



OSTEOARTHRITIS: PATHOPHYSIOLOGY, DIAGNOSE, MANAGEMENT AN OVERVIEW

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Abstract

Osteoarthritis is one of the most prevalent disorders in the world. It is characterized as deterioration of articular cartilage, intraarticular inflammation, change in Periarticular and subchondral bone. The prevalence of osteoarthritis in India is 27-28 %. Osteoarthritis involves many joints hip joint, knee joint, spine facet joint, interphalangeal joints, CMC joints. Alteration in chondrocytes and Extracellular matrix homeostasis mechanism, cartilage destruction, activation of inflammatory mediators, Interleukins, metalloproteinase, collagenase. Some genes are also involved. Assessment of Osteoarthritis is done by assessing pain in joints, age, narrow joint space, radiographic imaging. Various drugs to be used for the treatment of degenerative joint disease include NSAIDs, opioids, acetaminophen. Apart from corticosteroid injections, serotonin reuptake inhibitors, some dietary supplements are also used

Keywords: Osteoarthritis, Pathophysiology, Genes, Diagnose criteria, Management.

Introduction

Osteoarthritis is a prevalent joint disorder within the world. (1) Osteoarthritis is described by the deterioration of the articular cartilage, limited intraarticular inflammation with synovitis, and change in the peri-articular and subchondral bone. (2) Joints affected are Hip joint, knee joints, Spine ankle, foot, knee (tibiofemoral joint), ankle (tibiotalar joint), DIP(distal interphalangeal), proximal interphalangeal, CMC(carpometacarpal metatarsophalangeal)1 st Cuneo-metatarsal. (3) Osteoarthritis of the knee is most common and frequency grows in rate with the age in both gender but it is more prone in women following the last fourth decade (4). Osteoarthritis may be a primary condition that occurs spontaneously or secondary as a consequence of trauma, surgery, infection, or another disease process. (5) Osteoarthritis is thought to be caused by manual stress on the joint and low-grade inflammatory processes. (6) The disease occurs when the dynamic equilibrium between the breakdown and rebuilding of joint tissues becomes unbalanced. (7) Osteoarthritis (OA) is an unknown cause disorder characterized by a deterioration of articular cartilage. A breakdown of the cartilage matrix results in the event of fibrillation and fissures, the looks of gross ulcerations, and therefore the complete thickness surface of the joint. This is explained by changes in bone with osteophyte formation and thickening of the subchondral plate.

(8) Moreover, at the clinical stage of the disease, changes caused by Osteoarthritis involve not only the cartilage but also the synovial membrane, where an inflammatory reaction is often observed. (9) Various drugs to be used for the treatment of degenerative joint disease include NSAIDs, opioids, acetaminophen. Apart from corticosteroid injections, serotonin reuptake inhibitors, some dietary supplements are also used. As these medicines are primarily used so these drugs require some great inspection in clinical use to reduce the probabilities of their adverse results. (10)

Prevalence ; In India incidence rates are 10.2% and prevalence of osteoarthritis is 27-28% mostly in big cities about 33% ,in villages (31%),Small cities and towns (17%).[11]prevalence rate in Africa is 5.5%to 36% ,In East Asia 2.96-56.99%,In south Asia 1.4-83%.The overall prevalence rate in Asia is about 20-68% the most prevalent type of osteoarthritis is knee arthritis Is about 13.1-71% .[12]

PATHOPHYSIOLOGY OF OSTEOARTHRITIS

Knee osteoarthritis Knee acts as the largest synovial joint. It consists of hyaline, meniscus cartilage, ligament, synovial membrane. Synovial fluid provides lubrication and nutrients .alteration in synovial fluid or decrease in fluid leads to high stress to the joint. It is characterized as a degenerative disease of cartilage. Articular cartilage is the thin layer covering the joint surface. It does not have any nervous system or blood vessels. It decreases the friction between joints for the proper functioning of joints. It properly maintains the cartilage matrix consist of chondrocytes cells. Which maintain the proteoglycans and collagen fibers [13]

Chondrocytes and extracellular matrix help in the regulation of cartilage homeostasis mechanism and also help in repairing mechanism. Alteration in the chondrocytes mechanism is due to aging, any injury, or some genetic predisposition. Chondrocytes metabolism processes involved both synthetic and degradation processes. Throughout life, there is continuous remodeling in chondrocytes' metabolism processes. During the period of growth, the synthesis process is more than degradation after that matrix synthesis is less followed by a controlled degradation process. Imbalance in chondrocytes homeostasis mechanism may increase the secretion of many Extracellular matrix molecules and liberation of more enzymes responsible for degeneration such as collagenase, stromelysin, metalloproteinase. When the cartilage is going through some repetitive mechanical forces and biological processes there is some functional impairment such as the proliferation of chondrocytes, proteoglycans stimulation and then production of collagen fibers mostly type II.[14]

