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A Review on Osteoarthritis

Ayasha Saiffi*, Yatendra Kumar, Rashid Khan, Shekhar P. Kushwaha, Prabhu Dayal Rajan
Department of Pharmacology, R.V. Northland Institute, G.B.Nagar, Dadri, Uttar Pradesh India-203207
***Corresponding author: E-Mail: ayashasaiffi@gmail.com, Mobile No: 9599469022**

ABSTRACT

Osteoarthritis (OA) is a wear and tear disease which include loss of cartilage. OA is an inflammatory disease of synovium. It is a chronic musculoskeletal disease. Inflammatory mediators such as cytokines and chemokines play a vital role in the progression of disease. OA is a condition which considered pain, disability and loss of function. It is functional as well as structural failure of synovial joints. It is considered as degenerative joint disorder. The major risk factor includes gender, age and obesity. Osteoarthritis is treat by the multidisciplinary approach. This review include epidemiology, pathophysiology and current concept of treatment. The nonpharmacological approaches such as exercise and weight loss are helpful in reducing the symptoms of osteoarthritis.

KEY WORDS: Osteoarthritis, Synovitis, Hyaluronic acid and cytokines.

1. INTRODUCTION

The disorder which affect joint is called as arthritis. Arthritis is a term used for inflammation of joints, which cause pain and stiffness. It can worsen with age. The causes depend on the type of arthritis. The causes of arthritis involve misdirected immune system (in RA and systemic lupus erythematosus), metabolic abnormalities (In gout and pseudo gout), hereditary factors and injury (leading to osteoarthritis).

Osteoarthritis: Osteoarthritis is the most popular type of arthritis (Wieland, 2005). It is a degenerative disease due to excessive mechanical load on joints (Pedro Morouco, 2019). The joints which bear the most of the weight of body is affected by osteoarthritis such as hip, knee, vertebra and hand (Melainie Cameron Sigrun Chrubasik, 2013), it is a disease of cartilage in which interleukin play an important role. Interleukin induce synovial cell to synthesize MMPs. MMPs (Matrix metallo proteinases) are the primary enzymes responsible for the degradation of articular cartilage (Berenbaum, 2013). Female gender, Age and Obesity are the main risk factor for OA (Rouhin Sen, 2018).

Epidemiology: It is the commonest cause of disability including 30.8 million cases (Cisternas, 2015). OA is the fifth leading cause of disability worldwide (Murray, 2012). About 3.3% to 3.6% of world population is affected by OA. In US, OA economically stand on second position where people spend $80 billion with 1 million hospitalizations for OA according to the survey in 2014. It was estimated that prevalence rate reach upto 25% till 2030 (Bove, 2003).

Symptoms: Symptoms of RA include (Hootman, 2006), Pain, Stiffness, Swelling, Degradation of articular cartilage, Synovitis.

Pathophysiology (Mobasheri, 2016): Cytokines and nitric oxide play an important role in the cartilage destruction. Cytokines target chondrocytes and syniviocytes to enhance the activity of degradative enzyme and suppress the synthesis of collagen. Cartilage injury leads to the damage of collagen matrix, cause chondrocytes to proliferate and produce clusters. Hypertrophic chondrocyte promote cartilage outgrowths which form osteophytes. Chondrocytes undergo apoptosis because of damaged collagen matrix. Improperly mineralized collagen leads to bone thickening (Mary, 2011).

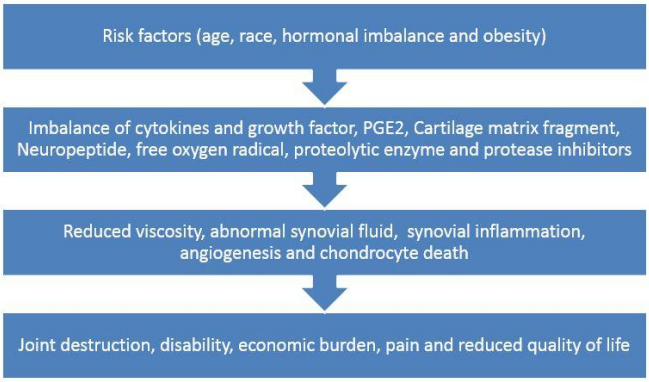

Figure.1. Pathophysiology of Osteoarthritis

Diagnosis: In the synovial fluid, WBC count should be <2000/uL for the diagnosis of OA. The affected joint show cysts, marginal osteophytes and subchondral sclerosis in X-Ray (Rouhin Sen, 2018).

