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Review Article

Osteoarthritis-Diagnosis, and Management

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Abstract

Introduction: 300 million people throughout the world are affected by osteoarthritis, and it is mostly seen in older individuals decreasing their quality of life due to increased pain and loss of function. The etiology of OA is much more complicated and involves inflammatory and metabolic factors. A thorough understanding of the pathophysiology of the disease has opened doors to various novel treatment approaches which can be more cost-efficient and conservative for the patient.

Aim of the Study: This review article aims at highlighting an overview of and an update on the pathophysiology, diagnosis, and novel treatment approach for Osteoarthritis.

Methodology: This review is a comprehensive research of PUBMED and Google Scholar from the years 1993 - 2020.

Conclusion: In recent times, Osteoarthritis has become a pernicious condition that tends to decrease the quality of life due to the severe pain and deformation in the joints, which inhibits the patient from performing his daily activities. The improved diagnostic modalities have helped to provide a better understanding of the various stages of the disease. A comprehensive treatment plan with a multidisciplinary approach helps in a faster recovery for the patient. More focus should be put on various treatment developments in order to decrease the recovery time and allowing the patient to resume his normal activities sooner.

Keywords: *Osteoarthritis; Obesity; Total Knee Replacement; Acetaminophen*

Introduction

A huge population of the world is affected by Osteoarthritis (OA), and it has been declared endemic throughout the world. 300 million people throughout the world are affected by OA, and it is mostly seen in older individuals decreasing their quality of life due to increased

pain and loss of function [1]. Contrary to the previous belief that OA was caused by simple wear and tear due to damaged biomechanics causing destruction and inflammation of the bone, it is now believed that the etiology of OA is much more complicated and involves inflammatory and metabolic factors. The articular cartilage, which is present at the end of long bones, is smooth cartilage that helps in the transmission of heavy loads and provides a low friction surface for articulation. The cartilage is a very delicate organ and heals very slowly, even in cases of minor injuries. Although the cartilage shows the most evident changes, the entire joint with the synovium, subchondral bone, and joint ligaments are affected. Systemic inflammation, as well as active synovitis, is one of the main factors causing OA; once the cartilage is degraded as a result of inflammation, it causes a foreign body reaction causing defense cell secretion like inflammatory cytokines, synovial angiogenesis, and metalloproteases which causes an immune reaction thereby damaging the cartilage further [2].

Another theory about the pathogenesis of OA is derived from the study conducted by Yusuf., *et al*. in 2010, where they concluded that body weight was a very important risk factor in the development of OA. Obesity may directly or indirectly affect the pathogenesis of OA either as a play of body weight and joint mechanics or systemic factors affecting obesity like leptins or adipokines. Another theory is the aging of cartilage with time caused by damage in DNA, aging of the cartilage matrix, oxidative stress, and genetic death caused by termination in further propagation of chondrocytes [3].

Etiological factors affecting osteoarthritis

The development and progression of Osteoarthritis depend on various factors. These factors can be divided into Modifiable factors like body weight, deficiency of certain vitamins, occupational loading or impact, and Non-Modifiable factors like age, genetic predisposition, gender, etc. The following table 1 enumerates the various risk factors associated with and responsible for Osteoarthritis [4].

Risk Factors associated with osteoarthritis
Age
Occupation
Body Weight
Previous Trauma
The shape of the joint
Sports
Genetic Predisposition

Table 1: *Risk factors associated with osteoarthritis [4].*

Age: Increasing age is one of the greatest risk factors for OA. Patients have shown an increased prevalence of radiographic and clinical symptoms as their age increases. The study conducted by Christopher., *et al*. presented evidence that an increased rate in symptoms of OA was seen in patients older than 60 years, with women showing a further increased rate of 18% as compared to 9.6% in men [5]. Knee, hip and hand OA have shown the maximum prevalence in older age groups. Osteoarthritis study done in Framingham revealed that 27% of people in the age group between 63 to 70 had increased symptoms of OA which further increased to 44% in the age group above 80 [6].

Genetic predisposition: The pathogenesis of OA has shown the involvement of almost 80 genes making OA a polygenetic disease in nature. Single nucleotide polymorphism in the factor 5 gene of growth and differentiation plays a vital role in the development of healthy bone and cartilage. Epigenetic changes in gene sequence are also being reviewed as a possible causal factor for OA [7].

Bodyweight: A very high prevalence of OA is seen in overweight or obese patients. A meta-analysis conducted in 2010 showed that the odds ratio for patients with obesity as compared to non-obese normal weight individuals was 2.96. Endocrine diseases like Diabetes or vitamin C and D deficit and dyslipidemias have also been associated with OA as independent risk factors [7,8].

