

The current state of acupuncture treatment for inflammatory arthritis

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Inflammatory arthritis refers to the migration of inflammatory cells (such as monocytes/macrophages, lymphocytes, and granulocytes) from the blood to the synovium or synovial fluid, causing joint pain and swelling. It is often associated with decreased joint mobility and functional damage. Some diseases lead to cartilage and skeletal damage, resulting in joint destruction. Common inflammatory arthritis includes rheumatoid arthritis, ankylosing spondylitis, and gout. Arthritis and other rheumatic diseases are currently the most important causes of disability, gradually becoming a major public health concern. While the treatment of certain types of arthritis, such as rheumatoid arthritis, has shown significant improvement, the increasing prevalence of arthritis and related disability rates due to an aging population is leading to a growing demand for treatment. Acupuncture, as a traditional Chinese medicine, is accepted by patients with inflammatory arthritis, providing timely relief from short-term pain and immune balance regulation. This article will summarize and provide a perspective on the current research status of acupuncture treatment for inflammatory arthritis.

In recent years, an increasing number of experimental studies have shown that acupuncture can effectively alleviate clinical symptoms in patients with inflammatory arthritis, providing symptomatic pain relief. This effect is closely related to acupuncture's ability to reduce the release of inflammatory factors and inhibit interferon expression. Adly et al. [1] clinically confirmed that rheumatoid arthritis patients treated with acupuncture combined with methotrexate exhibited significant reductions in C-reactive protein (CRP), interleukin-6 (IL-6), and malondialdehyde (MDA) oxidative markers. Sun et al. [2] found that acupuncture significantly reduced serum levels of TNF- α , IL-1 β , and IL-6, effectively alleviating joint swelling and pain in collagen-induced arthritis (CIA) rats.

Inflammatory arthritis is an immune-mediated inflammatory disease, and immune tolerance imbalance can lead to its occurrence. Imbalance between helper T cells (Th) and Treg cells can lead to the onset of rheumatoid arthritis (RA), while the imbalance between Th1/Th17/Treg cell immunity is closely related to ankylosing spondylitis [3]. Shujing et al. [4] discovered that acupuncture with nanocomposite hydrogel at specific acupoints could reduce serum IL-17 and TNF- α levels in CIA rats, regulate inflammatory factors, and restore Th17/Treg cell balance. Yu et al. [5] found that acupuncture treatment significantly increased the population of Treg cells and transforming growth factor- β 1 (TGF- β 1) in inguinal lymph nodes of rats, demonstrating acupuncture's immune regulatory effects.

As a form of physical stimulation on the body surface, acupuncture not only regulates the release of downstream inflammatory factors and restores upstream immune balance, but also affects intermediate links that communicate between upstream and downstream pathways. These effects include adjusting relevant signaling pathways, regulating cell metabolism and apoptosis, and influencing the internal environment of the body, thereby affecting protein expression, gene transcription, and translation. Acupuncture can suppress immune responses and lower inflammatory factor levels by modulating signaling pathways. Zhao Chen et al. [6] found that acupuncture could inhibit the PI3K/AKT/mTOR signaling pathway, enhance autophagy in synovial cells of adjuvant arthritis (AA) rats, reduce inflammatory factor levels, and thus alleviate synovial injury and protect synovial tissue. Other research suggests that the analgesic and anti-inflammatory effects of acupuncture may be closely related to the inhibition of the Toll-like receptor 2/4 (TLR2/4)-MyD88-NF- κ B

signaling pathway, which is associated with innate immune responses in the synovium [2]. Acupuncture can also regulate cell metabolism, and its therapeutic effect on adjuvant-induced arthritis (AIA) rats is achieved mainly by regulating corticosteroid hormone synthesis, cell metabolism, and tissue repair processes. Acupuncture at the "Zusanli" acupoint can increase the expression of tissue repair growth factors such as PEG3, GADD45A, GDF5, FGF5, SOX2, ATP6V1C2, and the anti-inflammatory cytokine IL-10 in the inflamed side joints of AIA mice [7]. Liu Li et al. [8] found that electroacupuncture at the "Zusanli" and "Guanyuan" acupoints increased the apoptosis rate of synovial cells in AIA rats, upregulated the protein expression of Fas and Caspase-3 in synovial tissue, suggesting that electroacupuncture treatment for RA may promote synovial cell apoptosis via the Fas apoptotic pathway, thereby alleviating synovial inflammatory responses. In summary, acupuncture employs multiple pathways and channels to restore immune tolerance imbalance in patients with inflammatory arthritis.

Numerous clinical studies have shown that acupuncture treatment for arthritis, including regular acupuncture, electroacupuncture, fire needling, and warm needling, has significant efficacy in alleviating arthritis symptoms. Existing evidence indicates that regular acupuncture can effectively relieve pain in patients with knee osteoarthritis [9], while warm needling treatment for osteoarthritis has shown significant efficacy comparable to oral medication and intra-articular injection of hyaluronic acid [10]. Furthermore, acupuncture treatment for chronic low back pain has demonstrated short-term pain relief effects [11]. Research also suggests that combining acupuncture with moxibustion can improve sacroiliac joint marrow edema in early and middle-stage ankylosing spondylitis patients, control disease activity, and enhance daily life capability [12]. Lu et al. [13] conducted a meta-analysis that showed patients receiving a combination of Western medicine and acupuncture, moxibustion, or electroacupuncture had lower post-treatment scores on the visual analog scale (VAS) for pain, disease activity score (DAS-28), swollen joint count (SJC), and tender joint count (TJC) compared to patients receiving Western medicine alone. Yu et al. [14] performed a meta-analysis on 21 animal research data, revealing that acupuncture increased pain tolerance to stimuli and reduced joint swelling in rats.

Current clinical studies suggest that acupuncture effectively treats inflammatory arthritis through various pathways, often using a "point-to-point" or "point-to-system" research approach. However, the process by which acupuncture conveys information from acupoints through meridians to target organs is complex. At present, research on acupuncture's comprehensive network regulation of immune balance through multiple levels, stages, target points, and systems is lacking. To further study acupuncture's impact on inflammatory arthritis, in-depth research is needed at the acupoint level. This could include investigating whether there are differences in treatment outcomes between proximal and distal acupoint selection, the correlation between different acupoint combinations and inflammatory factor levels, and the relationship between acupuncture at different meridians and various cell pathways. The proposal of "acupuncture network medicine" [15] provides new insights into the mechanisms underlying acupuncture's effectiveness, offering broad application prospects and becoming a key research direction in the future.

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Competing interests

The authors declare no conflicts of interest.

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