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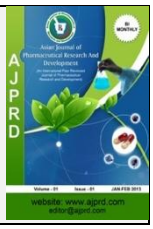

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Review Article

Areview on Rheumatoid Arthiritis

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A B S T R A C T

Abstract:

Rheumatoid arthritis is a persistent, painful inflammatory condition characterized by serious destruction of the bone marrow and cartilage in the joints. It can also affect the body as a whole, including the tissues, leading to disorders of the heart, lungs, nervous system, and eyes. It is an extremely painful inflammatory condition that significantly limits movement due to pain and joint deterioration. Systemic disease rheumatoid arthritis usually affects tissues that constrict. Age, race, inheritance, aberrant immunological functioning, and stress are risk factors. Early rheumatoid arthritis appears to have a unique cytokine profile for the production of interleukin-4, 13, and 15,52, which later show in chronic rheumatoid arthritis. The main objectives of rheumatoid arthritis treatment are to minimize pain and stop or slow the disease's progression. Therefore, early disease detection and correct diagnosis and treatment are crucial. Low-dose GCs combined with Awards are a safe and effective therapy choice for radiographic progression, symptom reduction, and high rates of clinical remission.

Keywords: Rheumatoid arthritis, autoimmune disease, chronotherapy, DMARDs.

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INTRODUCTION

Rheumatoid arthritis (RA) is a symmetrical, chronic inflammatory autoimmune disease that first affects tiny joints before spreading to larger joints. Joint destruction leads to deformities and bone degradation, both of which are typically excruciatingly painful [(1)]. Synovial inflammation and hyperplasia (swelling), the production of autoantibodies (rheumatoid factor and anti-citrullinated protein antibody [ACPA]), the destruction of cartilage and bone (deformity), and systemic features, such as cardiovascular, pulmonary, psychological, and skeletal disorders are the main characteristics of rheumatoid arthritis[(2)]. Disease-modifying antirheumatic medications (DMARDs) are currently employed to suppress immunological abnormalities and to reduce disease activity, even though palliative therapy with glucocorticoids and anti-inflammatory medicines has been used [(3)]. Glucocorticoids and disease-modifying antirheumatic medications have been used in chronotherapy, which is based on the 24-hour cycle of rheumatoid arthritis. Modified-release prednisone tablets were given to rheumatoid arthritis patients at night in a prior trial, which showed that the intensity of morning stiffness was significantly less than that in patients receiving the conventional medication. Methotrexate and

hydroxychloroquine are two examples of disease-modifying anti-rheumatic medications (DMARDs) that can be used to slow the progression of the illness. When conventional therapies don't work, biological DMARDs may be utilised[4].

Types of Rheumatoid Arthritis:

SEROPOSITIVE and SERONEGATIVE (RA) are the two primary forms of rheumatoid arthritis (RA), with juvenile RA being an additional type that only affects children.

Seropositive

Seropositive rheumatoid arthritis patients have anti-cyclic citrullinated peptides (anti-CCPs) in their blood. Antibodies against citrullinated proteins are also called anti-citrullinated protein antibodies (ACPAs). Antibodies that attack the body and cause rheumatoid arthritis symptoms are known as autoantibodies. Anti-CCPs are found in 60 to 80 percent of rheumatoid arthritis patients, indicating that they are a reliable diagnostic marker. These antibodies are not present in seronegative RA patients, yet they fully involve symptoms [5].

Seropositive RA Symptoms

Patients with RA, both seropositive and seronegative, have a unique collection of symptoms that appear and disappear entirely. The symptoms of RA include swelling and pain in various joints, particularly those of the hands and feet. Stiffness that lasts about 45 minutes in the morning, degeneration of cartilage and bone (determined by X-rays), solid lumps form under the skin near the joints (rheumatoid nodules) RA symptoms are comparable to those of other illnesses in certain ways, including:

a) A low-grade fever

b) Repeated illnesses

c) Constant exhaustion

d) Despondency

e) Aplastic anaemia

f) Ocular inflammation

g) Excessive dryness of the mouth and eyes

Your blood will be tested for anti-CCPs and rheumatoid factors. If the test is positive, you have a 70% to 80% chance of being diagnosed with RA.

Medication

The most commonly prescribed medication for seropositive RA is disease-modifying antirheumatic medication (DMARD) therapy. This class of drugs can help slow the progression of RA and prevent further joint damage. Many individuals are familiar with methotrexate, a DMARD. Pain and swelling can also be relieved using nonsteroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen. Prednisone and other steroid medicines can help manage severe inflammatory flares, but they should be constantly monitored and tapered to the lowest dose possible before being withdrawn after the flares have subsided[6].

