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Updates in prevalence and management of medial meniscal injury among adolescents and young adults in Saudi Arabia: systematic review

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ABSTRACT

Although medial meniscus tears in stable knees are frequently seen in young active populations, there are few studies on their epidemiology, particularly in younger populations. The first step in reducing injury rates is to have a better understanding of injury patterns. This study set out to identify the demographic and athletic risk factors as well as the incidence of medial meniscus injuries. For pertinent information, Google Scholar, PubMed, Web of Science, Science Direct, and EBSCO were systematically searched. The entire careful procedure was carried out using the Rayyan QRCI. The current article included 16 studies, in which the overall prevalence of medial meniscal injuries became higher. The main parameters like age, sex, number of participants, and period of study were obtained. The clinical studies were required to report the prevalence of medial meniscal injuries and the correlations related to the disorder.

Meniscus tears are a frequent orthopedic disease. A thorough medical history, physical examinations, specialized diagnostic procedures, and most likely magnetic resonance imaging to confirm the lesion are all necessary for the diagnosis of meniscal tears. To create the best management strategy, a thorough understanding of the meniscal anatomy, the impacted motions, and the related symptoms is essential.

Keywords: Medial meniscal injury, ACL, meniscal tears, Saudi Arabia, review.

Introduction

The menisci in the knee’s medial and lateral tibio-femoral compartments are essential for appropriate joint function [1]. Assisting in the distribution of compressive stresses during dynamic knee joint motions and static loading is the meniscus’ main purpose [2].

The menisci also act as secondary joint stabilizers and are crucial for proprioception and the lubrication of the knee joint [3]. Injuries to the meniscus in the knee can impair joint function and raise contact pressures in the troublesome compartment [4]. Long-term dysfunction, degenerative joint changes, and knee osteoarthritis have all been linked to meniscal injuries [5].

Since the first detailed case report, written by Pagnani et al. [6] involving a patient who was 20 years old, the bulk of reported meniscal root injuries have affected adults and young adults, with little information available for children and adolescents. Matheny et al. [7] evaluated 1,857 knee arthroscopies and found a 7.4% prevalence of meniscal injuries with a mean patient age of 37 years (range, 17-68 years). The cumulative chance of a

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These studies give rough estimates of the frequency of meniscal damage, but they also shed some light on the size and severity of this clinical issue. Both the public and physically active individuals frequently report knee meniscal injuries that require surgery, and in the US, about 1 million meniscal procedures are carried out each year [8]. There are fewer and more challenging population-based estimates of the frequency of symptomatic meniscal tears, and the statistics on the frequency of meniscal injuries likely understated the real frequency of meniscal tears [5].

Meniscal injuries are more frequent in incidents involving vehicles and in contact sports. The anterior cruciate ligament (ACL) and meniscus problems are frequently related. The meniscus serves as a secondary stabilizer in the anterior-posterior direction to the ACL, which serves as the knee joint’s primary stabilizer. When there is a persistent ACL injury or lack of ACL function, the meniscus becomes the primary stabilizer of the knee joint. Both components are susceptible to damage, which might reduce joint motion and jeopardize knee stability.

Meniscal injuries or internal knee derangements can be diagnosed with an MRI or diagnostic arthroscopy. When used as a screening technique before therapeutic intervention, MRI knee is noninvasive and has the advantage of being more precise in its preoperative diagnosis of meniscus and ACL damage. More of a screening tool than a treatment option, MRI is arthroscopy [9].

Meniscus injuries have been linked to the early onset of osteoarthritis, according to certain research. Poor results with early osteoarthritis development are seen in patients with meniscus injuries who had their ACLs repaired. Meniscus repair is therefore favored over meniscectomy in modern times, and meniscal tissue is retained as much as feasible. Chronic ACL injuries increase the intricacy of meniscus rips, making it more challenging to repair the meniscus. Therefore, a meniscus tear must be found and fixed very away to stop the knee joint from degenerating [9]. However, a number of fresh studies have been carried out globally due to the rising interest in medial meniscal injury among young adults research. This systematic review updates the existing body of information regarding the literature on medial meniscal injury across the world, with a focus on Saudi Arabia.

Subjects and Methods
The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed for this systematic review. This detailed evaluation was completed in August 2023.

Search strategy
A thorough search was conducted in five major databases, including Google Scholar, PubMed, Web of Science, Science Direct, and EBSCO, to find the pertinent studies. The search was restricted to English language articles and considered the specific requirements of each database. To discover relevant studies, the following keywords were transformed into PubMed Mesh terms: “meniscus, medial meniscal injury, knee, sports, ACL, Olympics, meniscal tears, Saudi Arabia.” To match the necessary terms, the Boolean operators “OR” and “AND” were employed. Publicly accessible articles, human trials, and publications in the whole English language were returned by the search.

