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THE MOST COMMON KNEE INJURIES AND THEIR TREATMENT METHODS

Abstract. Athletes involved in power sports such as running, football and basketball are at risk of injury due to repetitive stress on the knees. This can lead to inflammation and damage to the knee joint. Improper training techniques, such as insufficient warm-up or stretching, can increase the risk of knee injury. Weak hip and lower leg muscles can put more pressure on the knee joint and increase the risk of injury. An imbalance in muscle strength can also cause instability in the knee joint, leading to injury. Contact sports such as football, hockey and rugby can result in direct blows to the knee, causing injuries such as ligament tears, fractures and dislocations. The most common knee injuries are a problem in the fields of sports medicine and orthopaedics, surgery and traumatology. They affect people of all ages



and activity levels, from professional athletes to everyday people who play sports. Understanding these injuries and their treatment is crucial for healthcare professionals and the general public. They can occur for a variety of reasons, such as accidents, sports injuries or overuse. The most common knee injuries include sprains and strains, which are caused by stretching or tearing of the ligaments (sprains) or muscles/tendons (sprains) in the knee. Meniscus tears can also occur due to sudden twisting or turning movements. Another possible consequence may be damage to the medial collateral ligament and lateral collateral ligament. This article aims to provide an overview of the most common knee injuries, their causes, symptoms and treatments. By highlighting the prevalence and consequences of these injuries, the article emphasises the importance of proper prevention, diagnosis and treatment. It also sheds light on recent advances in treatment methods, including non-invasive and surgical options, and their effectiveness in promoting full recovery and preventing future injuries.

Keywords: knee, injury, treatment, sport, ligaments, meniscus.

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НАЙЧАСТІШІ ТРАВМИ КОЛІНА ТА МЕТОДИ ЇХ ЛІКУВАННЯ

Анотація. Спортсмени, які займаються силовими видами спорту, такими як біг, футбол та баскетбол, ризикують отримати травму через повторювані навантаження на коліна. Це може призвести до запалення та пошкодження колінного суглоба. Неправильна техніка тренувань, наприклад, недостатня розминка або розтяжка, може підвищити ризик травмування колінного суглоба. Слабкі м'язи стегна і гомілки можуть чинити більший тиск на колінний суглоб і підвищувати ризик травми. Дисбаланс м'язової сили також може спричинити нестабільність колінного суглоба, що призводить до травм. Контактні види спорту, такі як футбол, хокей і регбі, можуть призвести до прямих ударів по коліну, що спричиняє такі травми, як розриви зв'язок, переломи і вивихи. Найпоширеніші травми колін є проблемою в галузі спортивної медицини та ортопедії, хірургії та травматології. Вони вражають людей різного віку та рівня активності, від професійних спортсменів до звичайних людей, які займаються спортом. Розуміння цих травм і методів їх лікування має вирішальне значення для медичних працівників і широкої громадськості. Вони можуть статися з різних причин, таких як нещасні випадки, спортивні травми або надмірне навантаження. До найпоширеніших травм колінного суглоба відносяться розтягнення та вивихи, що виникають через розтягнення або розрив зв'язок (розтягнення) або м'язів/сухожиль (розтягнення) в коліні. Також розриви меніска можуть статися через різке скручування або поворотні рухи. Ще одним можливим наслідком може бути пошкодження медіальної колатеральної зв'язки та бічної колатеральної зв'язки. Ця стаття має на меті надати огляд найпоширеніших травм колін, їх причин, симптомів та методів лікування. Висвітлюючи поширеність і наслідки цих травм, стаття підкреслює важливість належної профілактики, діагностики та лікування. Вона також проливає світло на останні досягнення в методах лікування, включаючи неінвазивні та хірургічні варіанти, та їхню ефективність у сприянні повному відновленню і запобіганні майбутнім травмам.

Ключові слова: коліно, травма, лікування, спорт, зв'язки, меніск.

Statement of the problem. Sport in the modern world is defined not only as a means of physical improvement, but also as an association that stimulates health and allows for exceptional achievements. Despite this, the stresses that accompany



an active sports lifestyle can lead to injuries, especially in a group of athletes who regularly engage in intense training [1]. One of the most common problems is traumatic knee injuries, which often result in serious therapeutic and surgical challenges [2]. Injuries in athletes are a recurring reality, driven by the high level of physical activity and the constant drive to improve [3].

