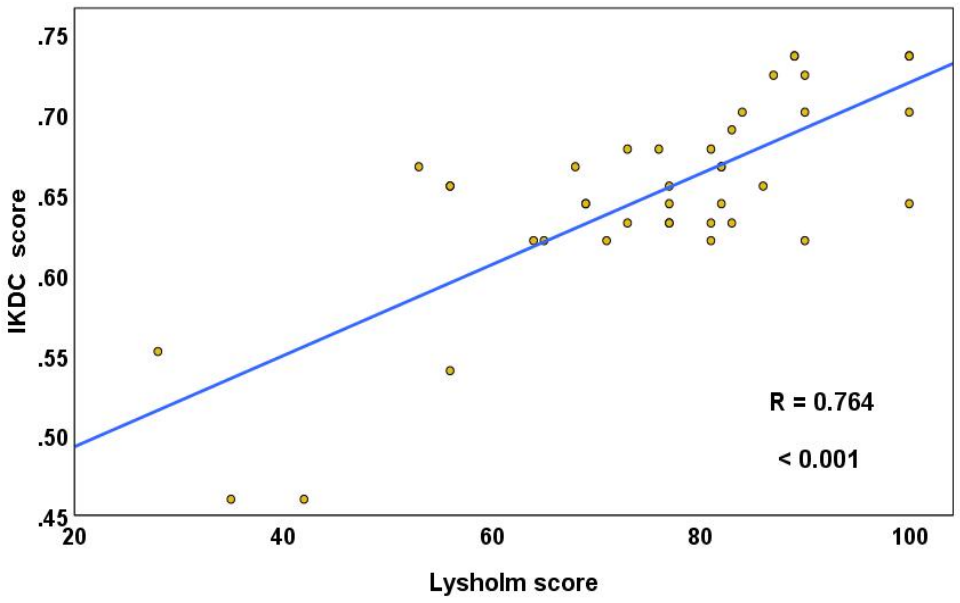


Figure 8. Curve-Estimation analysis, for the correlation of Lysholm score and IKDC score, [a significant direct (positive) strong correlation was found, R=0.764, P<0.001

4. DISCUSSION

The meniscus has an important role in preserving biomechanical function of the knee joint. The meniscus root repair is essential in lowering rate of osteoarthritis and arthroplasty with lower economic cost in comparison to conservative management and partial meniscectomy (16). The current study showed that mean age of women with isolated meniscal root avulsion was (45.7 years), 42.5% of them were in age group 40-49 years. This finding is close to results of Holmes et al. (17) in Unites States of America which showed that mean age of patients with medial meniscal root tear was (48.1 years) with predominance of female gender (86%). Kim et al. (18) study in South Korea stated that age is a common risk factor of osteoarthritis progression and the osteoarthritis progression risk was declined after age of 63.5 years. Our study found that mean body mass index of women with isolated meniscal root avulsion was (29.9 Kg/m2); 42.5% of women were overweight and 50% of them were obese. This finding coincides with results of Ford et al. (19) case-control study in United States of America which revealed an association between obesity and meniscal root tear in both gender. Guermazi et al. (20) study in Brazil reported that isolated medial posterior

meniscal root tear is related to incident and progressive medial tibiofemoral cartilage loss which commonly caused by obesity. In our study, the side of meniscal root avulsion was at right side in 32.53% of women, while left sided avulsion was present in 67.5% of women. This finding is similar to results of Carreau et al. (21) study in United States of America which documented predominance of left sided medical menical tear among women. The present study showed that mean Lysholm score of women with isolated meniscal root avulsion after repair was (75.9); 20% of women had poor Lysholm score, 50% of women had fair Lysholm score, 20% of women had good Lysholm score and 10% of women had excellent Lysholm score after surgical repair. These findings are close to results of Rocha de Faria et al. (22) retrospective multi-centric study in Brazil which revealed that mean Lysholm score of patients with isolated meniscal root avulsion after repair was (88.4) and 12% of them had excellent Lysholm score after repair. Our study found that mean IKDC score after surgical repair of isolated meniscal root avulsion was (64.82). This finding is close to results of Mahmoud et al.(23) study in Egypt which reported that mean IKDC score after surgical repair of isolated meniscal root avulsion was (76.7). The current study found that mean activity level score for women after isolated meniscal root avulsion injury was significantly lower than mean activity level before injury ($p<0.001$). This finding is consistent with reports of Bonasia et al.(24) review study in Italy which stated that the activity score was reduced after isolated meniscal root avulsion injury. Our study showed that mean activity level score for women after isolated meniscal root avulsion surgical repair was significantly higher than mean activity level before surgery ($p<0.001$). This finding is similar to results of many literatures such as Hanna et al. (25) review study in United States of America and Shekhar (26) et al. case series study in India which all documented that mean activity score of patients with isolated meniscal root avulsion was increased after surgical repair as compared to activity score after injury. In our study, the mean activity level score for women after isolated meniscal root avulsion surgical repair was significantly lower than mean activity level before injury ($p<0.001$). Similarly, Mordecai et al.(27) review study in United Kingdom reported that the activity score for patients with menical root avulsion were increased after surgical repair, but not returned to activity level before injury.

In present study, the mean Lysholm score was significantly decreased with increase age of women with isolated meniscal root avulsion (p=0.03). This finding is consistent with reports of Bhatia et al. (2) review study in United States of America which stated that Lysholm score was declined in older age patients. The aging leads to reduction in blood supply of meniscus which causes degenerative changes in knee joint (28), and for that, the meniscal repair among elderly age patients may be associated with high failure rates (29). Our study showed that mean Lysholm score was significantly decreased with increase body mass index of women with isolated meniscal root avulsion (p=0.05). This finding is inconsistent with results of Eren et al. (30) retrospective study in Turkey which reported no significant effect of BMI on outcome of meniscal root avulsion repair. This inconsistency might be related to high predominance of obesity in our study women. However, Ford et al.(19) case-control study in United States of America reported a negative effect of BMI on Lysholm score after repair of meniscal injury. In our study, there was a strong positive significant correlation between Lysholm score and IKDC score among women with isolated meniscal root avulsion (r=0.76, p<0.001). This finding is parallel to results of Abdallah et al. (31) prospective non-randomized case series study in Egypt which revealed a significant correlation between Lysholm score and IKDC score after surgical repair of meniscal injury.

5. CONCLUSIONS

This study concluded that the outcome of isolated meniscal root avulsion repair in female patients is good. The Lysholm and IKDC scores of women with isolated meniscal root avulsion are improved after surgical repair. The Lysholm score are affected by age and body mass index of women. This study recommended the earlier surgical repair of isolated meniscal root avulsion repair in women with use of Lysholm and IKDC scores in order to assess the outcomes.

Ethical Approval:

All ethical issues were approved by the author. Data collection and patients enrollment were in accordance with Declaration of Helsinki of World Medical Association , 2013 for the ethical principles of researches involving human. Signed informed consent was obtained from each participant and data were kept confidentially.

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