Seronegative

Seronegative RA is characterised as RA in which anti-cyclic citrullinated peptide (anti-CCP) antibodies are not present. In people with seronegative RA, other antibodies may be present, or tests may reveal no antibodies at all. They may, however, develop antibodies later in life. The doctor's diagnosis will be altered to seropositive RA if this occurs. Rheumatoid Arthritis that is seronegative is far less common than Rheumatoid Arthritis that is seropositive.

Signs and symptoms

The symptoms of seropositive and seronegative RA are similar. Joint tenderness, swelling, redness

Morning stiffness is especially evident in the hands, knees, ankles, hips, and elbows. In the early stages of the disease, these symptoms commonly affect the hands and feet. However, over age, they may cause damage to other joints.

Medication

Disease-modifying antirheumatic drugs (DMARDs) and targeted therapy can help to halt the progression of the disease. DMARDs can assist in slowing the course of RA by modifying the ability of the immune system a DMARD such as methotrexate. DMARDs do not cure pain, but they can help reduce symptoms and protect joints by lowering inflammation, which can cause joint tissue to degenerate over time in people with RA. DMARDs can take up to 2 months to take effect. If DMARDs are ineffective, a doctor may recommend targeted therapy, which includes medications that weaken the immune system in a variety of ways. Tofacitinib, a medicine that targets specific immune system cells, is an example of this type of medication[7].

Juvenile rheumatoid arthritis (JIA) is a type of rheumatoid arthritis that affects children.

Rheumatoid arthritis in children causes considerable joint swelling. It usually starts before a person reaches the age of sixteen. Children, even infants, can experience symptoms**.**

Symptoms

The signs and symptoms of JIA differ depending on the subtype. However, the following are the most common indications and symptoms**:**

- Unexplained fatigue**.**
- Fever or rash
- Stiff joints
- Swelling or redness

Therapy

A range of therapeutic approaches can help with JIA symptoms. Some of them are as follows: Changes in lifestyle can help reduce flare-ups by getting enough exercise and maintaining a healthy weight. Some teenagers find that adhering to certain diets or avoiding certain foods improves their mood. While pain medications such as nonsteroidal anti-inflammatory drugs (NSAIDs) can help with joint pain and inflammation, they shouldn't be used as the only treatment option. Corticosteroids, which include triamcinolone hexacetonide, are prescription drugs that can help with pain and inflammation. Doctors may not recommend using these steroids because of the risk of side effects such as growth suppression, weight gain, osteopenia, and cataracts. Biologic drugs reduce the body's inflammatory response, which helps to decrease pain and inflammation. Doctors are increasingly prescribing them early in the course of the disease, and they're frequently used in conjunction with a disease-modifying antirheumatic drug (DMARD). Physical and occupational therapy can help children learn to move in ways that are not harmful to their joints[8]

PATHOGENESIS OF RHEUMATOID ARTHRITIS:

Autoimmunity and immune complexes in the joints and other organs are the first signs of RA. Swelling and inflammation cause immune cells to invade the synovial membrane, which is where the infection begins. The three stages of RA progression are an initiation phase caused by non-specific inflammation, an amplification phase caused by T-cell activation, and a chronic inflammation phase mediated by the cytokines IL-I, TNF-alpha, and IL-6 (4). Systemic and local inflammation degrade smaller and medium-sized joints in patients with RA. At distinct positions in the progression of RA, several autoimmune and inflammatory processes are activated [9]. Both inherited and environmental factors play a role in the initiation of an immune response to the synovium as well as the specific triggers and mechanisms of tissue death in RA. Genetic variations of the mononuclear complex (MHC) II have been related to an increased risk of RA in several ethnic groups. MHC II encodes human leukocyte antigens (HLAs), and HLA-DR1, HLA-DR4, HLA-DR6, and HLA-DR10 are among the HLAs linked to an increased risk of RA. The antigen that triggers the immune system to overreact in RA when it is combined with specific MHC genetic markers has remained a mystery. Infections and environmental factors (such as cigarettes) have been proposed as potential triggers [10]. There are two basic categories of RA based on the presence or absence of anti-citrullinated protein antibodies (ACPAs). Citrullination is a post-translational mutation that occurs when a positively charged arginine is converted to a polar but neutral citrulline by the calcium-dependent enzyme peptidyl arginine-deiminase (PAD). ACPAs are found in approximately 67 percent of RA patients and can be used as both a diagnostic reference for patients with early, undifferentiated arthritis and a predictor of disease progression to RA.The ACPA-positive subset of RA has a more aggressive clinical profile when compared to the ACPA-negative subset [11]