Cartilage does not produce pain or inflammation by itself due to a lack of vessels. Proteoglycans produce elastic strength to the joint. Slowly proteolytic degradation of the cartilage matrix or modified matrix synthesis by chondrocytes cells results in a decrease in cartilage volume is responsible for OA. Not only cartilage is involved there are multiple causes like mechanical forces, biochemical reaction, trauma, but inflammations also involve. Not only cartilage but other non-cartilaginous tissues are involved such as subchondral bone, synovial membrane capsule, muscles of Pariarticular. In the advanced stage mostly changes that occur are Synovitis, remodeling of bone, Para articular muscle weakness, effusion of the synovial cavity.[15]

Many inflammatory mediators are present in synovial fluid which cause inflammation and activate proteolytic enzymes which are responsible for the degradation of the cartilage matrix. These mediators are C reactive proteins, Cytokines (IL 6, IL21,IL 18 ,IL 17 ,IL 15 ,TNF,) nitric oxide. These activate the metalloproteinase and hydrolytic enzymes cyclooxygenase, prostaglandin E which causes braking of cartilage.[16]

Osteoarthritis (OA) of the spine involves the facet joints, Spinal arthritis. Osteoarthritis of the spinal involves the destruction of the facet joint. It involves the complete joint cartilage, ligaments, subchondral bone, capsule, Periarticular paraspinal muscles, synovium, soft tissue. The facet joint is a helping component in the spinal motion segment. Facet joint osteoarthritis mostly involved 1-5, 7-11 degenerative discs.[17 In the progression of disease mostly load distributions and alignments are important factors. About 33% load is carried by healthy facet joint but in case of disc degeneration load is increasing to 70% .due to increasing load bone density increase which leads to the formation of osteophytes, cartilage necrosis, synovial hypertrophy, fibrillation, ulceration, eburnation, bony overgrowth .this will continuously lead towards spinal stenosis. Prostaglandin and other inflammatory mediators produce inflammation in the facet joint and increase entrance of macrophages, Neutrophil cells which leads to venous congestion and sensitize the Nociceptor and after a long time it will turn into chronic pain. Pain

associated with FJ OA is involved many factors. It also does not have any nervous system .pain is arisen from the Nociceptors present in bones and in surrounding tissue[18,19]

Genes involved: polymorphism in IL-6 gene, variation in SMAD3 gene, TGF beta.single-nucleotide polymorphisms (SNPs) within the Protease-activated receptor-2 (PAR-2) gene was associated with risk of knee OA[20]

Diagnosis

Assessment of Osteoarthritis is done by assessing pain in joints, age, narrow joint space, radiographic imaging. (21)mi RNA is also identified as a marker of disease. In early osteoarthritis stages patients, miRNA 155 expression is observed but in the later stage of osteoarthritis miRNA -146 is highly expressed.22)

Radiography plays a vital role in the diagnose of OA. By radiography observed a joint space narrowing, cartilage loss. In radiography bone structured is appeared white to light grey [23]

Magnetic resonance imaging is used to distinguish between osteonecrosis osteoarthritis, and rapid progression of osteoarthritis early in the disease stage.[24]

Diagnostic criteria of hip OA: Early diagnosis consist of hip pain, radiography shows narrow joint space or osteophytes. Some additional investigation include age [25]

Age <_ 50	Investigate dysplasia,labrum		Present - seek expert opinion	
Age > 70	Primary care management			
Age 50-70	Joint pain of abnormal intensity pain		RDC (rapidly destructive coxarthrosis.)	
	No abnormal pain	Check for morphological anomalies	If present Seek for expert opinion	If not present then primary care management

Diagnostic algorithm of hand/finger OA in primary care

Early diagnostic criteria for finger/hand OA is pain in finger/hand, osteophytes found in radiography involving joint space narrowing or without narrowing, and family history of hand finger OA and additional investigation are age: Age less than 50 years non- menopausal women seek for expert opinion. In case of age above 50 years check the criteria for swelling, joint pain in a metacarpophalangeal joint, Psoriasis if persistent pain occurs then refer for expert opinion. In the case of absence of this diagnose the patient clinically for deformity site. The osteoarthritis of the interphalangeal bone must be differentiated from osteoarthritis of thumb .also examine the number of joints affected. [26]