Occupational hazard: Individuals working at construction sites, farms, forests, armed forces, or any other places where the work involves excessive kneeling, jumping, lifting, etc. are at a higher risk of developing OA in knees and hips. Corporate jobs involving increased usage of computers or smartphones have also shown a higher association with hand OA.

Sportsmen tend to show a higher rate of joint degeneration due to repetitive impact on the joints. Due to the continuous loading and injuries to the knee, it is seen that sportsmen have an 80% chance of developing OA 10-20 years after their injury [9].

Diagnosis of osteoarthritis

The diagnosis of OA starts with reading the patient's symptoms. The most prominent and continuous symptom experienced by patients suffering from OA is pain. In the early stages of OA, the pain is occasional and is triggered by physical activity or impact on the joint. The pain progresses with time, and it becomes difficult to predict the onset and trigger factors. A more constant pain accompanied with daily chores is seen in the later stages, which leads the patients to avoid certain daily activities that aggravate the otherwise dull constant pain [10]. Although pain can be an associating factor, it does not necessarily explain the stage of the disease, as patients with severe pain lack radiological findings, and sometimes patients in advanced radiological stages experience no pain [11]. Another symptom seen in patients with OA is morning stiffness that lasts for about half an hour and increases during the course of the day. Sometimes, swelling around the joint, cramping, clicking and locking, deformation around the joint, and a lowered rate of motion is also seen in patients with OA. Systemic symptoms should also be monitored, and any fluctuation in body temperature, blood test reports, or bodyweight should be followed up in order to rule out chances of malignancy [12].

Clinical findings

The clinical findings seen in OA patients are due to accumulation of synovial fluid, vital inflammation, and deformation in the joints (Table 2). Joints affected by OA in descending order are Knee > hip > phalanges in the fingers > spine > elbow > wrist > shoulder.

Figure 1: *Hallux valgus deformity is seen in osteoarthritis of the metatarsophalangeal joint [13].*

Clinical features of osteoarthritis
Tenderness in the affected joints.
Lowered range of motions
Crepitus, locking, and clicking in the joints.
Swelling in the bones
Deformation around the bones
Heberden and Bouchard nodes
Popliteal cysts present secondary to knee OA
Hallux valgus deformity is seen in the foot (Figure 1)

Table 2: *Clinical features of osteoarthritis [4].*

Radiological findings

Although the diagnosis of OA is mostly made by clinical features, radiographs help in classifying the disease and coming to a confirmed conclusion. Radiographic findings seen are (Figure 2):

1. Narrowing of the joint space
2. Formation of osteophytes
3. Sclerosed synchondrosis
4. Cysts.

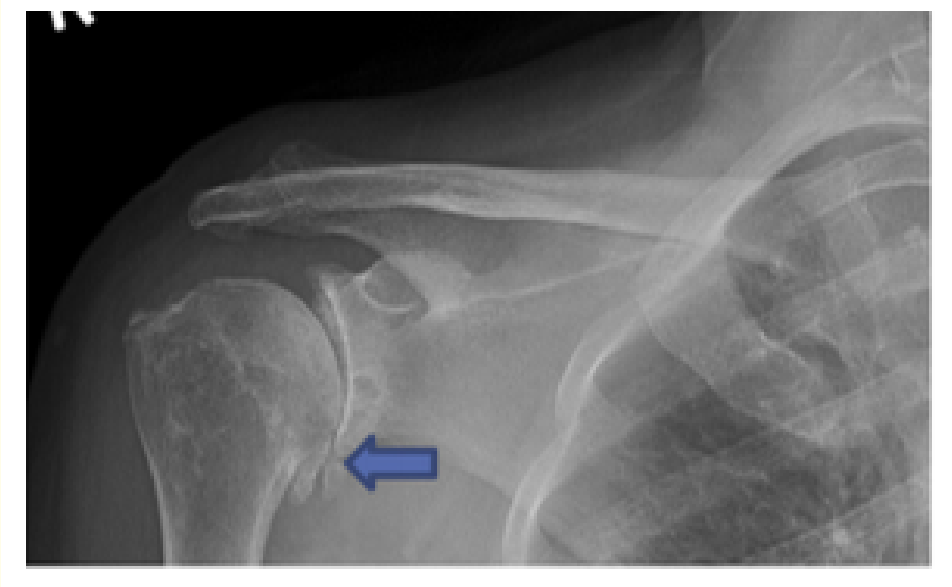

Figure 2: *Shoulder OA radiograph showing narrowed joint space and formation of osteophytes [17].*

