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Conservative and Surgical Management of Knee Osteoarthritis (Gonarthrosis)

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ABSTRACT

Knee osteoarthritis, also known as gonarthrosis, is a common joint condition that causes cartilage breakdown. It often leads to pain, limited movement, and a lower quality of life. The incidence of this disease is increasing, and it is fundamental to create evidence-based treatment plans. We conducted a narrative review of the literature, including randomized controlled trials, systematic reviews, and updated clinical guidelines, published between 2014 and 2021, from the PubMed and Cochrane Library databases. In this review, we discuss the epidemiology, possible causes, diagnosis, and treatment of knee osteoarthritis. For the early and moderate stages of the disease, the conservative treatment is the primary strategy. This approach includes lifestyle changes, weight loss, medication, injections, physiotherapy, and supplementary devices. These methods relieve pain and improve function, but provide only a temporary solution. Surgery is necessary for more advanced stages of the disease. Total knee arthroplasty (TKA) is the most definitive and long-lasting treatment. Other, less invasive procedures suitable for patients with limited compartment degeneration include unicompartmental knee arthroplasty (UKA) and high tibial osteotomy (HTO). HTO is a preferred method for young patients with bone misalignment. Surgical procedures have higher complication rates but better long-term outcomes than conservative treatments. Combining conservative and surgical approaches can improve clinical outcomes. More high-quality studies are needed to improve care guidelines.

Keywords: knee osteoarthritis, gonarthrosis, conservative treatment, surgical treatment, knee arthroplasty

1. INTRODUCTION

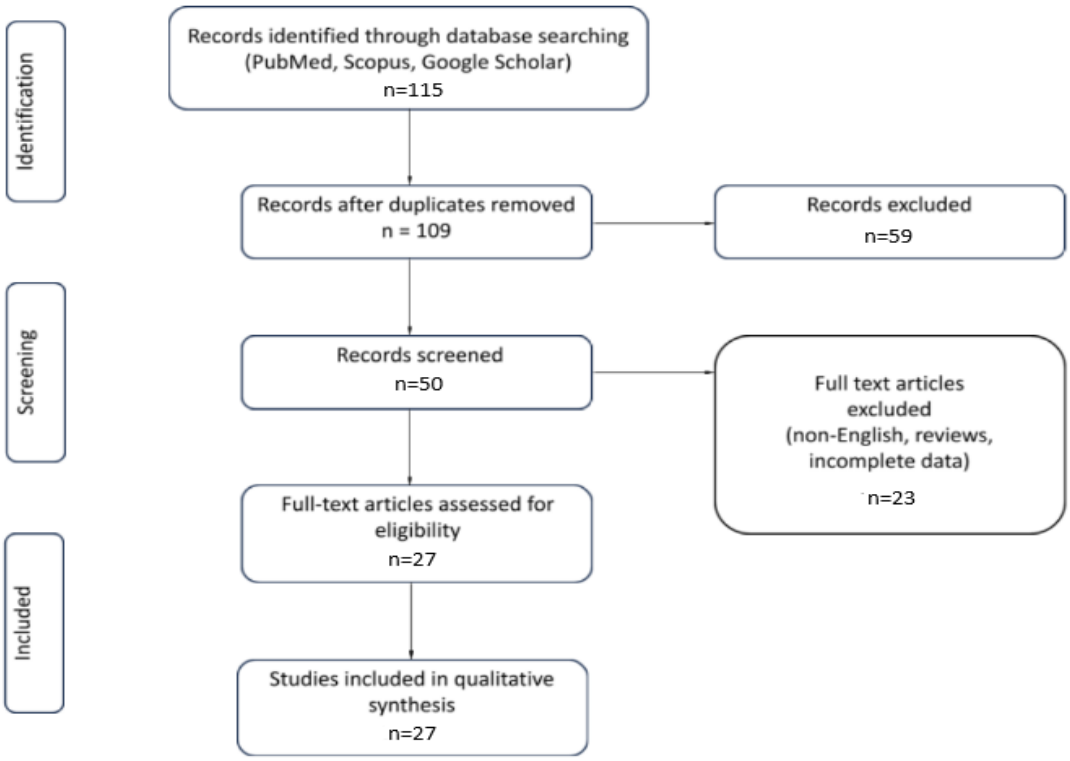
Osteoarthritis of the knee (gonarthrosis) is one of the most prevalent forms of osteoarthritis and one of the most significant sources of disability and pain in the world. It leads to progressive degeneration of joint cartilage. Changes in the subchondral bone, hypertrophy of the synovial membrane, and sometimes osteophytes are also present in this condition (Hunter and Bierma-Zeinstra, 2019; Loeser et al., 2012). These pathological changes cause decreased mobility, chronic pain, and stiffness. Functional decline of the lower limb may also significantly affect

the patient's quality of life and daily activities (Wang and Ni, 2022). Gonarthrosis is an important public health issue due to its high prevalence.