In this context, joint, muscle and tendon injuries are one of the most common and important categories of injuries. The limbs of athletes, subjected to constant stress and maximum load, become particularly vulnerable to various injuries. Among the most common injuries in sports are bruises, sprains, fractures, dislocations, and common joint injuries, such as knee injuries, which include damage to cartilage, ligaments and bone. These injuries often require complex treatment and a great deal of attention to the rehabilitation process to fully restore functionality [4, 5, 6].

Making treatment choices for sports-related knee injuries is a task that requires in-depth research and identification of the most relevant strategies. In this context, understanding not only the pathophysiology and mechanisms of injury, but also the development of innovative treatments is an important prerequisite for successfully addressing this problematic issue [7, 8].

Knee injuries are also often associated with various pathologies and dysplasias of the connective tissue. Connective tissue hypermobility (CTH) can increase joint mobility, contributing to joint instability. Osteoarthritis, the wear and tear of the cartilage in the knee joint, increases vulnerability to further injury. Dysplasia of the knee joint, an abnormality in its development, can also lead to malfunction and injury. Overload syndromes, uneven load distribution, and rheumatoid arthritis can contribute to cartilage and ligament damage. Non-infectious conditions such as patellar chondromalacia and knee deformities also increase the risk of injury. Understanding these factors helps doctors determine the best treatment and injury prevention approach for each individual patient [9, 10, 11].

Analysis of the latest research and publications. Traumatic knee injuries have become not only an integral part of the sporting reality, but also a challenge for doctors and scientists who dedicate their efforts to understanding and treating these unpredictable and often long-term injuries. As athletes persistently strive for high performance and improve their physical condition, they face the risk of injury, especially in the knee area, which is a key ligament in the lower extremities [12, 13].

The aim of this article is to study the literature on current scientific information about knee injuries in athletes and to review current popular methods of treating this pathology.

Presentation of the main material. One of the most common areas of injury in the knee is damage to the medial collateral ligament (MCL). The knee joint has a number of important structures that ensure stability and proper functioning. The MCL is located on the inside of the knee and is responsible for stabilising the area.



Injuries to the MCL can range from mild sprains to serious tears, and their treatment depends on the severity [14].

Another commonly affected area is the medial and lateral menisci of the knee. The menisci are cartilaginous structures located inside and outside the knee joint. Their main function is to cushion and distribute the load on the knee joint. Meniscus injuries can occur as a result of various mechanical and sports injuries, as well as due to aging and wear and tear [15].

The third area involved is the lateral collateral ligament (LCL), which is located on the outside of the knee joint. The LCL is responsible for stabilising the joint laterally. LCL injuries can occur as a result of traumatic events or sports injuries [16].

Given the importance of these structures to the normal functioning of the knee joint, injuries to them often require careful diagnosis and proper treatment to ensure effective recovery and prevent further complications.

MCL extends from the inner surface of the upper shin bone to the inner surface of the lower thigh bone, providing stability to the shin bone (tibia). Typically, MCL injuries result from pressure or stress on the outer part of the knee, commonly during football when there is a block to the outside of the knee.

MCL injuries are common in the athletic population, with partial injuries often treated nonoperatively and complete ruptures sometimes requiring surgery. A comprehensive rehabilitation program is critical for optimal outcomes, but a standardized program does not exist. Isolated MCL injuries can frequently be treated nonoperatively, while certain features such as far distal injuries or combined ligamentous injuries may necessitate surgery. It is important to identify patients with medial instability and develop an operative plan to restore stability and function to the injured knee. MCL injuries are most commonly seen in linemen, who also experience more severe injuries and longer recovery times compared to nonlinemen. Overall, the goal of treatment is for the injured athlete to return to play without functional limitations and to address risk factors to prevent future injuries. These injuries to the MCL can range from a stretch to a partial tear or a complete tear of the ligament. Additionally, MCL injuries frequently coincide with anterior cruciate ligament (ACL) injuries [17, 18, 19].

The study conducted by Matilda Lundblad et al. (2019) aimed to investigate the epidemiology and mechanisms of MCL injuries in men's professional football. In addition, the study aimed to evaluate the diagnostic and therapeutic approaches used for these injuries in football [20]. During one to three complete seasons (2013/2014-2015/2016), a prospective study followed 51 teams, documenting individual player exposure and time-loss injuries. Out of 4364 registered injuries, 130 (3%) were MCL injuries, with 75% resulting from contact, particularly being tackled (29%) or tackling (12%). MRI was utilized in 68% of cases, while 25% were diagnosed through clinical examination alone. When both methods were employed



for grading MCL injuries, there was a 92% agreement with a weighted kappa of 0.87. Use of a stabilizing knee brace in grade II MCL injuries correlated with a longer recovery period compared to those without a brace (41.5 vs. 31.5 days, $p = 0.010$). This emphasizes that not all grade II MCL injuries were treated with a brace, suggesting routine bracing may not be necessary for milder cases.