Selection criteria
The following elements were considered for the review including all studies that examined the prevalence of medial meniscal injury and its correlations, with no age limitations. In addition, all free, easily accessed articles were included. However, letters to the editors, case reports, and responses to controversies were not included. Furthermore, foreign language articles were also not included. Moreover, young adults suffering from any other disorders, medical history of knee surgery, or any other lower limb joint surgery were excluded from the study.

Data extraction
Rayyan Qatar Computing Research Institute was used to find duplicates in the search strategy’s output. The researchers employed a set of inclusion/exclusion criteria to filter the combined search results to assess the relevance of the titles and abstracts. Each manuscript that satisfied the criteria for inclusion was undergone a thorough evaluation by the reviewers. Following extensive investigation, a number of conflict resolution techniques were provided. The names, authors, research year, nation, participants, gender, drug dose, key findings, and conclusion of the studies were made available.

Strategy for data synthesis
A qualitative overview of the findings and study components was carried out through summary tables, utilizing data from relevant research. The most efficient method for using the data from the included study articles was chosen once the data from the systematic review were extracted.

Risk of bias assessment
The quality of the included studies was evaluated using the ROBINS-I risk of bias assessment technique for nonrandomized trials of therapies. Confounding, participant selection for the study, classification of interventions, deviations from intended interventions, missing data, evaluation of outcomes, and choice
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of reported result were the seven topics that were evaluated.

Results

Search results

The systematic search found 230 study articles, 40 of which were deleted as duplicates. After screening the titles and abstracts of 190 investigations, 40 papers were excluded. Out of 150 reports that were looked for, only 55 could not be located. Last but not least, 95 publications were screened for full-text review; 70 were disqualified owing to flawed study findings, and 9 were disqualified due to the wrong population type. In this systematic review, 16 relevant study articles were included (Figure 1).

Characteristics of the included studies

The current review results included 16 studies. The age of the instances was from 5 to 70 years old to compare the prevalence between all ages [9-24]. Furthermore, the percentage of instances of males was higher than females as the studies reported [9,10,14-17,20,21,24]. In addition, five of them were conducted in the US [10-14], one was conducted in Denmark [19], one in France [24], one in India [22], one in Canada [23], and one in Russia [21] (Table 1).

It was inferred that in young athletes, isolated meniscus tears were extremely prevalent and resulted in substantial time away from sports competitions [10,22,24]. Meniscal injuries were related to male sex [14], growing older, and service in the Army or Marine Corps. Instances of medial meniscal injury were more common in active-duty personnel than in civilians [11,12]. ACL injuries and meniscal injuries were commonly treated together [9,13-15,23]. Compared to lateral meniscus damage, the frequency of medial meniscus injury was more common in chronic ACL tears [9]. The best imaging method for assessing the knee’s intact, torn, or healed ligaments and muscles is magnetic resonance imaging (MRI) as stated in four studies [16,17,21,23]. One study reported that mechanical knee symptoms have little utility as a meniscal surgery indication [19] (Table 2).

Discussion

Acute traumatic injuries, such as a quick fall or a long-term repetitive strain injury, can result in knee problems in young athletes. An athlete might have a chronic issue that unexpectedly gets worse as a result of an acute traumatic incident, leading to a knee injury on occasion. Various symptoms, including pain, shakiness, edema, and stiffness, can be brought on by these injuries. Hoogeslag et al. [25] noted that extra-articular soft tissue injuries are the most frequent kind of knee trauma, whereas knee injuries in children and adolescents are uncommon. Age causes a rise in the frequency and severity of knee injuries, mostly in men. The two main causes of knee injury are sporting venues and auto accidents.

Figure 1. PRISMA flowchart summarizes the study selection process.
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The current review focused on medial meniscal injuries. The meniscal tear patient’s clinical presentation varies depending on the cause of injury and severity of concurrent tibio-femoral insults. An ACL rupture with a potential medial meniscal tear is linked to the sensation of a “pop,” with an immediate effusion of the knee following high-impact exercise or trauma. John et al. [26] studied sports-related knee injuries in 363 Indian professional and amateur players and discovered that ACL injuries were the most common (86.5%), followed by meniscal injuries (78.2%). Approximately 2.2 times as often, or in the medial meniscus (53.7%), as in the lateral meniscus (24.5%), were meniscal injuries. For the various sports played in Brazil, the total incidence of meniscal injuries was 18% (79 injuries in 430 athletes), but it was 79% (284 injuries in 363 athletes) for Indian players. Less than 40% of injured athletes in India returned to their sport, and those who underwent surgery had a higher chance of doing so than those who received conservative treatment.