Various techniques used are the extended knee radiographs and flexed knee radiographs that evaluate knee joint and intra articular space. Kellgren Lawrence classification system further helps in classifying OA with the help of radiographs by evaluating joint space, bone deformation, subchondral sclerosis, etc [14]. One of the limitations of 2 plane radiographs is their inability to detect any initial stage of damage or degeneration in the articular cartilage. MRIs can help in overcoming this drawback by detecting any partial or full damage to the cartilage; it also detects any changes due to ligament injuries [15] (Figure 3). Ultrasonography is very useful in identifying minor degeneration in cartilage morphology and osteophytes. The major advantage of Ultrasonography is its ability to detect changes in soft tissues like baker's cyst, injuries to the meniscus, and the fact that it can detect the smallest of changes in small joints. The lowered exposure to radiation and the lower cost makes ultrasound a good mode of diagnosis in Osteoarthritis cases [16].

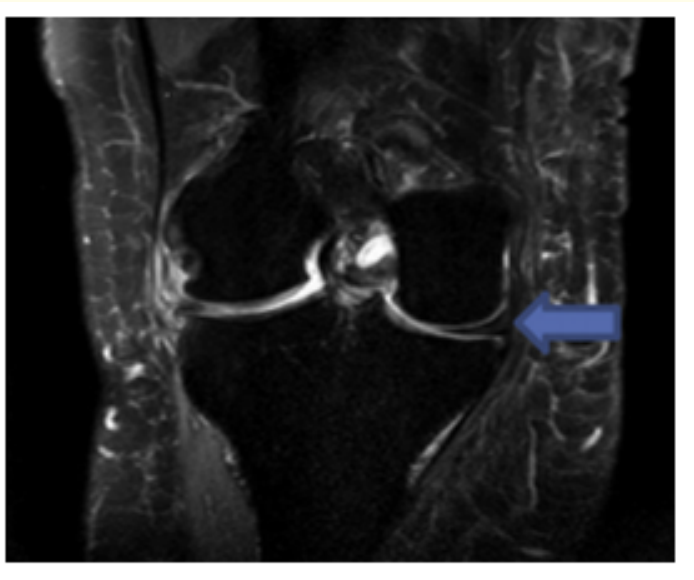

Figure 3: *MRI image of OA showing medial meniscus that cannot be seen in radiographs [17].*

LAB findings in OA cases generally do not show much variation than normal. C-Reactive protein and erythrocyte sedimentation rates tend to elevate, showing autoimmune involvement.

Treatment of osteoarthritis

The treatment for OA is not confined to a particular drug and is a curation of various pharmacological and non-pharmacological treatment options (Table 3). The treatment plan in the early stages of the disease focuses on only reducing the pain so that the daily activities of the patient are not hampered.

Non-Pharmacological Treatment	Pharmacological Treatment
Reducing the Risk Factors	Acetaminophen
Physical modalities	Corticosteroids
TENS	NSAIDs
Ultrasound	Duloxetine
Laser Therapy	

Table 3: *Treatment modalities for osteoarthritis [17].*

The main aspect of the treatment plan is focussing on the reduction of risk factors leading to the disease. A study conducted by Pai., *et al*. concluded that the risk for women suffering from OA due to obesity is reduced by 50% by losing 5 kg weight [18] cartilage and bone also tend to show a considerable amount of improvement by weight loss [19]. Physical exercise also tends to improve the patients' symptoms and quality of life. A meta-analysis conducted on 60 randomized control trials by Uthman., *et al*. concluded that exercise as a treatment modality for OA increases the strength and flexibility of the patients. Physical therapy should be started for the patient under the guidance of a specialist, which includes stretching, strengthening, mobilization of the soft tissues, etc. the presence of a home-based program or specialist guidance helps the patient to be more compliant to the treatment.

Physical Modalities like braces are helpful in various instances like knee braces help in alleviating the symptoms for patients with medial and lateral knee OA. Other modalities used are the lateral and medial wedge insoles and rigid or semi-rigid splints [20].

Other non-pharmacological treatment options

Acupuncture of the knee has proven to be useful as an alternate treatment option for knee OA. Self-management technique also proves to be very useful in the overall improvement of OA patients, as the symptoms and treatment both are in the patient's hands, thereby making him more responsible towards his goal settings, monitoring of the disease, and action planning. Psychological sessions to overcome negative thinking and depression caused by pain should also be monitored, and cognitive behavioral therapy can be taken by the patient [21].