Study by Dong Ren et al. (2017) created a three-dimensional finite element model (FEM) of the knee joint to examine the biomechanical roles of the superficial and deep medial collateral ligaments (MCLs) and explore treatment approaches for MCL injuries [21]. Using CT and MRI scans from a healthy male volunteer, the FEM simulated various knee movements to observe stress distribution and ligament deficiencies. Results revealed that the superficial MCL could withstand significant stresses, particularly at femoral endpoints, while the deep MCL tolerated minimal stress. The findings suggest that MCL II° injuries may necessitate surgical intervention based on biomechanical considerations.

Christopher Watura's (2022) analysis aimed to assess the correlation between MRI and clinical gradings of medial collateral ligament (MCL) injuries in the knee and explore associated structures on MRI that might influence clinical perceptions of MCL laxity [22]. The retrospective review of 119 knee MRIs with acute MCL injuries from 2016 to 2020 revealed a 48% agreement between MRI and clinical gradings, indicating only a 'fair' correlation ($\kappa = 0.21$). Notably, MRI tended to overestimate the injury grade compared to clinical assessments. MRI grades showed 29% grade I, 50% grade II, and 21% grade III MCL injuries. Clinical grades, however, demonstrated 67% grade I, 26% grade II, and 7% grade III. In cases with clinically graded III MCL injuries, MRI revealed specific findings such as waviness of the superficial MCL, deep menisiofemoral ligament tears, anterior cruciate ligament (ACL) partial or complete tears, and posteromedial corner (PMC) injuries. These findings were significantly more prevalent compared to clinical grade I or II injuries.

In conclusion, while there was only a 'fair' agreement between MRI and clinical gradings, specific MRI findings like superficial MCL waviness and associated injuries to the deep MCL, ACL, and PMC were correlated with clinical instability, providing valuable insights into the complexity of MCL injuries [22].

Ryan G. Miyamoto et al. (2009) indicated prophylactic knee bracing has shown potential in preventing MCL injuries, but may impact functional performance. Most isolated MCL injuries are treated nonsurgically, with recent studies examining healing modalities like ultrasound and nonsteroidal anti-inflammatory drugs. High-grade MCL injuries with concurrent damage to anterior or posterior cruciate ligaments may require surgical intervention. The optimal approach to multiligamentous knee injuries remains a topic of evolution, with ongoing debate over the role of MCL repair/reconstruction, supporting both conservative and surgical management [23].



The majority of medial collateral ligament (MCL) injuries can be managed without resorting to surgery, utilizing conservative approaches. The appropriate treatment is contingent upon the injury's severity, distinguishing between a strained or stretched ligament and a partially or completely torn MCL. Non-surgical interventions, such as rest and bracing, are commonly employed. Surgery for MCL is only considered when the ligament fails to heal and restore stability to the inner knee, even after a period of rest. To facilitate healing, it is crucial to rest the knee for several weeks. Applying ice and using a compressive dressing in the initial days post-injury helps minimize swelling. Before returning to physical activity, a re-evaluation of the knee ensures that the ligament has adequately healed. A specialized brace may be employed to offer additional support when resuming sports. Various surgical options exist for treating MCL injuries, including ligament repair or reconstruction. If reconstruction is deemed necessary, the surgeon may utilize either the patient's own tissue or donor tissue to create a new ligament. The choice between surgical methods and the type of tissue employed depends on the nature of the injury and the preferences of both the surgeon and the patient [24, 25].

Raju Vaishya's et al. (2020) investigation examines the incidence and treatment of meniscus injuries in elite and Olympic athletes across a variety of sports in the Olympic Games. The knee and meniscus are frequently injured in these athletes, which affects their performance. The study analysed publications on meniscus injuries at the Olympic Games, finding limited data and a higher prevalence in football. Differences in injury rates were observed between countries and sports. The study highlights the dearth of literature on meniscus injuries in elite athletes, especially outside of football, and suggests improvements in data collection to better understand these injuries [26].

