

Original Research Article

**EVALUATING THE PREVALENCE OF
DEGENERATIVE MENISCAL INJURIES IN KNOWN
CASES OF OSTEOARTHRITIS OF THE KNEE BY
MAGNETIC RESONANCE IMAGING: AN
OBSERVATIONAL STUDY**

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Abstract

Background: There is increasing evidence on the prevalence of meniscal injuries in patients suffering from osteoarthritis. Magnetic resonance imaging (MRI) is important in confirming the diagnosis of such tears in these patients.

Materials and methods: This was a cross-sectional study performed by the radiology department in collaboration with the department of orthopedics in a tertiary care hospital for a duration of one year. All the patients with osteoarthritis willing to give consent for MRI were included in the study. Patients with traumatic or terminal knee injuries were excluded. MRI scans of right knee was read by radiologist and orthopedic and their individual findings were noted and compared. Kellgren–Lawrence scale was used to grade the images. All the data was processed using SPSS v 22.0. Relevant statistical tests were used for comparison between groups. P value < 0.05 was considered as statistically significant.

Results : Out of 320 osteoarthritic subjects, 61% were females. Among the participants, 86.25% suffered from meniscal injuries. The most common location of tear was medial meniscus (67.86%) and the most common type of tear was complex tear (38%). The most common site was posterior horn of the meniscus (66%). The incidence of meniscal tear significantly increased with increasing age (54% in 60 years or older, $P < 0.001$). The prevalence also significantly increased with increasing severity of osteoarthritis ($P < 0.001$). Half of the grade 4 osteoarthritic patients had meniscal tear as compared to 10% in grade 1 patients. Body mass index significantly affected the prevalence of tear in females ($P < 0.001$) while it was not significant in males.

Conclusion: In conclusion, prevalence of meniscal tears is much higher in osteoarthritic patients on MRI scans. It increased with increasing age and severity of osteoarthritis. Routine MRI screening of such patients will be helpful in diagnosing meniscal tears early and plan better management.

Keywords : Meniscus, Osteoarthritis, Radiography.

Introduction

Magnetic resonance imaging (MRI) is a widely used imaging technology which uses radio waves and magnetic field to produce detailed three dimensional anatomical image.¹ The main advantage of MRI is that it is a non-invasive procedure and also does not use radiation like computed tomography scans. It is a frequently used modality for disease diagnosis and treatment monitorin.² It is frequently used in orthopedic diagnosis also.

Menisci are two fibrocartilaginous structures present within the knee joint, whose main purpose is to reduce the friction and thus, improve the articulation between femur and tibia. Thus, they absorb shock, transmit load and improve the stability of knee joint. Hence, menisci are vital for normal join function.³ There are two crescent-shaped menisci in knee joint, medial and lateral. They have posterior and anterior horns and body. Meniscal injury is usually due to some kind of trauma. Meniscal tears could be acute or chronic. Acute tears usually result from injury during sports. Chronic tears are usually a result of regular wear and tear.⁴ Medial meniscus tear can also be associated with a tear of medial collateral and anterior cruciate ligaments.⁵

The most common symptoms of knee meniscal damage include knee pain, swelling, limitation of range of joint movement, clicking of knee joint. Various tests such as McMurray test, Steinmann test, apley grind test etc can also help to reveal meniscal injury.⁶ Confirmatory evidence is provided by MRI which is the best imaging technique to identify the site and type of meniscal tears.⁶ The initial treatment involves management of pain and swelling using the non-steroidal anti-inflammatory drugs. The definitive treatment for meniscal tears include menisectomy.⁷

Degenerative meniscal tears are more common in the ages 40 and above. Osteoarthritis increases the risk of such tears. Osteoarthritis is the commonest type of arthritis affecting the protective cartilage cushion between the joints.⁸ Thus, it can lead to damage to menisci in the knee joint. There have been many incidental cases of meniscal tears in patients with osteoarthritis.^{9,10} However, there is dearth of data regarding the actual prevalence of meniscal injury in osteoarthritic patients. Thus, this study was performed with an aim to clearly identify the extent of meniscal injury including meniscal tears and destruction in all the osteoarthritic patients.

Materials & Methods

This was an observational study carried out in a tertiary care hospital by the department of radiology in collaboration with department of Orthopedics. The study was carried out for a duration of one year. It was commenced after receiving the permission from Institutional Ethical Board.

The subjects were selected based on the following inclusion and exclusion criteria –

Inclusion criteria -

1. All old and new patients of both genders aged 40 and above suffering from osteoarthritis.
2. Subjects willing to give informed consent.

