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RESEARCH ARTICLE

Meniscal Lesions in Geriatric Population: Prevalence and Association with Knee Osteoarthritis

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ARTICLE HISTORY

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Abstract: ***Objective*:** This study evaluated the prevalence of different types of meniscal lesions among elderly patients with knee pain. Moreover, this study assessed the relationship between meniscal lesions and the presence of radiographic knee osteoarthritis (OA) in the elderly population.

***Methods*:** The radiographs and magnetic resonance images of one knee out of 306 patients with knee pain aged 65-89 years were reviewed for knee OA and meniscal lesions. The prevalence of different types of meniscal lesions was calculated, and the relationship between the prevalence of meniscal lesion types and the presence of radiographic knee OA was analyzed.

***Results*:** Among 306 participants, 274 (89.5%) showed radiographic knee OA. We found one or more meniscal lesion(s) in 93% of the total subjects, in 94% of all patients with knee OA, and in 84% of all patients without knee OA. The prevalence of surgically target, possible-target, and non-target lesions were 24%, 72%, and 69%, respectively. The prevalence of surgically target lesions was significantly higher in patients with knee OA than in those without it. The most common lesion observed was meniscal extrusion, followed by the horizontal and complex meniscal tears.

***Conclusions*:** Our results demonstrated that meniscal damage is considerably prevalent among elderly individuals with knee pain, especially in those with knee OA. The fact that surgically target and possible-target lesions constitute a substantial proportion of these lesions should be considered in the clinical approach to these patients.

Keywords: Aged, knee osteoarthritis, meniscus, MRI, geriatric population, radiographs.

1. INTRODUCTION

The menisci are two fibrocartilage structures that perform lubrication, shock absorption, load bearing, and joint stability functions in the knee joint. Mechanical impairment of the menisci decreases the weight-bearing capacity of the joints and causes damage to the adjacent knee structures [1]. Osteoarthritis (OA) is an extremely common chronic disease among the aging population, and the knee joint is one of the most common target joints of this disorder. As several meniscal lesions are asymptomatic, there is a tendency in clinical settings to attribute any non-traumatic knee pain of a middle-aged or elderly patient to knee OA [2-4]. However, recent research data have shown that a considerable number of elderly individuals with knee pain, who are free of radiographic OA findings, show evidence of meniscal damage on knee Magnetic Resonance Imaging (MRI) [5-7]. In their study conducted in a middle-aged and elderly population, Englund *et al*. demonstrated the prevalence of meniscal tear/destruction among the ones with knee pain and without radiographic knee OA to be 32% [7].

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Studies on the prevalence of meniscal injury in the elderly population are rare [7]. This study evaluated the prevalence of different types of meniscal lesions among elderly patients with knee pain with reference to a classification system based on the current consensus regarding the definition and investigation of meniscal lesions [8]. We also aimed to assess the relationship between meniscal lesions and the presence of radiographic knee OA in the elderly population.

2. MATERIALS AND METHOD

2.1. Patient Population and Study Design

Following institutional review board approval (Approval No: 59/14, Date: February 4, 2019), the clinical and radiological records of 325 elderly patients who were admitted to the hospital with the complaint of any knee pain and who had undergone knee MRI examination at the Radiology Department between January 1, 2017 and January 1, 2019 were retrospectively evaluated. Patients with a history of trauma to the knee or a prior knee surgery were excluded from the study. In cases where the patient had undergone MRI of both the knees, only the right knee examination was included in the study. As a result, the study group consisted of 306 knees

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of 306 patients. The age of the study population ranged from 65 to 89 years (mean age: 70.67 ± 4.69 years).

2.2. Radiographic Evaluation

Anteroposterior radiographs of all knees were acquired in the standing position with both the knees fully extended. All radiographs were interpreted by the same radiologist with 20 years of experience in conventional radiography and who was unaware of the clinical and MRI data of the participants. Radiographic grading was performed using the Kellgren Lawrence (KL) scale: grade 0, normal; grade 1, uncertain osteophytes; grade 2, distinct osteophytes with normal joint space distance; grade 3, moderate/multiple osteophytes with joint space narrowing, mild sclerosis and uncertain wear; and grade 4, large osteophytes, severe joint space reduction, intense sclerosis, and distinct wear [9]. Knee OA was considered to be present in cases with KL grade ≥ 2.