RHEUMATOID ARTHRITIS STAGES:

Early detection and management to reduce inflammation are critical in RA, given the potential for effective destruction of joint and other tissue, as well as impairment of function. X-rays can detect some degree of joint erosion in the hands and feet of the majority of RA patients (70 percent) within the first two years of the disease, despite the fact that the disease's progression and the pattern of inflammation vary from patient to patient. There are four primary stages that can occur over time. Stage 1 (early RA), stage 2 (middle RA), stage 3 (late RA), and stage 4 (late RA) are the four stages of RA.

Stage 1: (Initial Stage)

In the early stages of rheumatism, the synovium (joint lining) becomes inflamed. There hasn't been any cracking of bones yet. The tissue that contains them, on the other hand, frequently swells, making your joints stiff and unpleasant [12]. Early on the progression of RA, joint damage is uncommon, a clinician should recognise and treat early symptoms of RA within 12 weeks after beginning. Methotrexate, a chemotherapeutic drug that alters the immune system's response, is generally one of the first treatments prescribed to someone with RA[13].

Stage 2: Moderate (Antibodies develop, swell, and worsen)

RA frequently develops into the second stage before it is diagnosed. "Antibodies are produced by the body during the stage 2, and the joints begin to bulge. Other organ systems, such as the lungs, eyes, a skin rash, and even the heart, might become inflamed." Rheumatoid nodules, or lumps, can also appear on the elbows. According to the X-rays, it has a moth-eaten, broken appearance. Another alternative is ultrasound, and the most sensitive is an MRI, which can uncover problems even if the X-ray is normal [14].

Stage 3: (Difficult stages) Symptoms are visible

Blood tests and imaging are less diagnostic in this later, more severe stage since the joints begin to flex and deform, the fingers become stiff, and these malformed joints can impinge on the nerves and produce nerve pain. RA is classified as severe when it reaches stage 3, this point has resulted as a cartilage and bone damage. The bones will grind against one another because the cushion between them has eroded away. Stage 3 RA, often known as severe RA, is indicated by much more severe pain, joint swelling, and other symptoms than stage 1 or stage 2 RA. The inflammation has developed to the point that the bones and cartilage in the joints have been degraded in stage 3 RA.

Stage 4 (Finishing stage)

At stage 4, the joint is not highly inflammatory. It's considered end-stage of rheumatoid arthritis when joints stop working. Pain, oedema, stiffness, and loss of mobility may persist in people with end-stage RA. It is probable that

the bones will fuse together and the joints will be destroyed (ankylosis).

SIGNS AND SYMPTOMS OF RHEUMATOID ARTHRITIS:

Rheumatoid arthritis symptoms usually arise progressively over weeks to months. One of the symptomatic signs is lethargy. Symptoms to watch for include weakness, a low-grade temperature, a loss of appetite (anorexia), and joint pain. Stiffness and muscle pain can precede joint swelling (myalgic). Around 20% of people with RA experience fevers, polyarthritis, and general constitutional symptoms such as fatigue, anorexia, weight loss, melancholy, and anxiety. Fatigue can be induced by anemia, sadness, muscle weakness, or neuropeptides. Depression is frequently linked to RA, and it may have an impact on patients' perceptions of the disease's progression. The link between depression and disease activity is unclear [(15)]. Joint pain and stiffness, especially in the morning, are indicative of rheumatoid arthritis. Chronic inflammation can cause long-term damage to body tissues, including cartilage and bone. Joint deformity, damage, and loss of function result from cartilage loss, bone erosion, and muscle weakness [(16)]. Fatigue Before experiencing any other symptoms, a person with RA may feel lousy and drained. They may also be depressed. Fatigue can affect: 1. Daily activities 2. Productivity at work. 3. Fatigue may be a side effect of the body's response to joint inflammation. Mild fever, People with RA may become unwell and overheated as a result of the inflammation [(17)]. The inflammatory joint lining tissue has activated the nerves in the joint capsule. When the inflammatory joint capsule is crushed by external pressure, such as from contacting the joint, it is normal for it to become sensitive. Deformity of a joint Rheumatoid arthritis is a chronic inflammatory disease that can lead to joint deformities. Uncontrolled inflammation in rheumatoid arthritis promotes cartilage and bone loss, as well as ligament relaxation, resulting in deformity (laxity). To minimize chronic joint deterioration and deformity,rheumatoid arthritis must be detected and treated as soon as possible [(18)].