Pharmacological treatment

The first line of drug-related treatment for OA is NSAIDs. NSAIDs have proven to be very effective in alleviating pain in patients with OA. The only disadvantage of NSAIDs is the gastric irritation caused by them, and hence it should always be accompanied by gastroprotective agents [22]. Acetaminophen is safer than NSAIDs as a pain killer in OA patients as it does not have any side effects on the gastrointestinal system. Pain in OA has a central origin, and hence Duloxetine, when administered with NSAIDs, has shown better results [23]. In another Randomized control trial performed by Chapell., *et al*. they concluded that duloxetine, when compared with placebo, had a better outcome in patients with knee OA. Other stronger drugs like opioids, hyaluronic acid, and chondroitin sulfate, etc. have also shown to be effective in the treatment of pain in Oa patients when taken in the right amount. Steroid injections in the intraarticular space have also shown good results [22].

Surgical treatment of osteoarthritis

The gold standard for surgical treatment in OA patients is total joint replacement. It has been found to be a more concrete treatment option as compared to the conservative treatment approaches in the form of Painkillers or physical therapy. The recovery time after a total knee or hip replacement surgery is variable between 6 months to 12 months. During the post-surgical phase, patients are generally kept in a rehabilitation center or with full-time nursing staff at home where the progress can be acutely monitored, and once the post-surgical pain is relieved, patients can be put on physiotherapy in order to regain their muscle strength and a full range of motion. The post-surgical phase includes a complete bed rest for the initial few days with pain control provided by NSAIDs, analgesics, and narcotics in severe pain cases. Typically, a patient needs to stay in the hospital for 2 - 3 days, after which he can be sent home with a full follow-up regime. Complications in the surgery are generally rare but can occur in the form of DVT, swelling, and the body's rejection of the implant that has been placed. Thrombosis in the post-surgical phase is generally avoided by prescribing blood thinners, compression stocking, or early mobilization, which also helps in reducing the duration of the hospital stay. On the day of the surgery, if the patient is mobilized, the chances of early release from the hospital increase [25]. The various precautions that need to be taken during the post-surgical phase greatly depend on the approach of the surgery; in cases of anterior surgical approach in cases of total hip replacement, the precautions to be taken are the

avoidance of external hip rotation, adduction, and hyperextension, similarly, in a posterior surgical approach hyperflexion, abduction and internal hip rotation should be avoided. The post-surgical strengthening exercises should focus on strengthening the quadriceps, which generally decreases by 60% after Total knee replacement; other exercises include gait training and daily activities training like climbing stairs, coordination exercises, etc. With the help of a good rehabilitation program during the post-surgical phase, chances of faster recovery are higher, and patients tend to regain their normal activities sooner. Good coordination should be present between the hospital and rehabilitation program to allow a comprehensive treatment approach for a faster recovery [26].

Recent developments in a treatment option for OA

A better understanding of the pathophysiology of the disease has now opened ways for novel treatment approaches. Drugs like Strontium renalate can be used for its inhibiting effect on subchondral bone resorption. Other benefits of strontium are its increased ability for proteoglycan synthesis, which in turn helps in the formation of the cartilage matrix [26]. Tanezumab is another drug that has proven to be efficient in the treatment of pain caused by OA. Tanezumab works against nerve growth factors that control central pain expressions [27]. Regenerative therapy is also being studied intensely and has given good results; platelet-rich plasma derived from patients' own blood becomes a source of growth factors directly placed in the affected area. Mesenchymal stem cells that are derived from the bone marrow or adipose tissue also help in the rapid proliferation of the cells, and a study has shown massive improvement in patients injected with mesenchymal cells in the knee joint [28]. Radiofrequency ablation treatment for OA involves thermally lesioning the nerves out in order to decrease the pain. This mode of treatment is not supported by many studies, and more research needs to be done to consider it as a treatment modality for OA [29].

Conclusion

In recent times, Osteoarthritis has become a pernicious condition that tends to decrease the quality of life due to the severe pain and deformation in the joints, which inhibits the patient from performing his daily activities. The improved diagnostic modalities have helped to provide a better understanding of the various stages of the disease. A thorough understanding of the pathophysiology of the disease has opened doors to various novel treatment approaches which can be more cost-efficient and conservative for the patient. A comprehensive treatment plan with a multidisciplinary approach helps in a faster recovery for the patient. More focus should be put on various treatment developments in order to decrease the recovery time and allowing the patient to resume his normal activities sooner.

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