Biomarkers in Osteoarthritis: Generally biomarkers are endogenous molecule that show the particular pathological process.

S.No.	Biomarker	Disease Process	Source
1.	Collagen II c-telopeptides (CTX-II)	Cartilage Degradation	Urine
2.	Collagen II collagenase generated cleavage products (C2C, C1, 2C)	Cartilage Degradation	Urine, serum, synovial fluid
3.	Collagen II propeptides	Collagen II Synthesis	Serum, synovial fluid
4.	Cartilage oligomeric matrix protein (COMP)	Cartilage Turnover	Serum, Synovial fluid
5.	C-reactive protein	Synovitis	Serum
6.	Hyaluronan	Synovitis	Serum, synovial fluid
7.	Osteocalcin, bone sialoprotein	Bone remodeling	Serum

Herbal Treatments in Osteoarthritis:

***Withania somnifera*:** Withanolides is the active chemical constituent of *withania sonifera*, used in the treatment of osteoarthritis to suppress oxidative stress and inflammation. It suppress the proinflammatory cytokinine including TNF-α and IL-6. Begum et al first time evaluate the therapeutic activity of *withania somnifera* in arthritis.

Curcuma longa: The active constituent of curcuma longa is curcumin, which is yellow coloured phenolic compound. In Ayurveda, curcumin is documented as anti-inflammatory agent**.** Curcumin inhibit the upregulation of MMPs, which is responsible for the degradation of articular cartilage. It also inhibit the proliferation of synoiocyte and expression of TNFα. The expression of COX and PGE-2 is suppressed by curcumin in chondrocytes.

Vitis vinifera: Resveratrol is the active constituent of vitis vinifera. It suppress the inflammatory mediator such as COX, LOX and interleukins.

***Capsicum* extract gel:** Dried fruit is used in semisolid or liquid formulations.

Cimicifuga racemose: It contain fukinolic acids, caffeic, isoflavone formononetin, isoferulic and salicylic acid, which shows its effect centrally. It alter the serotonin pathway.

***Elaeagnus angustifolia* L**. - It contain several types of flavanoids such as catechin, luteolin, epicatechin, quercetin, gallocatechin, epigallocatechin, isorhamnetin-3-*0*-β-D-galactopyranoside kaempferol and isorhamnetin. Flavanoids and terpenoids are the main components which exerts anti-inflammatory activity. They inhibit COX-1 and COX-2

Mentha piperita: **S**everal drops of essential oil of flowering top are rubbed in the skin dilution in liquid formulation.

Symphytum officinale: Roots are used in ointment with 4. 7% allantoin.

Urtica dioica Urtica urens: Fresh herbs or leaves are used.

Nutritional Support of OA: Several nutritional supplements such as niacinamide, glucosamine sulphate and chondroitin sulfate are used in the preventation and treatment of osteoarthritis.

Glucosamine Sulphate: It is a building block of body tissues which play a role in the formation of glycosaminoglycans, collagen and proteoglycans by activating chondrocytes (Frederick, 2000). Glucosamine synthesize hyaluronic acid which is a chief component of synovial fluid (McCarty, 1998).

Chondroitin Sulfate: It is a polysaccharide component of bone cartilage and tendon. It act on degradative enzymes that destroy the cartilage matrix (Ronca, 1998).

Vitamin E: Vitamin E is a fat soluble antioxidant which alleviate the indication of OA by minimizing degradation of cartilage matrix due to free radicals (Tiku, 2000).

Vitamin C: Ascorbic acid play a role in formation of collagen which is an essential constituent of joint cartilage (Schwarz, 1987).