Baker et al. [27] examined discharge summaries from 1,515 meniscectomies performed in the New York region from 1973 to 1982, 505 of which were sports-related. Meniscectomy risk factors were investigated and contrasted between the general population and athletes. They discovered that in the general population, the ratio of medial to lateral meniscectomy was 4.9:1. Basketball players experienced right knee meniscus injuries more frequently than other sports. Of the two menisci, the medial meniscus was damaged in 75% of cases in football, 75% in baseball, 55% in wrestling, 78% in skiing, and 90% of cases in basketball.

Meniscal tear treatments include meniscal repair, meniscectomy, and nonoperative maintenance. The majority of meniscal tears are treated primarily with surgery.
<table>
<thead>
<tr>
<th>Study</th>
<th>Methods</th>
<th>Outcomes</th>
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<tbody>
<tr>
<td>Venkataraman et al. [9]</td>
<td>Details from the diagnostic arthroscopy of the knee joint, MRI, and clinical evaluation of patients with knee injuries were gathered. We calculated the frequency of meniscus injuries linked to recurrent ACL injuries after collecting the data.</td>
<td>37 had both an ACL rupture and a meniscus problem. There were 24 patients with isolated medial meniscus injuries.</td>
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<tr>
<td>Masini et al. [10]</td>
<td>Injuries reported in the Cadet Illness and Injury Tracking System and verified by medical records from clinics, operations, and radiographs. Meniscus tears were localized using Cooper's categorization. Data on demographics, injury characteristics, and time lost were also examined.</td>
<td>Meniscal injuries were 30% of meniscus tears. Injuries treated surgically lost 112.7 days compared to 36.1 days in non-operative patients.</td>
</tr>
<tr>
<td>Widener et al. [11]</td>
<td>To determine the prevalence of meniscal pathology found at the time of revision ACL surgery, an extensive case review was conducted. Both patient demographic information and meniscal injury trends were examined.</td>
<td>Medial meniscal tears were noted in 38 patients. A clear re-injury was reported by 64.1% of patients. In 43 individuals, re-injury was cited as the reason for revision ACL repair.</td>
</tr>
<tr>
<td>Jones et al. [12]</td>
<td>NA</td>
<td>Men were about 20% more likely than women to suffer an acute meniscal injury. The medial meniscus was injured in 50.3% of meniscus injuries.</td>
</tr>
<tr>
<td>Wilson et al. [13]</td>
<td>All patients treated arthroscopically by one of two surgeons for a medial or lateral meniscal tear were the subject of an electronic medical records search.</td>
<td>Three individuals had meniscal root injuries on both the medial and lateral sides. There are nine individuals who had a single medial meniscal root damage.</td>
</tr>
<tr>
<td>Jackson et al. [14]</td>
<td>NA</td>
<td>Meniscal repairs made up 53% of operations. Medial meniscus was more prevalent in female patients (24%).</td>
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<td>Cox et al. [15]</td>
<td>1,411 (93%) of the original 1,512 respondents received at least one repeat questionnaire. 1,308 of 1,512 received a 2-year follow-up (87%), while 1,307 of 1,512 received a 6-year follow-up (86%).</td>
<td>Medial meniscal injuries were 38%.</td>
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<tr>
<td>Yu [16]</td>
<td>For the experiment, a group of 29 guys was employed. Exactly the same age as the control group, 31 outpatients. Two expert radiation surgeons scanned both groups using a 1.5 tissue maximum ratio scanner and knee joint standard array coil imaging.</td>
<td>MRI provides a high degree of diagnostic accuracy for a variety of clinical knee problems.</td>
</tr>
<tr>
<td>Xu et al. [17]</td>
<td>MRI scanner was used.</td>
<td>MRI signs show 24.4% medial meniscal injuries with acute ACL tears and 28.6% medial meniscal injuries with chronic ACL tears.</td>
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<tr>
<td>Chang et al. [18]</td>
<td>Plain radiography and multi-detector computed tomography scans were used in preoperative radiographic examinations.</td>
<td>Meniscal injuries were common (52.9% of participants) and were linked to surgical tibial plateau fractures. Nine (9.0%) of 102 fractures had degenerative pathology of the meniscus, which predominantly affected the medial meniscus.</td>
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<tr>
<td>Thorlund et al. [19]</td>
<td>The Knee Arthroscopy Cohort Southern Denmark (KACS) data were used. On the basis of a possible meniscal tear, KACS recommended knee arthroscopy.</td>
<td>47% of patients were unable to fully straighten their knee, and 55% of patients experienced catching or locking sensations. Both patients with a meniscal tear and those without it experienced preoperative mechanical complaints at similar rates.</td>
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<tr>
<td>Sanders et al. [20]</td>
<td>NA</td>
<td>Meniscal pathology was discovered in 63.4% of patients at the time of the first ACL injury; 29.9% of patients had medial meniscal tears, and 139 patients had both medial and lateral meniscal tears.</td>
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<td>Bezegulov et al. [21]</td>
<td>The presence of joint effusion, bone marrow edema, and meniscal or cartilage abnormalities was determined using MRI scans.</td>
<td>Eight subjects had one grade three lesion site, while two persons had two. The posterior horn of the medial meniscus (53.8%) was where these lesions were most frequently discovered.</td>
</tr>
<tr>
<td>Vaishya et al. [22]</td>
<td>NA</td>
<td>Meniscal damage occurred in 68.4% of cases. In 32 knees, medial meniscal tears were discovered. Football is the sport where meniscal injuries occur most frequently.</td>
</tr>
<tr>
<td>Guenther et al. [23]</td>
<td>NA</td>
<td>30% of cases had medial menisci injuries. Meniscal tears found during surgery were substantially correlated with the occurrence of a meniscal tear seen on the initial MR images.</td>
</tr>
<tr>
<td>Caudal et al. [24]</td>
<td>NA</td>
<td>MRI is accurate in examining knee injuries.</td>
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</table>
In 1885, Annandale conducted the first open surgical repair of a meniscal tear. This was followed by the development of several arthroscopic methods. Due to a lack of knowledge about the crucial function of menisci, total meniscectomy was the gold-standard treatment for meniscal tears until the 1970s [28].