2.3. MRI Protocol and Meniscal Evaluation

MRI examinations were performed using a 1.5-T scanner (Gyroscan Intera; Philips Medical Systems, Nederland B. V.) with a dedicated knee coil. During scanning, the patients were asked to maintain a supine position with their knees at full extension. A routine knee imaging protocol consisting of these five sequences was performed: coronal fast spin-echo T1-weighted [repetition time (TR)/echo time (TE):550/17 ms, Echo Train Length (ETL): 3, matrix: 320 × 224, Field Of View (FOV): 14 × 14 cm, slice thickness: 3 mm]; sagittal fat-suppressed proton density-weighted (TR/TE: 2584/23 ms, ETL: 8, matrix: 384 × 224, FOV: 14 × 14 cm, slice thickness: 3.5 mm); coronal fat-suppressed proton density-weighted (TR/TE: 2850/22 ms, ETL: 6, matrix: 320 × 224, FOV: 14 × 14 cm, slice thickness: 3 mm); axial fat-suppressed proton density-weighted (TR/TE: 3250/30 ms, ETL: 8, matrix: 448 × 224, FOV: 12 × 12 cm, slice thickness: 3 mm), and sagittal fast spin-echo T2-weighted (TR/TE: 5050/70 ms, ETL: 16, matrix: 384 × 256, FOV: 14 × 14 cm, slice thickness: 3 mm).

Two experienced radiologists evaluated the meniscal integrity and identified the type of the meniscal damage independently and in a blinded manner for the clinical and radiographic data of the participants. In cases where a discrepancy occurred in the interpretations of the images, a common re-examination was performed and the final decisions were made by consensus. The anterior horn, body, and the posterior horn of each meniscus of both the menisci (*i.e.*, medial and lateral) were separately examined. The meniscal lesions were identified to be of the following types:

1) *Tear:* We identified a meniscal tear as a high meniscal signal intensity reaching either surfaces of the meniscus on at least two consecutive sections (for a radial tear, those evident on both the coronal and sagittal images) [10, 11].
   a. *Horizontal Tear:* A tear extending parallel to the tibial plateau and dividing the meniscus into upper and lower portions.
   b. *Longitudinal Tear:* A vertical tear extending parallel to the circumferential fibers and perpendicular to the tibial plateau. Bucket-handle tear; a longitudinal tear covering more than 25% of the length of the meniscus (either displaced or undisplaced). Short longitudinal tear; a longitudinal tear covering <25% of the length of the meniscus.
   c. *Radial Tear:* A vertical tear initiating in the central meniscal margin and extending perpendicular to both the tibial plateau and circumferential fibers.
   d. *Complex Tear:* Multiple tears extending in more than one orthogonal planes [12].
2) *Root Failure:* A complete tear/avulsion of the meniscal root.
3) *Contour Abnormality:* Meniscus with an abnormal contour accompanied by an extremely small tear.
4) *Meniscal Extrusion:* Extension of the meniscal edge beyond the tibial margins.

The classification of the meniscal lesions was performed according to the national consensus on the definition, investigation, and classification of meniscal lesions of the knee, as reported by the British Association for Surgery of the Knee Meniscal Working Group [8].

2.4. Statistical Analysis

Mann Whitney U test was used to compare two independent groups for numerical data. Chi-square test was used to evaluate the relationship between the categorical variables. Statistical analysis was performed with SPSS for Windows version 24.0; and $P < 0.05$ was accepted as statistically significant.

3. RESULTS

Of the current sample of 306 participants, 274 (89.5%) demonstrated radiographic evidence of knee OA (KL grade ≥ 2). The baseline characteristics of the study population are summarized in Table **1**. The patients with knee OA were significantly older than those without knee OA. In addition, the number of women among the OA patients was significantly higher than that in those without knee OA (Fig. **1**).

Table 1. Baseline characteristics of the study population.

-	Patients WITH Radiographic Evidence of Osteoarthritis (N= 274)	Patients WITHOUT Radiographic Evidence of Osteoarthritis (N= 32)	P
Age- year ‡	70,96 ± 4,7	68,25 ± 3,9	0,001*
Female gender – N (%) §	177 (64,6)	13 (40,6)	0.008*

‡Mann Whitney U test, §Chi-square test. *Significant at 0.05 level.