Diagnose of spine arthritis

The main diagnoses Criteria involved complete history and physical exams history involves the symptoms such as pain, stiffness, and motion restriction. The area of pain depends upon the joint involved in the case of cervical facet joints refer to pain is in the region of the scapular and shoulder. Sometimes posterior head and chest pain. In case of nerve compression numbness and tingling are also involved Lumber spine osteoarthritis involved radiating pain in the buttocks and thigh region if the pain radiating below-knee also is due to nerve compression. Localized and unilateral pain arises due to degenerative osteoarthritis. [19]Physical exams involved examination of the area and palpation of the joint. When the palpation of facet joint the pain is reproducible but relieved during

Flexation..radiological findings MRI, CT scan used for evaluation of neoplasms, disc herniation, and spinal stenosis[27]

TREATMENT

The main goal behind the management of osteoarthritis is to decrease the pain, symptoms, and disability and also educate the patient related to disease, Therapy. [28] Osteoarthritis management is patient-oriented depends upon the modifiable risk factors and types of comorbidity. Non-therapeutic treatment involves a particular type of exercise, in case of obesity reduced weight.[29]There are more studies on the growth factors. These are responsible for the enhancement of matrix synthesis. Efficacy of growth factors depend upon increase chondrogenic cell, stimulate and proliferation of cartilage synthesis [30]

Exercise has been a focal segment of any work to minimize Osteoarthritis progression. Activities can be endorsed to work with weight reduction, safeguard joint scope of movement, further develop strength, work on useful execution, and lessen manifestations. People with Osteoarthritis fit for practice have been prescribed to be urged to participate in a low-sway vigorous exercise program (strolling, trekking, swimming, or another amphibian exercise).[31]

pharmacological management of osteoarthritis involves Simple analgesics, NSAIDs, Intra-articular therapies (corticosteroids, hyaluronic acid), Supplements or alternative therapy, Symptomatic slow-acting drugs in osteoarthritis (SYSADOAs), Disease modification therapy. Non-steroidal anti-inflammatory drugs (NSAIDs) are the first-line pharmacologic treatment for osteoarthritis.[32] Duloxetine is approved by FDA for the treatment of neuropathy is also a better response for controlling pain and improvement of functions inpatient with OA.[33] Intraarticular injections of steroids are used for the management of acute exacerbation of pain with or without effusion. Intraarticular injections which are approved by FDA for osteoarthritis are Methyl prednisolone, Triamcinolone Hexacetonide (TH), Triamcinolone Acetate (TA), Betamethasone Acetate (BA)Betamethasone Sodium Phosphate (BSP), and Dexamethasone .excessive use of intraarticular injection more than two times in year leads to tendon rupture and steroid arthropathy. [34,35]

The new category which is used for the treatment of osteoarthritis is SYSADOA (symptomatic slow-acting drugs for osteoarthritis) it includes chondroitin sulfate, glucosamine sulfate, diacerein, hyaluronic acid. Chondroitin sulfate and glucosamine sulfate are taken orally to decrease the pain in knee osteoarthritis and improve functions. Hyaluronic acid is a glycosaminoglycan synthesized naturally by chondrocytes, type B synovial cells.it acts as a shock-absorbing and lubricant also having antioxidant and anti-inflammatory properties. so it is used to restore the HA in joints for benefit. Intraarticular injection of HA decreases the progression of OA.[36]

There are also some new pharmacological targets neutralization of some inflammatory targets such as IL-I, TNF alpha. It has been shown that IL- I receptor antagonists decline the transcription of a metalloprotease in the model of rabbit another potential approach is to stimulate chondrocyte biosynthesis pathways by using an agent like TGF-beta, insulin like growth factor I. [37]

The surgical intervention involved are osteotomy (removing painful osteophytes mostly used in mild cases, abrasion arthroplasty (stripping the damaged cartilage), Total joint replacement Arthroscopic techniques which involved lavage, and debridement of the knee., arthroscopy is used to remove the debris and inflammatory cytokines that cause synovitis.[38]

Discussion:

Osteoarthritis has become a public concern day by day. Osteoarthritis is an increasingly important public health. OA is one of the most prevalent disorders of rheumatic disease. In Asian countries, it is the leading cause of disability. Mostly impact on the knee. The prevalence of OA increases with an increase in age but nowadays early ages are also involved due to lifestyle. There are many studies regarding the pathogenesis of disease for progression but more studies are required for an early stage of disease for better prevention strategies. As its prevalence increased day by day with a large impact on quality of life its primary management is required. Specific education programs are more required according to the person's disability, functional capacity. More

novel therapeutic strategies are required. the new categorize of drugs that have a promising effect are developed and established in treatment recommendations.

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