However, it soon became clear that meniscectomy patients also had deterioration due to femoral condylar flattening and joint space shortening. Since then, research has proven that the meniscus is a crucial weight-bearing structure and that its absence causes osteoarthritis and knee instability. As a result, orthopedic research on meniscal injury healing and preservation has grown dramatically just in the last few decades. The number of meniscal preservation surgeries has increased over the past 5 years, according to research by Abrams et al. [29]. Meniscal preservation instead of resection has demonstrated encouraging results with quicker recovery periods and functional outcomes, whether it be surgical or conservative.

MRI is the radiographic diagnostic that is most frequently used to identify meniscus tears. MRI has a specificity of 88% and a sensitivity of 93% for identifying a torn meniscus. On MRI, the meniscus’ aberrant form and strong signal intensity around the surface edge can be seen [30].

Gardner et al. [31] were the first to demonstrate the occurrence of soft-tissue injuries on MRI in 103 individuals. It was reported that destabilizing ACL injuries (footprint avulsion or full rupture) affected 57% of their patients. The connection between preoperative imaging parameters and arthroscopic findings in acute tibial plateau fractures was first shown by Tang et al. [32].

The occurrence of meniscal injury and concomitant root tears might be anticipated to rise along with rising juvenile athletic participation. Untreated posterior meniscal injuries might cause a loss of chondroprotective and stabilizing meniscal function, notwithstanding the absence of natural history research on meniscal injury therapy. The current study offers large-sample information on the rarely mentioned meniscal tear injury in the teenage population. Despite being rare, these injuries could happen more frequently than previously thought. These injuries should be taken into account when treating an athletic teenage patient since they could be fixable and essential to preserving the joint’s lifespan in the young athlete.

**Conclusion**

Years ago, the menisci were totally removed since it was believed that they were an inactive structure. Orthopedic research on menisci changed from excision to preservation when it became clear that the menisci were actually crucial to the biomechanics of the knee. Meniscus tears are a relatively prevalent injury nowadays, and their prevalence is rising across the board for all ages, whether from trauma or osteoarthritis. Recent developments in ongoing research projects and clinical trials help with the condition’s diagnosis and treatment. A comprehensive study of the patient’s medical history, physical examination, and meniscal tear characteristics can help to better understand the pathophysiology and the appropriate course of treatment. More work on current imaging and technology development would keep producing cutting-edge tools for generating diagnostic and therapy treatments.

**List of Abbreviations**

- ACL: Anterior cruciate ligament
- KACS: Knee Arthroscopy Cohort Southern Denmark
- MRI: Magnetic resonance imaging
- PRISMA: Preferred reporting items for systematic reviews and meta-analyses

**Conflict of interests**

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