DIAGNOSIS OF RHEUMATOID ARTHRITIS

Rheumatoid arthritis is notoriously difficult to diagnose. RA-like symptoms can be found in a variety of different conditions. Its symptoms and signs may arise gradually. Blood tests and x-rays may appear normal for years after the onset of joint soreness. Morning stiffness, simultaneous activation of three joints, involvement of both sides of the body, subcutaneous nodules, positive rheumatoid factor, and abnormalities in x-rays are all more likely to indicate a diagnosis of rheumatoid arthritis.

Laboratory examinations

Abnormal laboratory test results are one of the most common signs of RA. The erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) are the most important indices of the acute phase response (CRP). CRP levels in the blood were found to be connected to disease severity and radiographic abnormalities. Autoantibodies such as RF and anti-CCP are quite beneficial in the diagnosis of RA. For RA diagnosis, RA anti-CCP antibody has similar sensitivity as RF but higher specificity.The combination of anti-CCP and RF increases RA diagnostic specificity [(19)].

Test for Rheumatoid Factor

The Fc region of human IgG is the target of the autoantibody known as rheumatoid factor (RF). Deposits of RF related to IgG are seen in a variety of organs, including the synovium and joints, which interfere with proper joint function and encourage local inflammation, leading to tissue damage. Since the presence of the RF test is linked to a higher likelihood of developing RA in persons with moderate arthritic symptoms, it is utilised as a diagnostic marker for rheumatoid arthritis. Additionally, higher amounts are found in the disease's more severe manifestations, which is a serious prognostic concern for patients.

Anti-citrullinated protein antibody testing

Another RA antibody test is the anti-CCP. This test is 97% specific for RA if the illness is present. Anti-CCP levels in the blood should be less than 20 u/ml in order to be considered normal. A score of 20 or higher implies that RA may be present; the higher the score, the more certain the diagnosis. Despite the fact that roughly 20% of patients test negative for RF and anti-CCP antibodies, they may still be diagnosed with RA after a physical exam and imaging [(20)]

The erythrocyte sedimentation test

The ESR test is another name for the sedimentation rate test. It measures how closely red blood cells clump together. The rate at which erythrocytes, or red blood cells, sink to the bottom of a test tube is measured. Because of the presence of proteins that indicate inflammation, red blood cells stick together and fall to the bottom of the tube. Sedimentation at a faster rate indicates increased inflammation.[(21)]

C-reactive protein

When your liver is inflamed, it releases a protein that is less than 10mg per litre on average, but results vary by individual and lab. CRP levels often rise before symptoms manifest thus this test can help with early diagnosis. A high level shows that your body is inflamed or wounded, and after you've been diagnosed, you can use this test to track

disease activity and see how well your treatment is working [22]

Imagination test

Imaging investigations can be utilised to test for inflammation, joint damage, and the progression of the disease. The following are a few examples: X-rays may reveal any physical changes in your joints. MRI scans employ magnetic fields and radio waves to create an image of the joints. Ultrasound imaging creates an image of the joints by using high-frequency sound waves [23]. Inflammatory illnesses like RA have recently been diagnosed, described, and monitored using molecular imaging techniques including positron emission tomography (PET/CT) and single photon emission computed tomography (SPECT) [24]. In nodules, histological changes include granulomatous foci with central zones of cell necrosis surrounded by proliferating fixed cells, as well as peripheral fibrosis and chronic inflammatory cell infiltration, primarily perivascular [25]

CHRONOTHERAPHY FOR RHEUMATOID ARTHRITIS

The development of chronotherapy, a form of therapy based on the 24-hour rhythms of RA symptoms, is still in progress. Numerous rheumatoid arthritis individuals have 24-hour patterns in their pain, functional impairment, and stiffness, with the morning being the time when these symptoms peak. The blood levels of these cytokines have been found to follow distinct 24-hour cycles, with RA patients reporting higher levels in the morning. However, healthy adults have not shown any evidence of a substantial 24-hour rhythm in plasma IL-6 levels. The 24-hour cycles of cytokines thus play crucial roles in the pathophysiology of rheumatoid arthritis. [26]