Exclusion criteria –

1. Subjects suffering from any traumatic knee injury, terminal cancer, or any other knee injury which may affect the menisci.
2. Subjects with knee replacement, rheumatoid arthritis, walking with assisted devices like cane or walker.
3. Subjects with contraindications to MRI

Study procedure

The patients coming to the orthopedics outpatient department and suffering from osteoarthritis were included in the study. Only the patients willing to give written informed consent were included in the study. All the patients, either new or old, diagnosed with osteoarthritis during the one-year period by the orthopedic surgeon, were included in the study. Demographic data of the patients was recorded in a pre-approved pre-validated data sheet. Among these patients the

integrity of both the medial and lateral menisci of right knee was assessed in those who were eligible and willing to undergo MRI.

MRI of the knee was obtained using 1.5 tesla-scanner (Siemens) with a phased array knee coil. To assess the integrity of menisci, images from three pulse sequences were used: sagittal T1-weighted spin-echo images (repetition time, 475 msec; echo time, 24 msec; slice thickness, 3.5 mm; interslice gap, 0 mm; field of view, 140 mm × 140 mm; matrix, 256 × 256) as well as sagittal and coronal fat-saturated, proton-density-weighted, turbo spin-echo images (repetition time, 3610 msec; echo time, 40 msec; slice thickness, 3.5 mm; interslice gap, 0 mm; echo spacing, 13.2 msec; turbo factor, 7; field of view, 140 mm × 140 mm; matrix, 256 × 256). These MRI scans were read by musculoskeletal radiologist and orthopaedic to confirm the diagnosis in case of meniscal injury. All the segments such as anterior and posterior horns and body of both the medial and lateral menisci were read carefully and systematically. Both the scan readers were not informed about the clinical and radiographic data of the subject.

An increased meniscal signal on communication with inferior, superior or free edge of the meniscal surface was regarded as indicative of meniscal tear on minimum two consecutive images was regarded as indicative of meniscal tear. A radial tear was considered if the tear was visible on both coronal and sagittal images.^{11,12} Meniscal tears were classified as:¹³

- Horizontal – tears parallel to tibial plateau which separated the meniscus into upper and lower parts
- Oblique or parrot-beak - tears running obliquely to the circumferentially oriented collagen fibres;
- Longitudinal - tears perpendicular to the tibial plateau
- Radial – tears beginning in central free margin which is perpendicular to both tibial plateau and circumferential fibre orientation
- Complex – multiple tears in more than one configuration
- Root – tears located in the posterior or anterior central meniscal attachment.

Meniscal destruction was recorded when there was absence of meniscal tissue following surgical resection or complete maceration, due to any reason.

Knee radiography and image grading

Weight-bearing posteroanterior knee radiography with a fixed-flexion protocol^{14,15} was performed for the subjects whose MRI scans were readable. They were graded by a radiologist who was blinded on the patient details. Kellgren–Lawrence scale was used to grade the images.^{16,17} The Kellgren–Lawrence grade of 2 or higher was considered as radiographic evidence of tibiofemoral osteoarthritis (a scale of 0 to 4 grading).

Statistical analysis

The data was collected and entered into Microsoft excel 2016. It was analysed using SPSS version 22.0 and relevant tests such as t-test, one way anova and chi-square test were used for comparison between groups. P value < 0.05 were considered as statistically significant.

RESULTS

A total of 320 patients diagnosed with osteoarthritis willing to undergo MRI scan were included in the study. Among them, 61% (n = 195) were women and 39% (n = 125) were men. The mean age of the subjects was 57.8 ± 7.6 years. The mean body mass index of the participants was 28.5 ± 5.2.

Prevalence of meniscal tears

Among the 320 subjects suffering from osteoarthritis, 276 participants (86.25%) had one or more meniscal tear in their right knee. The prevalence of medial meniscal tear was more common as compared to the lateral meniscal tear (prevalence 52% vs 34%, P < 0.001), which was statistically significant. Out of the 276 participants with meniscal damage, meniscal tear was present in 81.16% (n = 224) and meniscal destruction was seen in the remaining 18.84% (n = 52) subjects.

Among the 224 subjects with meniscal tear, the most common type of tear was medial meniscus tear (67.86%, $n = 154$). This was followed by 21% ($n = 49$) having lateral tear and 9% ($n = 21$) had both medial and lateral tears. The most common site of meniscal tear was posterior horn of meniscus (66%) in both the medial and lateral menisci, this was followed by 52% in the body segment and 10% in anterior segment. Figure 1 shows the characterization of meniscal tears. The most common type of tear was a complex meniscal tear in 38% subjects followed by radial tear in 16% and oblique tear in 13% patients (the total percentage does not add up to 100% as the meniscal tears may involve more than one segment of meniscus; also, the same knee may have more than one type of meniscal tear).