The research by Katrin Karpinski et al. (2023) aimed to provide insights into the causes and development of medial (MM) and lateral (LM) meniscus root tears [27]. The hypothesis was that MM root tears are primarily due to degeneration, while LM root injuries are mainly traumatic. The study included 53 patients with medial meniscus root tears (MMRT) and 51 with lateral meniscus root tears (LMRT), confirmed by both MRI and arthroscopy. Results revealed that MMRT patients had a higher mean age (57.2 years) and BMI (30.5) compared to LMRT patients (33.9 years, BMI 25.1). LMRT cases often showed an accompanying anterior cruciate ligament (ACL) rupture (82.4%), while only 5.7% of MMRT cases were associated with an ACL injury. Trauma was reported in only 13.2% of MMRT cases, in contrast to 88.2% of LMRT cases. MMRT cases often exhibited medial meniscus extrusion (>3 mm) in MRI (86.8%), indicative of medial osteoarthritis and knee varus deformity. LMRT cases had a lower extrusion rate (15.7%). Mechanical varus angle was higher in MMRT (5.6°) compared to LMRT (2.4°). Concomitant cartilage damage in the affected compartment was more prevalent and severe in MMRT cases than in LMRT cases. In conclusion, MM and LM root injuries differ significantly in



terms of patient age, causes, and accompanying injuries. MM root tears are mostly non-traumatic and associated with osteoarthritis and knee varus deformity, while LM root tears are often traumatic and linked to ACL ruptures. Nonetheless, subgroups with opposite etiologies exist in both MMRT and LMRT cases.

The initial management of a knee experiencing acute pain and swelling, suspected of having a meniscal tear, should involve applying the RICE principles for acute soft tissue injuries—rest, ice, compression, and elevation. Oral analgesics and NSAIDs might be recommended to alleviate pain and reduce swelling. Bracing or knee sleeves can be utilized for protection and compression, and initiating pain-free range of motion exercises for the knee and ankle early on may be beneficial in preventing motion loss and aiding in edema control. In cases of simple tears limited to the outer 1/3 of the meniscus or degenerative tears, a pragmatic approach involves a 4-6 week period of relative rest and participation in physical therapy. This strategy aims to assess whether spontaneous healing occurs and if the individual can return to their desired level of function [28, 29].

As per the 2019 ESSKA meniscus consensus statements, traumatic meniscus tears are typically addressed through repair, leaving the meniscus in place, or partial meniscectomy. The preferred choices often include repair and partial meniscectomy, while leaving the meniscus in place is recommended for stable asymptomatic tears of the lateral meniscus during ACL reconstruction (ACLR). Partial meniscectomy for traumatic meniscus tears is considered when repair or leaving the meniscus in place is not feasible, such as in cases of complex tears, flap tears, or nonreducible bucket handle tears. For acute root tears, treatment options encompass arthroscopic repair, meniscectomy, or a non-surgical approach. Improvement can generally be expected in all three groups after 12 months. Existing evidence suggests that arthroscopic repair may offer better protection in terms of slowing down the onset of osteoarthritis. When repair is deemed necessary, it is recommended to perform surgery as early as possible. Preserving as much of the meniscus as feasible is emphasized for the long-term health of the knee joint. However, there is a lack of comprehensive guidance in the literature concerning the rehabilitation and return-to-sport progression for football players who have undergone lateral meniscus surgery [30, 31, 32, 33]

The fibular ligament, commonly referred to as the lateral collateral ligament (LCL), plays a crucial role in stabilizing the knee joint. It originates from the lateral epicondyle of the femur and attaches to the fibular head. The main function of the LCL is to protect the knee from excessive varus stress and posterior-lateral rotation. Emerging 1.4 mm proximal and 3.1 mm posterior to the lateral epicondyle of the femur, the lateral collateral ligament (LCL) courses approximately 0.69 mm along the lateral aspect of the knee. Its insertion point is situated 28.4 mm distal to the fibular styloid tip, covering nearly 38% of the fibular head [34].



The LCL exhibits differences from the medial collateral ligament (MCL) by having a more cord-like structure rather than a fan-like arrangement. Additionally, unlike the MCL, the LCL does not attach to a meniscus or the joint capsule [35].