MR PREDNISONE

MR prednisone is released around 4 hours after consumption by the recently created MR prednisone. The symptoms of rheumatoid arthritis early in the morning may be lessened by taking it in the evening and so adjusting its release to the diurnal rises in proinflammatory cytokine concentrations than when the same dose of prednisone is given early in the morning. [27] In many people, a single morning dose of prednisolone seems to be just as helpful as a single evening dose or split doses. Therefore, it makes sense to start treatment with a morning-only schedule since adrenopituitary suppression should be kept to a minimum.[28]

GLUCOCORTICODIES

Today, low-dose exogenous glucocorticoid remedy for RA is cautionedwhen you consider thatit is able tocharacteristic as a "substituteremedy" with inside the situation that endogenous cortisol availability is compromised. Since it's been developed that pain, stiffness, and purposefulincapacity are at their topwith inside the early morning hours, it's far now apparent that stopping the nocturnal upward thrust of proinflammatory cytokines with the aid of using glucocorticoids is greaterpowerful than treating installedsignswith inside the morning. Administration of low doses of prednisolone (5 or 7.5 mg daily) at 2:00 confirmedbeneficialoutcomesat thelength of morning stiffness after most effectivefive days [29]. In addition, long-time period low-dose glucocorticoid remedy for rheumatoid arthritis sufferers with early infectionmight also additionallylessen radiographic progression with the aid of usingas a minimum 50%. [30]

CONCLUSION:

In conclusion, it has been demonstrated that a number of innovative antidepressants block the brain's SANK/MAP and JAK/STAT pathways, which are triggered by pro-inflammatory cytokines. According to the scientists, SANK/MAP and JAK/STAT pathways may be suppressed by antidepressants to lessen the impact of cytokines on the brain. These pathways may also be useful targets for slowing the progression of RA synovial joint deterioration. The best way to balance the risks and benefits of GC therapy is to use chemotherapy with low-dose MR prednisone. To slow radiographic progression, diminish signs and symptoms, and generate high rates of clinical remission, low-dose GCs in combination with Awards are an efficient and secure treatment option.

REFRENCES:

1. Al-Rubaye AF, Kadhim MJ, Hameed IH. Rheumatoid Arthritis: History, Stages, Epidemiology, Pathogenesis, Diagnosis and Treatment. International Journal of Toxicological and Pharmacological Research. 2017; 9(2):145-55.
2. McInnes IB, Schett G. The pathogenesis of rheumatoid arthritis. New England Journal of Medicine. 2011 Dec 8; 365(23):2205-19.
3. Smolen JS, Pangan AL, Emery P, Rigby W, Tanaka Y, Vargas JI, Zhang Y, Damjanov N, Friedman A, Othman AA, Camp HS. Upadacitinib as monotherapy in patients with active rheumatoid arthritis and inadequate response to methotrexate (SELECT-MONOTHERAPY): a randomised, placebo-controlled, double-blind phase 3 study. The Lancet. 2019; 393(10188):2303-11.
4. Genovese MC. Biologic therapies in clinical development for the treatment of rheumatoid arthritis. JCR: Journal of Clinical Rheumatology. 2005;11(3):S45-54.
5. Johnston SS, Turpcu A, Shi N, Fowler R, Chu BC, Alexander K. Risk of infections in rheumatoid arthritis patients switching from anti-TNF agents to rituximab, abatacept, or another anti-TNF agent, a retrospective administrative claims analysis. InSeminars in arthritis and rheumatism 2013 43(1): 39-47. WB Saunders.
6. Heliövaara M, Aho K, Aromaa A, Knekt P, Reunanen A. Smoking and risk of rheumatoid arthritis. The Journal of rheumatology. 1993; 20(11):1830-5.
7. Van Schaardenburg D, Hazes JM, De Boer A, Zwinderman AH, Meijers KA, Breedveld FC. Outcome of rheumatoid arthritis in relation to age and rheumatoid factor at diagnosis. The Journal of rheumatology. 1993 ;20(1):45-52.
8. Wallace CA, Levinson JE. Juvenile rheumatoid arthritis: outcome and treatment for the 1990s. Rheumatic diseases clinics of North America. 1991; 17(4):891-905.