Approximately 250 million people are suffering from gonarthrosis (Hunter and Bierma-Zeinstra, 2019). The incidence of knee osteoarthritis is increasing due to increased age and the prevalence of obesity. The management of gonarthrosis is complex. It requires an individualized approach, depending on the patient's clinical picture (Hunter and Bierma-Zeinstra, 2019; Loeser et al., 2012).

2. REVIEW METHODS

We performed a narrative review guided by the principles of a systematic review. PubMed, Scopus, and the Cochrane Library were searched to find the most recent publications. Studies were selected and analyzed to summarize the disease etiology and the available conservative and surgical treatment strategies. Particular attention was given to efficacy, indications, functional outcomes, and quality of life. We followed the PRISMA 2020 guidelines during study selection, and specified the inclusion and exclusion criteria in Figure 1.



*n - number of articles

Figure 1. PRISMA flow diagram.

3. RESULTS & DISCUSSION

The main risk factors for gonarthrosis include age, obesity, and knee trauma. Women are at a higher risk because of genetic factors, posture issues, and malformations of the lower limbs. Increasing life expectancy and the high rate of obesity lead to more patients needing medical assistance (Martel-Pelletier et al., 2016). Osteoarthritis of the knee negatively impacts patients' quality of life. Pain, reduced mobility, and an inability to carry out daily tasks can result in social isolation, physical inactivity, loss of independence, and the development of depression (Wang and Ni, 2022).

The major pathological process in gonarthrosis is the breakdown of joint cartilage, accompanied by changes in the subchondral bone and the synovial membrane. The causes of gonarthrosis are complex and involve both mechanical and biological factors that lead to the ongoing degeneration of the knee joint (Hunter and Bierma-Zeinstra, 2019).

Articular cartilage primarily consists of type II collagen, proteoglycans, and chondrocytes. In a healthy state, this cartilage can absorb mechanical stress, enabling smooth movement. In gonarthrosis, it is not possible due to an imbalance between the breakdown

and synthesis of the extracellular matrix. Collagen breakdown and loss of proteoglycans occur due to the activity of proteolytic enzymes, such as matrix metalloproteinases (MMPs), and proinflammatory factors (IL-1β, TNF-α). These changes cause wear and softening of the articular cartilage, eventually exposing the bone surface (Loeser et al., 2012). Changes also occur in the subchondral bone, including remodeling, enchondral ossification, thickening, cyst formation, and osteophyte formation. The degenerative process is often accompanied by synovial fluid production, joint swelling, and stiffness. Biomechanical problems, unstable gait patterns, muscle weakness, and uneven joint loading may all contribute to the progression of gonarthrosis. These factors may create mechanical conflicts that contribute to pain (Martel-Pelletier et al., 2016). The Kellgren-Lawrence (KL) radiographic classification is the most commonly used method for assessing gonarthrosis in Polish healthcare. This system analyzes anteroposterior radiographs and categorizes degenerative changes into four levels. We present the scale in Table 1.

Table 1. Kellgren–Lawrence (KL) radiographic classification of the gonarthrosis

KL Grade	Radiographic Characteristics
Grade 0	No radiographic features of osteoarthritis
Grade I	Doubtful joint space narrowint; possible small osteophytes
Grade II	Definite osteophytes; possible mild joint space narrowing
Grade III	Moderate joint space narrowing; multiple or large osteophytes; possible deformity of bone ends
Grade IV	Severe joint space narrowing; marked subchondral sclerosis; large osteophytes; significant joint deformity

Despite the popularity of the Kellgren-Lawrence scale, its sensitivity is insufficient to detect early degenerative changes. The most appropriate tool in this case is magnetic resonance imaging (MRI), which enables assessment of cartilage, menisci, ligaments, and synovial membranes (Guermazi et al., 2011). The diagnosis of gonarthrosis is based on a thorough clinical assessment of symptoms, supported by physical examination and radiological imaging. In clinical practice, it is also worth considering the use of functional scales in the assessment of the patient's condition, such as the Western Ontario and McMaster Universities (WOMAC) Osteoarthritis Index score or the Knee Injury and Osteoarthritis Outcome Score (KOOS), which allow the assessment of the treatment and the monitoring of the disease (Bijlsma et al., 2011).

Conservative treatment of gonarthrosis

Conservative treatment of knee osteoarthritis aims to improve joint function, reduce pain, and prevent disease progression.

I. Patient education and lifestyle modification

Patient education about lifestyle changes is essential. Patients must preserve optimal body weight. Even a 5-10% weight reduction can minimize pain and improve joint function (Christensen et al., 2007).