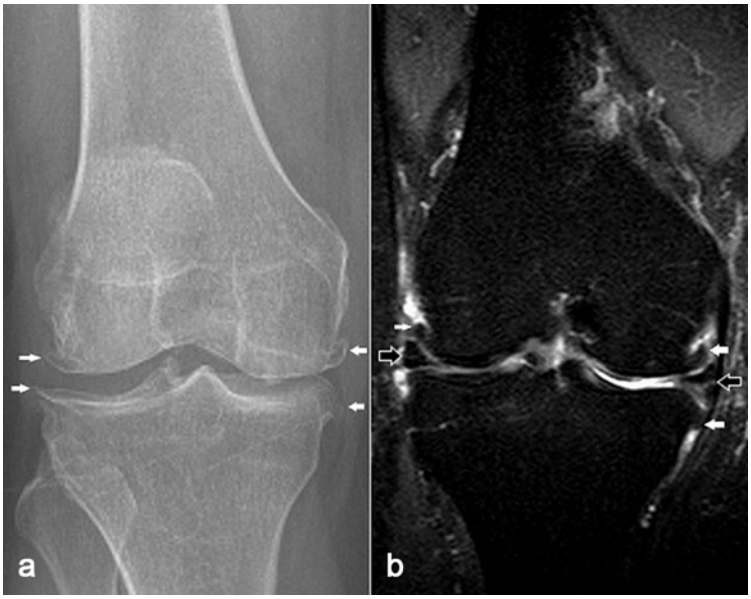

Fig. (1). Knee osteoarthritis as seen on radiograph (**a**) and magnetic resonance image (**b**) of the right knee of a 76 year-old woman with knee pain. The knee radiograph shows Kellgren Lawrence grade 4 changes characterized by multiple large osteophytes, prominent joint space narrowing, subchondral sclerosis and bone attrition (**a**). Large osteophytes (white arrows) accompanied by medial and lateral meniscal extrusion are clearly seen on coronal fat-suppressed proton density-weighted magnetic resonance image. A horizontal tear in the lateral and a complex tear in the medial menisci are evident on magnetic resonance image (black arrows) (**b**).

We recorded ≥1 meniscal lesion(s) in 285 (93.14%) of the overall study population. There was at least one meniscal lesion among 94.16% of the patients with and among 84.37% of all patients without radiographic knee OA. The prevalence of meniscal lesion types according to the presence or absence of radiographic evidence of knee OA are demonstrated in Table **2**. The prevalence of target and non-target lesions were significantly higher in patients with knee OA than in those without OA findings. In both the patient groups with and without knee OA, meniscal extrusion was the most commonly detected lesion with a prevalence of 64% and 50%, respectively. In both the groups, horizontal tear was the second-most (prevalence as 24% and 28%, respectively) and complex tear was the third-most (prevalence as 19% and 18%, respectively) common meniscal lesions (Fig. **2**). With a prevalence of 18%, meniscal root failure was a remarkably common lesion among the patients with knee OA (Fig. **3**).

The prevalence of meniscal lesion categories according to the gender and lesion location is depicted in Table **3**. The prevalence of all three categories of meniscal lesion was higher in women than in men. Medial meniscus was more commonly exposed to all categories of meniscal lesions in both women and men. In both the genders, possible-target lesions were more common than both target and non-target lesions. In the overall study population, the prevalence of target, possible-target, and non-target meniscal lesions were 24.2%, 72.2%, and 69.6%, respectively.

4. DISCUSSION

We investigated the prevalence of meniscal lesion(s) in an elderly population and evaluated its relationship with radiographic knee OA. We demonstrated that meniscal damage is considerably prevalent among elder individuals with knee pain, especially in those with knee OA. Among the overall study population, 24% showed target and 72% showed possible-target meniscal lesions on MRI. The prevalence of target lesions was significantly higher in patients with knee OA than in those without OA. Among both OA and non-OA patients, the most common lesion observed was meniscal extrusion followed by the horizontal and complex meniscal tears, respectively. Being present in approximately one-fifth of all patients with knee OA, the meniscal root failure was a remarkably common lesion in our study population. The women were more likely to be exposed to meniscal damage as compared to men, and the medial meniscus was the major target for the meniscal lesions.