As shown in figure 2, the prevalence of meniscal injury was found to significantly increase with increasing age of the patients ($P < 0.001$). It was most common in the 60 onwards age group (54%) followed by 48% in 50-59 years' age group. The prevalence was higher in males as compared to females (67% vs 46%) which was statistically significant ($P < 0.001$).

Also, as depicted in figure 3, the prevalence of meniscal damage increased significantly with increase in the grade of osteoarthritis as measured using Kellgren and Lawrence grade. The meniscal damage was higher among subjects with Kellgren and Lawrence grade 3 or 4 as compared to those with grade 2 or lower tibiofemoral osteoarthritis (84% vs 26%, $P < 0.001$).

Among the subjects, females with at least one meniscal tear had significantly higher body mass index as compared to females without meniscal injury (28.9 vs 26.4, $P < 0.001$). This was not significant in males with and without meniscal damage (28.8 vs 28.6, $P = 0.84$).

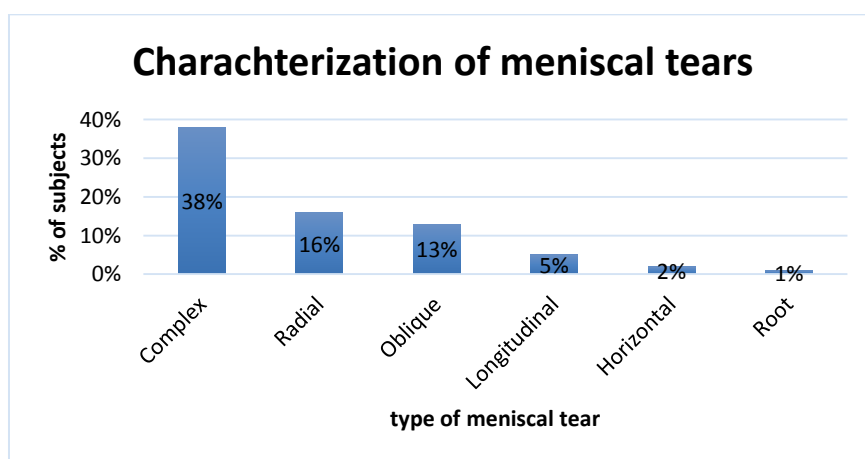


Figure 1. Characterization of meniscal tears. ($n = 224$)

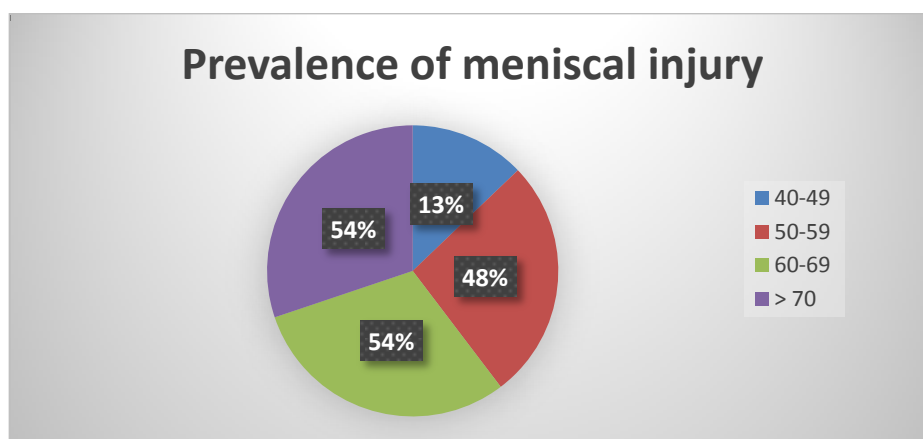


Figure 2. Prevalence of meniscal injury in different age groups ($n = 224$).