II. Pharmacotherapy

The first-line drugs for pain relief for osteoarthritis are non-steroidal anti-inflammatory drugs (NSAIDs). We can administer them systemically or topically. Using NSAIDs topically is indicated for older adults, who are at higher risk of side effects from systemic use. For patients who cannot take NSAIDs, we can suggest paracetamol, though it only provides moderate relief for gonarthrosis pain (da Costa et al., 2017). In cases that do not respond to other treatments, we may consider short-term use of opioids such as tramadol. However, we need to remember opioids are highly addictive and have other side effects (Zhang et al., 2008).

III. Joint injections

Joint injections are a common form of therapy. Corticosteroids provide short-term pain relief. We often use them when joint swelling is present, but we should avoid long-term use, as it may accelerate cartilage damage (McAlindon et al., 2017). Alternatively, we can

consider hyaluronic acid injections, though their effectiveness is unclear. In some studies, moderate improvements in function and pain relief were found. However, other studies found no benefit compared to placebo (Bannuru et al., 2015).

Recently, there has been growing interest in biological treatments such as platelet-rich plasma (PRP). It is rich in growth factors that promote tissue healing. Multiple systematic reviews demonstrated their effectiveness at reducing pain and improving function in patients with early-stage disease (Shen et al., 2017).

IV. Physiotherapy and rehabilitation

Physiotherapy plays a key role in conservative treatment. Important exercises include those that strengthen the thigh muscles, improve joint stability, and reduce stress on joint surfaces (Lange et al., 2008). Manual therapy, proprioception training, and balance exercises have also been shown to be effective. Physical therapy treatments, such as electrotherapy, cryotherapy, and ultrasound, are also used, although their effectiveness is limited (Brosseau et al., 2010).

V. Orthoses and orthopedic supplies

Using orthoses may relieve pressure on the medial knee compartment and help patients with unilateral gonarthrosis. Walking sticks, elbow crutches, and other aids reduce stress on the joint and improve safety during movement (Brouwer et al., 2006).

Operative treatment of gonarthrosis

In patients with advanced knee osteoarthritis, conservative treatment may not be sufficient. In these situations, surgical treatment is more suitable and may reduce pain, improve joint function and quality of life, and help the patient regain as much physical function as possible.

I. Arthroscopy of the knee joint

Arthroscopy was commonly used in the past to treat gonarthrosis, especially in patients with meniscus damage or loose bodies in the joint. However, after reviewing many randomized trials and meta-analyses, its value in cases of isolated osteoarthrosis without mechanical joint locking is considered limited. Findings show that arthroscopy does not produce significant long-term improvement in joint function or pain relief when compared to non-operative treatment (Khan et al., 2014). Therefore, arthroscopy has limited uses and is not recommended as a standard treatment for gonarthrosis.

II. Periarticular osteotomy

Osteotomy is most often done as a high tibial osteotomy (HTO). It is mainly recommended for younger, active patients with damage to the medial compartment and lower limb axis deformities. In this procedure, the aim is to realign the limb's mechanical axis and redistribute weight across the knee. When performed correctly, it can postpone the need for joint replacement for several years (Duivenvoorden et al., 2014). Many studies have confirmed the effectiveness of osteotomy. However, its success relies on choosing the right patients and careful preoperative planning (Kutzner et al., 2012).

III. Endoprosthesis of the knee joint

TKA is currently the most effective and commonly used treatment for advanced gonarthrosis. It includes replacing the joint surfaces with a metal-polyethylene prosthesis. TKA is recommended for patients with severe chronic pain and significant disability, for whom conservative treatment failed. It has been shown to improve joint function, with about 80-90% of patients reporting considerable improvements in quality of life (Skou et al., 2018).

The TKA complications include infection, venous thromboembolism, patellar dislocation, and implant loosening. Adverse events occur more often in patients with comorbidities, obesity, or a history of previous knee surgery (Bozic et al., 2014). Regardless of these risks, TKA remains highly effective. Modern knee implants typically last between 15 and 20 years. usually lasts between 15 and 20 years. The most common reasons for revision surgery are mechanical loosening and infection around the implant. Patients who receive implants at a younger age are more likely to require revision later because of longer implant survival and higher functional demands (Evans et al., 2019). Partial knee replacement might be an option for some patients instead of total knee arthroplasty. In unicompartmental knee arthroplasty (UKA), one compartment of the knee is targeted. It is less invasive than TKA and allows for a

shorter recovery and better preservation of joint proprioception. However, it has a higher reoperation rate compared to TKA (David et al., 2020).

Conservative versus surgical treatment of gonarthrosis

The decision between conservative and surgical management of knee osteoarthritis depends on symptom severity, disease stage as shown on imaging, patient age, activity level, and personal expectations. Conservative treatment is primarily used in the early stages of gonarthrosis, while surgery is necessary for patients with advanced degeneration and significant functional loss. Non-surgical options such as structured exercise programs and pharmacotherapy can improve joint function and reduce pain in patients with mild to moderate disease (Juhl et al., 2014).