Knee OA is an extremely common degenerative disease among the aging population and is regarded as one of the most frequent disorders among patients suffering from knee pain. However, OA is not the only pathology that can cause pain in an elderly individual's knee. Englund *et al*. reported that, of the symptomatic individuals aged >50 years without radiographic knee OA, 32% showed evident meniscal damage on MRI. The authors reported that this ratio was up to 63% among the ones with radiographic evidence of knee OA [7]. These findings suggest that meniscal injury itself is an important source of knee pain in elderly individuals without knee OA, and that knee OA contributes to meniscal damage. We recorded meniscal lesion(s) in 84% of all patients without knee OA and in 94% of the ones with knee OA in our study population. The most important reason why we recorded such higher rates as compared to that by Englund *et al*. is probably because we included extrusion in the meniscal lesion category, but they did not accept extrusion as a meniscal damage. In addition, the difference between the results of the two studies may partly be attributed to the higher mean age of the population in which our study was performed (70.6) as compared to that in the other study (62.3).

Table 2. Prevalence of meniscal lesion types according to the presence or absence of radiographic evidence of knee osteoarthritis.

-	Patients WITH Radiographic Evidence of Osteoarthritis N (%)	Patients WITHOUT Radiographic Evidence of Osteoarthritis N (%)	P
Target (Treatable) Lesion			
Bucket-handle tear	5 (1.8)	0 (0)	0.441
Displaced meniscal tears	23 (8.4)	0 (0)	0.088
Meniscal root failure	50 (18.2)	1 (3.1)	0.030*
Total	73 (26.6)	1 (3.1)	0.003*
Possible-Target (Indeterminate) Lesion (= Undisplaced Meniscal Tears)			
Radial tears			
Radial flap tear	20 (7.3)	0 (0)	0.114
Complete radial split tear	14 (5.1)	0 (0)	0.191
Partial radial split tear	27 (9.9)	1 (3.1)	0.212
Horizontal Tear ± Cyst			
Horizontal tear and meniscal cyst	12 (4.4)	2 (6.3)	0.632
Horizontal tear in isolation	67 (24.5)	9 (28.1)	0.649
Complex meniscal lesion	54 (19.7)	6 (18.8)	0.897
Short longitudinal tear	23 (8.4)	6 (18.8)	0.058
Total	197 (71.9)	24 (75)	0.711
Non-Target (Unlikely Treatable) Lesion			
Contour abnormality	49 (17.8)	5 (15.6)	0.248
Meniscal extrusion	177 (64.6)	16 (50)	0.105
Total	196 (71.5)	17 (53.1)	0.032*

*Significant at 0.05 level; Chi-square test.

Fig. (2). Anteroposterior radiograph of the left knee of a 69 year-old woman with knee pain shows Kellgren Lawrence grade 3 changes (**a**). A horizontal medial meniscal tear (white arrow) is seen on the sagittal fat-suppressed proton density-weighted magnetic resonance image of the same patient (**b**).

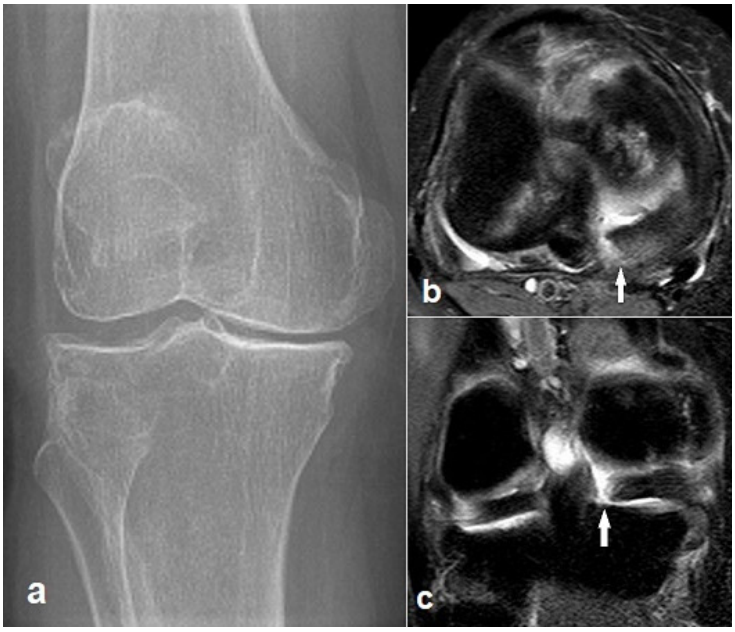

Fig. (3). Anteroposterior radiograph of the right knee of a 71 year-old man with knee pain shows Kellgren Lawrence grade 3 changes (**a**). A medial meniscal root tear (white arrow) is evident on the axial (**b**) and coronal (**c**) fat-suppressed proton density-weighted magnetic resonance images (white arrows) of the same patient.

