

Nanotechnology in treatment of Rheumatoid Arthritis

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Abstract: Rheumatoid Arthritis (RA) is a disease that affects 0.92 % of the Indian population. It is an autoimmune disease that leads to inflammation of various joints. This swelling destroys joints from within and causes permanent deformities. Early diagnosis and therapy at proper time can prevent this disability. This disease is more common in females. Stress and environmental factors can trigger the onset of disease. The T-lymphocytes release cellular toxins (cytokines) and degradative enzymes which damage the joints. They also stimulate B lymphocytes to produce auto-antibodies. Swelling of 3 or more joints of hands and wrists, symmetry of joint involvement and morning stiffness are main features of the disease. Sometimes it remains confined to knees. The joints are progressively damaged in untreated or inadequately treated cases. Rheumatoid arthritis can involve various systems of the body. Erythrocyte sedimentation rate (ESR) and C reactive proteins are blood tests that indicate inflammation. Diagnosis of RA is clinical and presence of joint swelling (synovitis) is essential for diagnosis. Other blood tests are required for assessment of systemic involvement (liver, kidneys, etc) and monitoring of adverse drug events. X –rays of joints may indicate destruction and bone loss. Ultra-sound and magnetic resonance examination of joints can detect joint involvement at a very early stage.

Significant progress has been made in drug management of this disabling disease. Many drugs if used appropriately can slow down the disease progression. The aim of the therapy is to relieve pain and stiffness to control the disease and to avert possible disease complications. Non-steroidal anti-inflammatory drugs and gluco-corticoids have been used to treat the disease. Anti-rheumatic drugs have also been used to cure the disease. Joint replacement or other operations are indicated in deformed joint with functional impairment.

In recent times, Nanotechnology has improved rheumatoid arthritis treatments. The search for controlled, specified way to deliver therapeutic agents is fast becoming an area of innovation, as researchers are developing nanosystems capable of delivering drugs directly to sites of inflammation, e.g , targeted biodegradable nanoparticles (tBNPs) and tiny particles of polylactic acid, polycaprolactone and polyethylene glycol. Nanomedicine can accumulate into chronic inflammatory tissues via the enhanced permeability and retention phenomenon or be conjugated with a ligand to actively bind to receptors overexpressed by cells within chronic inflammatory tissues, leading to increased efficacy and reduced systemic side-effects. Nanomedicine includes drug loaded liposomes, nanoparticles, polymeric micelles, nanogels and nanocapsules. Drugs like NSAIDs,Gold salts, Corticosteroids,folic acid antagonists used as immunesuppressants, Tumour necrosis factor alpha inhibitors used as immunosuppressants, some drugs used as immunomodulatory agents, angiogenesis inhibitors and gene therapy have been formulated as nanomedicine for treatment of Rheumatoid arthritis. There has been increased interest and

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applications of nanomedicines in treating RA and other chronic inflammatory diseases. In the near future, more anti-inflammatory agents targeting pro-inflammatory cytokines will be developed to treat RA and other chronic inflammations. Various nanomedicines that lower the dose and dosing frequency of existing anti-inflammatory agents and thus reducing their side effects. Increased understanding of mechanisms underlying RA and other chronic inflammatory diseases will lead to identification of new drug targets and new nanomedicine molecules

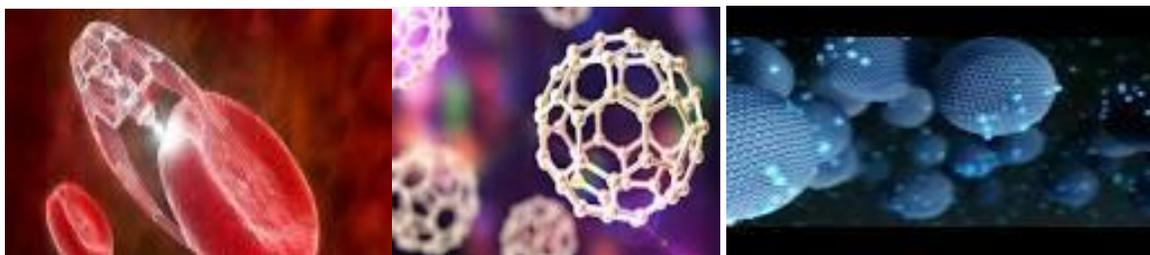


Figure showing Nanomedicine particles used in treatment of various diseases

References: Pham CT. Nanotherapeutic approaches for the treatment of rheumatoid arthritis, Wiley Interdisciplinary Reviews: Nano medicine and Nanobiotechnology. 2011; 3(6): 607-619.