From a safety viewpoint, conservative treatment carries a lower risk of complications than surgery. After surgery, patients are at risk of developing infection, blood clots, issues with implants, and problems related to anesthesia (Beswick et al., 2012). Therefore, the choice of treatment should involve a careful evaluation of the benefits and risks. Monetary considerations are also important in choosing a treatment plan. Surgical options tend to have greater upfront costs but are financially beneficial in the long run due to reduced need for pain medications and better functional independence and work capacity (Ferket et al., 2017). Conservative treatment is not definitive and is often associated with progressive deterioration of joint function and long-term healthcare costs. Current clinical guidelines point out the necessity for an individualized approach. In younger, active patients with minimal degeneration, conservative therapy or joint-preserving procedures such as osteotomy may yield good results. For patients with severe pain, limb deformity, and a poor quality of life, TKA is the most effective option (Arden et al., 2021). The summarized possible treatments with their indications, advantages, and limitations are presented in Table 2.

Table 2. Comparison of conservative and surgical treatment methods for gonarthrosis

Treatment type	Main indications	Advantages	Limitations / Risks
Lifestyle modification and patient education	Early-stage of the disease, overweight patients	Reduces joint load, improves joint mobility; low cost	Requires long-term patient adherence, limited effectiveness in advanced disease
Pharmacotherapy (paracetamol, NSAIDs, opioids)	Mild to moderate symptoms, pain	Effective pain reduction, easily accessible	Risk of gastrointestinal, cardiovascular adverse effects; addictive risk for opioids
Intra-articular injections (corticosteroids, hyaluronic acid, PRP)	Moderate symptoms, inflammation, insufficient response to pharmacotherapy	Localized therapy, temporary pain relief	Repeated injections may damage cartilage; variable clinical outcomes
Physiotherapy and rehabilitation	All disease stages, especially in early patients	Improvesfunction-muscle strength, joint stability	Requires regular participation; variable clinical outcomes
Orthoses and assistive devices	Unilateral joint overload, gait instability	Reduces mechanical stress, improves mobility	Symptomatic relief only
Arthroscopy	Selected cases with mechanical symptoms	Minimally invasive procedure	Limited effectiveness in isolated osteoarthritis
High tibial osteotomy (HTO)	Young patients with malalignment and medial compartment degeneration	Preserves native joint, delays need for arthroplasty	Requires precise patient selection; long rehabilitation period

Total knee arthroplasty (TKA)	Advanced gonarthrosis, functional disability, failure of conservative treatment	Major improvement in function and quality of life, long-term durability	Surgical risks (infection, thromboembolism, implant loosening)
Unicompartmental knee arthroplasty (UKA)	Isolated compartment degeneration	Less invasive than TKA, faster recovery, better proprioception	Higher revision rates, limited patient eligibility

4. CONCLUSION

Osteoarthritis of the knee is a major medical and social issue. It is chronic, progressive, and often leads to marked mobility limitations and a reduced quality of life. Early diagnosis and suitable treatment are important for inhibiting disease progression and easing pain. Conservative treatment, which incorporates lifestyle changes, medications, physical therapy, and injections into the joint, is the main approach for patients with mild to moderate gonarthrosis. Although the benefits of conservative management are well recognized, they may not be sufficient in more advanced stages of the disease. In these advanced stages, surgical options can improve function and provide long-term pain relief. Recent developments in surgical treatment have made TKA a safe and effective choice. However, it does carry a risk of complications and should only be considered after all non-surgical treatments have been thoroughly tried.

In current research, it is suggested that the best treatment outcomes come from a personalized approach that considers the severity of the disease, the patient's age and activity level, other health conditions, and individual expectations. Patient education and a team-based care approach may improve clinical outcomes and may delay the need for surgery. Despite the available scientific evidence, further high-quality studies are needed to compare the long-term outcomes of different treatment options. This research would enable refining treatment plans and support evidence-based decision-making in everyday clinical practice.

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Authors' Contributions

Aleksandra Bilinska: Conceptualization, literature search, drafting the manuscript, supervision.
Dominika Dmowska: Literature search, data analysis, drafting sections on conservative management.
Rafał Ejsner: Critical revision of the manuscript, methodological guidance, editing.
Mateusz Mierniczek: Literature review, preparation of figures and tables.
Maria Mierniczek: Data verification, drafting sections on surgical management.
Paweł Izdebski: Review and editing, clinical expertise, validation of content.
Ewa Gloc: Formatting, references management, proofreading.
All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

Informed consent

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Ethical approval

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Conflict of interest

The authors declare that they have no conflicts of interest, competing financial interests or personal relationships that could have influenced the work reported in this paper.

Data and materials availability

All data associated with this study will be available based on reasonable request to the corresponding author.

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