Niacinamide and N-acetyl cysteine:

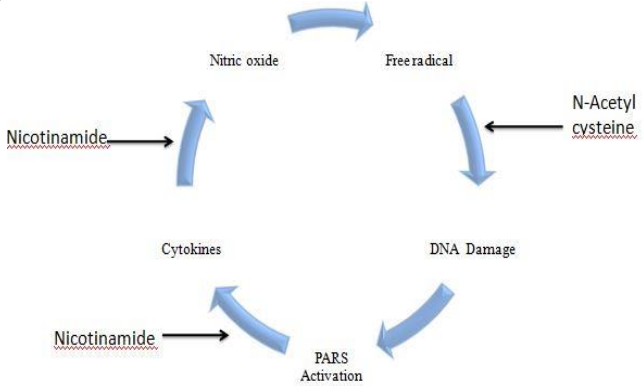

Figure.2. Inhibition of poly (ADP-ribose) synthetase by Niacinamide and N-acetyl cysteine

Treatments/Managements:

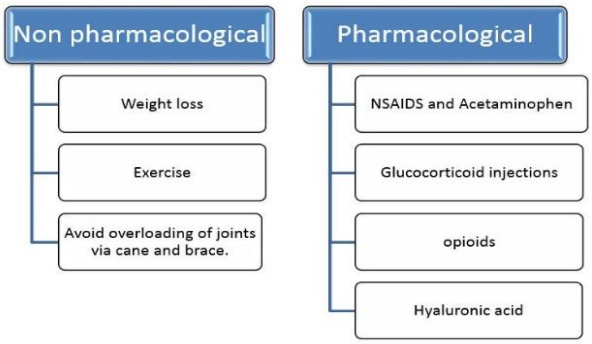

Figure.3. Treatment and Management of Osteoarthritis

Recent Advances in Treatment of OA (Wehling, 2017):

Intra-articular treatment:

Corticosteroids: Intra Articular corticosteroids have been widely employed in the treatment of OA, to reduce joint pain and inflammation. A Cochrane review in 2009 of Intra-articular Corticosteroids for Osteoarthritis conclude that Intra-articular Corticosteroids were more effective in reducing pain as compared to placebo with few side effects. At higher dose and long term treatment of Intra-articular Corticosteroids show chondrotoxicity.

Hyaluronic acid: Intra-articular *Hyaluronic acid* act by lubricating synovial fluid. IA injection of *Hyaluronic acid* increase proliferation of chondrocyte and decrease apoptosis of chondrocyte, which decelerates progressive joint space narrowing in osteoarthritis.

Autologous blood product therapies: The two main types of Intra-articular autologous blood therapies are given as follows: platelet-rich plasma (PRP) autologous conditioned serum (ACS). IA therapy of plasma coagulates induce activation of platelets, which undergo degranulation and release growth factors such as TGF-β, PDGF, fibroblast growth factor and insulin-like growth factor. They promote healing of soft tissue and bone which activates various signaling pathways.

Mesenchymal stem cells: IA therapy of MSCs enhance regeneration of ruptured joint tissue and local repair, and reduce pain and inflammation.

Models of Osteoarthritis:

Chemically induce OA: Osteoarthritis is induced by the use of various chemical such as collagenases, monosodium iodoacetate (MIA) and papain. MIA induce osteoarthritis by death of chondrocytes, Papain destroy proteoglycans of cartilage matrix to induce OA and collagenase enzymatically modify the composition of collagen. These chemicals induce osteoarthritis by destroying the joints via different mechanisms (Pond, 1973).

Surgically induced OA: ACLT (anterior cruciate ligament transection model) and DMM (destabilized medial meniscus) are the most widely used model for the induction of osteoarthritis. These model exactly represent the event of injury that leads to joint degradation (Christiansen, 2012).

Mechanically induced OA: In this model mechanical force alter the kinetics of joints. These models are used to produce traumatic injury invasively. These models are produced by applying compression load until the ACL destroy, which will cause instability of joints (Derek, 2016).

2. CONCLUSION

Osteoarthritis is a well-established major health problem worldwide. This paper provide current concept for treatment of osteoarthritis. The current problem is to deal with identification of patient by knowledge of epidemiology, pathophysiology and diagnosis. This review provide the extensive knowledge of osteoarthritis.

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