Table 3. Prevalence of meniscal lesion categories according to gender and lesion location.

-	Medial Meniscus N (%)	Lateral Meniscus N (%)	Medial or Lateral Meniscus N (%)
Men			
Target lesion	18 (21.7)	2 (6.1)	20 (17.2)
Possible-target lesion	58 (69.9)	28 (84.8)	86 (74.1)
Non-target lesion	58 (69.9)	21 (63.6)	79 (68.1)
Women			
Target lesion	46 (36.2)	8 (12.7)	54 (28.4)
Possible-target lesion	90 (70.9)	45 (71.4)	135 (71.1)
Non-target lesion	100 (78.7)	34 (54)	134 (70.5)
Total			
Target lesion	64 (30.5)	10 (10.4)	74 (24.2)
Possible-target lesion	148 (70.5)	73 (76)	221 (72.2)
Non-target lesion	158 (75.2)	55 (57.3)	213 (69.6)

The reported prevalence for meniscal injuries in the general population is 12%-14% [13]. The degenerative tears which occur secondary to age-related cumulative stress constitute up to 30% of all meniscal tears. Unlike the acute tears, they may or may not be associated with trauma [14], and mostly occur in men of ages 40-60 years [15]. There is inadequate data in the relevant literature regarding the occurrence of meniscal pathologies in elderly individuals [7]. To the best of our knowledge, this is the first study to investigate the prevalence of meniscal lesion categories observed in the elderly population. In the current sample of 306 patients aged 65-89 years, we recorded a considerably high prevalence of meniscal damage. Among the several meniscal lesion types; the horizontal tear, complex tear, and the meniscal root failure featured among the other types of tears in terms of frequency. As these lesions fall in the categories of surgically possible-target or target lesions, these findings are

of utmost importance in the clinical approach to elderly patients presenting with knee pain.

Accounting for approximately 32% of all meniscal tear cases, horizontal tears are frequent in the general population as well [16]. However, meniscal root tears, which constitute 10.1% of arthroscopic meniscectomies, are relatively rare lesions in the general population. The clinical diagnosis of root tears is difficult, and usually MRI is required for the identification of the lesion. We noted meniscal root tear in 18% of all patients with knee OA. This type of tear was the most common meniscal target lesion as per our results. In meniscal root tears, collagen fibers that supply the pulley strength are disrupted, causing meniscal extrusion [17]. Furthermore, meniscal root tears are reported to be associated with the occurrence or progression of adjacent cartilage damage [18]. Meniscal extrusion and cartilage damage are two lesions that commonly accompany knee OA; these associations suggest that the root tears could be addressed as one of the factors that enhance the complex interactions occurring in the process of knee OA. Indeed, while approximately one-fifth of our patients with knee OA showed meniscal root tear, it was present in only one of the 32 patients without knee OA in our study population.

In previous studies, meniscal extrusion was reported to be an initiator of the OA pathways and as a common complication accompanying knee OA [17]. However, recent studies have demonstrated that meniscal extrusion is evident in more than one-third of middle-aged individuals without knee OA [6, 19]. These findings show that meniscal extrusion is common not only in middle-aged/older individuals with knee OA but also in those without OA findings. In accordance with the previous data, we found that meniscal extrusion is an extremely common lesion in the patient groups both without and with knee OA in the elderly population.

The major limitation of this study is that physical examination findings and the clinical significance of the imaging findings were not evaluated. Further comprehensive studies adopting a clinico-radiological perspective are thus needed for the correct interpretation of the findings of the current study.

CONCLUSION

Our results demonstrated that meniscal damage is considerably prevalent among elder people with knee pain, especially in those with knee OA. The fact that surgically target and possible-target lesions constitute a substantial proportion of these lesions should be considered in the clinical approach to these patients.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval for this study was provided by the Institutional Review Board of the University of Health Sciences, Turkey (Approval No: 59/14, Date: February 4, 2019).

HUMAN AND ANIMAL RIGHTS

Not applicable.

CONSENT FOR PUBLICATION

Patients consents for this publication are not applicable due to the retrospective nature of the study.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of the article is available in the Picture Archiving and Communication System (PACS) of University of Health Sciences, Dışkapı Yıldırım Beyazıt Training and Research Hospital, Ankara, Turkey [20].

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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Declared none.

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