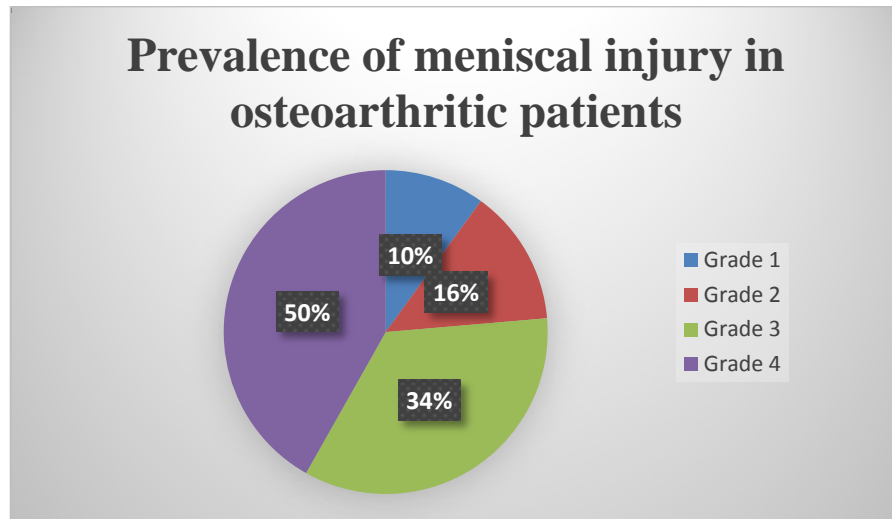


Figure 3. Prevalence of meniscal injury in osteoarthritic patients (n = 224).

Discussion

Osteoarthritis is a very common disorder of joints which mostly occurs in people of both genders with ages 40 and above. The incidence of osteoarthritis increases with increasing age of the patients. This commonly occurs due to day to day wear and tear of joints. Commonly affected joints include those of hands, knees, elbows etc. Osteoarthritis mainly affects the cartilage which protects the bone. Hence, there are high chances of meniscal injuries also. Knee joint have two menisci, medial and lateral. Most of the times, these meniscal injuries are asymptomatic and are often incidental findings on MRI scans. But, other times, it may lead to various symptoms such as pain, swelling and restricted joint movements. In such situations, it becomes imperative to treat the meniscal damage most commonly using surgical approach. Because of this, it is important to estimate the actual prevalence of meniscal injuries in patients with osteoarthritis.

Among the patients with osteoarthritis, 61% were females. Thus, prevalence of osteoarthritis was found to be more in females as compared to males. This is similar to the findings of many previous studies (18). A recent systematic review also published similar findings (19). This increased prevalence in females could be due to the changes in hormone levels during menopause and menstruation. Also, world statistics suggests that females are usually more obese than males, hence the knee joint of women experience more wear and tear. This is also similar to another finding of the present study where there was increased incidence of meniscal tear and osteoarthritis in women with higher body mass indexes.

It was observed that overall prevalence of meniscal injuries was quite high in osteoarthritic patients (86%). This is similar to finding observed by Lange et. al. where three-quarters of the women suffering from osteoarthritis had meniscal tear on MRI (20). The Framingham study also concluded similar findings that there was increased prevalence of meniscal tear in patients with hand osteoarthritis (21). The frequency of meniscal tears also increased with increasing Kellgren and Lawrence grade of osteoarthritis. Half of grade 4 osteoarthritic patients had meniscal injury (50%). This is similar to the findings published in previous studies (9, 21). These spontaneous meniscal tears could be due to the weakening of meniscal structure because of osteoarthritis.

The most common type of meniscal tear was observed to be complex tear (38%). This is similar to the findings published by Englund et.al. who also reported complex tears as the most common type (9). This was in contrast to a published review which mentioned radial tears as most common type of degenerative meniscal tears (22).

The incidence of meniscal injuries also increased with increasing age of the patients. It was most frequent in the 60 year upwards (54%). One of the recent studies corroborated these findings that

incidence of medial meniscus tears increased with increasing age, they also concluded that lateral meniscal tears decreases with increasing age (23). Increasing age leads to various changes in the composition of meniscus, like the degeneration of proteoglycans, cells and collagen. This weakens the meniscus and makes it prone to injuries.

There were a few limitations in the study. First of all, due to monetary and logistic reasons, we focused only on right knee MRI scans only, instead of both knees. So, we may have missed the meniscal injuries in the left knee. Secondly, these prevalence estimates cannot be generalised to younger population as the meniscal damage is usually age dependent. In young adults, meniscal tears could be due to physical trauma rather than osteoarthritis. Also, in our study, it is impossible to determine if osteoarthritis lead to meniscal tear or vice versa due to unavailability of previous scans.

Conclusion

It can be concluded from the study findings that meniscal injuries are common in osteoarthritic patients. Also, prevalence of such injuries increase as the age of patient increases. Also, severe the osteoarthritis, more chances of meniscal tears. Meniscal tears also increased with increasing body mass index. Thus, ordering an MRI in an osteoarthritic patient can help to identify meniscal tears early on in the disease and can be managed properly. Moreover, future studies comparing the prevalence of meniscal tears in osteoarthritic patients with general population can help in understanding the burden of the disease.

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Conflict of Interest: Nil

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