Wolf Petersen et al. (2013) conducted a systematic literature review over the past decade to examine evidence related to the treatment and prevention of lateral ankle sprains [36]. The data were sourced from Pubmed Central and Google Scholar, focusing on meta-analyses, prospective randomized trials, and English language articles. The review encompassed surgical and non-surgical treatments, comparisons between immobilization and functional treatment, exploration of different external supports, balance training for rehabilitation, balance training for prevention, and the use of braces for prevention. They identified three meta-analyses and 19 articles reporting 16 prospective randomized trials. Surgical ankle ligament repair demonstrated advantages in terms of reduced objective instability and recurrence rates compared to non-operative treatment. However, the study concluded that the majority of grades I, II, and III lateral ankle ligament ruptures can be managed without surgery. Non-surgical treatment, especially for grades I and II injuries, was found to be most effective with a semi-rigid ankle brace. For grade III injuries, a short period of immobilization followed by a semi-rigid brace was advantageous. Neuromuscular training was recommended to support the treatment of acute ankle sprains. Additionally, balance training proved effective for both rehabilitation and prevention, especially in athletes with prior sprains. The use of a brace was deemed effective for preventing ankle sprains, supported by high-level randomized trials. Article concludes that surgical and non-surgical treatments should be balanced, with the majority of lateral ankle ligament ruptures (grades I, II, and III) managed without surgery. Individualized decisions should guide the indication for surgical repair. The systematic review advocates for a phase-adapted non-surgical treatment approach, including short-term immobilization for grade III injuries followed by a semi-rigid brace. Further prospective randomized studies with extended follow-ups are recommended to determine the non-surgical treatment with the lowest re-sprain rate.

The article Chris Wall et al. (2023) explores the management of common sport-related knee injuries, particularly in Australia, a country with high sporting participation [37]. It covers non-operative treatments for injuries like medial collateral ligament (MCL), lateral collateral ligament (LCL), and posterior cruciate ligament (PCL), while indicating that anterior cruciate ligament (ACL) ruptures may require surgical intervention, especially for those returning to pivoting sports. The multidisciplinary approach involving general practitioners, physiotherapists, sports physicians, and orthopedic surgeons is emphasized for optimal patient care.

This study Dennis E Kramer et al. (2020) focuses on isolated collateral ligament injuries in adolescents, specifically medial (MCL) and lateral (LCL) collateral ligaments [38]. The research aimed to identify characteristics associated with these injuries and assess the timing for return to sports in patients below



17 years old. The study, based on electronic medical records, found that isolated collateral ligament injuries are rare in adolescent athletes. MCL injuries were four times more common than LCL injuries, and one-quarter of MCL injuries occurred with patellar instability events. Grade III injuries, representing 20-25% of collateral ligament injuries, were more common in football and soccer. The mean return to sports was 2.2 months, with most cases returning within 4 months. The study provides insights into the prevalence and characteristics of isolated collateral ligament injuries in adolescent athletes.

The appropriate treatment for Lateral Collateral Ligament injuries is highly contingent on the injury grade and the presence of associated injuries, emphasizing the crucial need for prompt and definitive imaging. In the acute phase, regardless of the injury grade, the standard approach involves rest, compression, nonsteroidal anti-inflammatory drugs (NSAIDs), and ice. It's important to limit ice application to the lateral knee to no longer than 15 minutes at a time to prevent potential cold injury to the common peroneal nerve. For Grade 1 and 2 injuries, nonoperative measures are typically preferred. Patients are advised to avoid weight-bearing and utilize crutches for the first week to enhance pain control. Subsequently, a hinged knee brace is recommended for 3 to 6 weeks to provide stability to the medial and lateral aspects of the joint during functional rehabilitation. Grade 3 injuries, according to recent studies, exhibit higher knee range of motion and reduced pain with surgical intervention. Intrasubstance LCL repairs have shown limited success, leading recent literature to advocate for reconstructive surgeries. In cases of isolated LCL injuries, reconstruction is favored, often utilizing a semitendinosus autograft. Special attention must be paid to the common peroneal nerve and the anterior cruciate ligament (ACL) to mitigate potential complications [35, 39, 40, 41].

Conclusions. Traumatic injuries to the medial collateral ligament, medial and lateral menisci of the knee, and lateral collateral ligament are serious injuries that often occur as a result of sudden rotations, twisting, or traumatic events during sports. The most important aspect of treatment is to treat knee injuries individually, taking into account the characteristics of each patient and the severity of the injury. Providing accessible and high-quality medical care in these cases is critical to ensure a quick recovery and prevent further complications.

Prospects for further research. Further research could explore the best methods of treating knees and their ligaments and speed up the recovery period.

Conflict of interest

The authors declare no conflict of interest.

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Contribution of the authors

All authors made significant contributions to the original and revised versions of this paper.



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