9. Deane KD, Demoruelle MK, Kelmenson LB, Kuhn KA, Norris JM, Holers VM. Genetic and environmental risk factors for rheumatoid arthritis. Best practice & research Clinical rheumatology. 2017; 31(1):3-18.
10. Van de Sande MG, De Hair MJ, Van Der Leij C, Klarenbeek PL, Bos WH, Smith MD, Maas M, De Vries N, Van Schaardenburg D, Dijkmans BA, Gerlag DM. Different stages of rheumatoid arthritis: features of the synovium in the preclinical phase. Annals of the rheumatic diseases. 2011; 70(5):772-7.
11. Al-Rubaye AF, Kadhim MJ, Hameed IH. Rheumatoid Arthritis: History, Stages, Epidemiology, Pathogenesis, Diagnosis and Treatment. International Journal of Toxicological and Pharmacological Research. 2017; 9(2):145-55.
12. Gaffo A, Saag KG, Curtis JR. Treatment of rheumatoid arthritis. American journal of health-system pharmacy. 2006; 63(24):2451-65.
13. Guo Q, Wang Y, Xu D, Nossent J, Pavlos NJ, Xu J. Rheumatoid arthritis: pathological mechanisms and modern pharmacologic therapies. Bone research. 2018; 6(1):1-4.
14. Combe B. Progression in early rheumatoid arthritis. Best Practice & Research Clinical Rheumatology. 2009 ;23(1):59-69.
15. Breedveld FC, Dijkmans BA. Differential therapy in early and late stages of rheumatoid arthritis. Current opinion in rheumatology. 1996; 8(3):226-9.
16. Dekkers J, Toes RE, Huizinga TW, van der Woude D. The role of anticitrullinated protein antibodies in the early stages of rheumatoid arthritis. Current opinion in rheumatology. 2016; 28(3):275-81.
17. Stanaszek WF, Carlstedt BC. Rheumatoid Arthritis: Pathophysiology. Journal of Pharmacy Practice. 1999 ;12(4):282-92.
18. Sailaja AK. An overall review on rheumatoid arthritis. Journal of Current Pharma Research. 2014; 4(2):1138.
19. Kung TN, Bykerk VP. Detecting the earliest signs of rheumatoid arthritis: symptoms and examination. Rheumatic Disease Clinics. 2014 Nov 1;40(4):669-83.
20. Combe B. Early rheumatoid arthritis: strategies for prevention and management. Best practice & research Clinical rheumatology. 2007 Feb 1;21(1):27-42.
21. Heidari B. Rheumatoid Arthritis: Early diagnosis and treatment outcomes. Caspian journal of internal medicine. 2011;2(1):161.
22. Pincus T, Sokka T. Laboratory tests to assess patients with rheumatoid arthritis: advantages and limitations. Rheumatic diseases clinics of North America. 2009 Nov 1;35(4):731-4
23. Flaishon L, Hart G, Zelman E, Moussion C, Grabovsky V, Lapidot Tal G, Feigelson S, Margalit R, Harmelin A, Avin-Wittenberg T, Shoseyov D. Anti-inflammatory effects of an inflammatory chemokine: CCL2 inhibits lymphocyte homing by modulation of CCL21-triggered integrin-mediated adhesions. Blood, The Journal of the American Society of Hematology. 2008 Dec 15;112(13):5016-25.
24. Majithia V, Geraci SA. Rheumatoid arthritis: diagnosis and management. The American journal of medicine. 2007 Nov 1;120(11):936-9.
25. Suresh E. Diagnosis of early rheumatoid arthritis: what the non-specialist needs to know. Journal of the Royal Society of Medicine. 2004 Sep;97(9):421-4.
26. To H. Chronotherapy for rheumatoid arthritis: current perspectives. ChronoPhysiology and Therapy. 2016 Aug 3;6:47-53
27. Jacobs JW, Bijlsma JW. Modified release prednisone in patients with rheumatoid arthritis. Annals of the rheumatic diseases. 2010 Jul 1;69(7):1257-9.
28. Kowanko IC, Pownall R, Knapp MS, Swannell AJ, Mahoney PG. Time of day of prednisolone administration in rheumatoid arthritis. Annals of the Rheumatic Diseases. 1982 Oct 1;41(5):447-52..
29. Cutolo M. Glucocorticoids and chronotherapy in rheumatoid arthritis. RMD open. 2016 Mar 1;2(1):e000203.
30. Paolino S, Cutolo M, Pizzorni C. Glucocorticoid management in rheumatoid arthritis: morning or night low dose?.Reumatologia/Rheumatology. 2017 Aug 31;55(4):189-97.