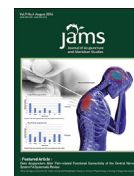


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## Review Article

# Spinal Cord Injury: How Could Acupuncture Help?

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### Abstract

Spinal cord injury (SCI) is one of the most common causes of death and disability worldwide, and it can result in both permanent disability and serial complications in patients. Research shows that patients with SCI complications are often interested in acupuncture for symptomatic relief. Therefore, the issue of physicians advising their patients regarding the use of acupuncture to alleviate SCI complications becomes pertinent. We review and summarize two types of relevant publications: (1) literature concerning acupuncture for SCI and its complications and (2) underlying mechanisms of acupuncture therapy for SCI. Clinical trials and reviews have suggested that acupuncture effectively manages a range of post-SCI complications, including motor and sensory dysfunction, pain, neurogenic bowel and bladder, pressure ulcers, spasticity, and osteoporosis. The effect of acupuncture on post-SCI orthostatic hypotension and sexual dysfunction remains unclear. Decreased oxidative stress, inhibition of inflammation and neuronal apoptosis, regulation of the expression and activity of endogenous biological mediators, and increased regenerative stem cell production are the possible mechanisms of acupuncture therapy for SCI. Although many limitations have been reported in previous studies, given the evidence for the efficacy of acupuncture, we recommend that physicians should support the use of acupuncture therapy for SCI complications.

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## 1. Introduction

Spinal cord injury (SCI) is one of the most common causes of death and disability worldwide. The global incidence of SCI is 8–246 cases per million people annually, and 236–1298 per million inhabitants suffer from SCI worldwide [1]. According to the National Spinal Cord Injury Statistical Center, there are approximately 259,000 SCI patients in America, with some studies reporting an even higher incidence (1,275,000 individuals) [2]. SCI is a devastating condition that can lead to permanent dysfunction and significant complications such as urinary tract infection, neurological function impairment, pain, pressure ulcers, orthostatic hypotension (OH), and spasticity [3], along with psychological and social impact on the patients, their families, and the community. Several strategies, such as surgery, pharmacological interventions, behavioral therapy, physical therapy, and supportive treatment, have been used to treat SCI patients. However, because of the potential complications of these methods [4], an increasing number of SCI patients have been choosing alternative medicine therapies such as acupuncture [5].

Acupuncture is an important part of Traditional Chinese Medicine, which has been used for more than 4000 years to prevent and treat a variety of diseases. During the procedure, a hair-thin needle is inserted into the skin at distinct acupoints and is manipulated manually, electrically, thermally, or pharmacologically. Even though the technique was first developed in China, it is now practiced by thousands of clinicians worldwide and has become one of the most frequently used complementary medicine therapies among SCI patients. Compared with other treatment methods, acupuncture is well known for its advantages, which include uncomplicated procedures, lack of toxicity, and lower cost. A growing body of scientific evidence has been published to illustrate the effect of acupuncture on neurological function, urinary retention, pain, pressure ulcers, and OH. Although several systematic reviews and clinical studies have indicated that there is no strong evidence to support the therapeutic efficacy of acupuncture in SCI [6–8], an increasing number of high-quality randomized controlled trials (RCTs) are currently being conducted, which may shed light on the benefits of acupuncture therapy.

Here, we have provided an extensive review that assesses the effectiveness of acupuncture for treating post-SCI complications and summarizes the potential mechanisms of acupuncture therapy for SCI.

## 2. Materials and methods

The literature search was conducted through the United States National Library of Medicine using the MEDLINE search engine, PubMed, Cochrane Review, Google Scholar, and the Ohio State University library. We used the following search terms alone and in combination: acupuncture, spinal cord injury, motor and sensory dysfunction, pain, neurogenic bladder, neurogenic bowel, pressure ulcers, osteoporosis, OH, spasticity, and sexual disorders.

## 3. Results

### 3.1. Efficacy of acupuncture therapy for spinal cord injury

#### 3.1.1. Motor and sensory dysfunction

Recovery of motor and sensory function after SCI is currently the most important step in rehabilitation. However, there is limited regeneration and functional recovery after SCI, especially in chronic SCI patients, whose paralysis may persist for more than 1 year following injury. Despite considerable research on multiple treatment modalities, no definitive rehabilitation intervention has been established to aid recovery.

Being a relatively simple, inexpensive, and safe treatment, acupuncture has been widely used to help the recovery of motor and sensory function after SCI. Acupuncture not only results in functional improvements but also aids neural restoration. Electroacupuncture (EA) can improve hind limb motor neurons in rats by affecting neuronal apoptosis and modulating relevant gene expression [9], inhibiting astrogliosis, and downregulating platelet-derived growth factor [10]. Acupuncture can also promote the recovery of motor neuron function in the affected anterior horn of SCI rats by increasing acetylcholinesterase activity, which upregulates glial cell line-derived neurotrophic factor mRNA activity [11]. A review and meta-analysis that aimed to investigate the impact of acupuncture on neurological recovery after SCI included 12 RCTs and demonstrated that acupuncture could have a beneficial effect on neurological and motor function recovery. This report also indicated that studies investigating acute SCI and those that used varied acupuncture sessions could achieve a larger magnitude of effect [6].

#### 3.1.2. Pain

Despite recent developments in rehabilitation strategies for SCI patients, adequate treatment of SCI-induced pain remains a common issue for many individuals. A large proportion of SCI patients continue to experience pain several years after injury; chronic pain is diagnosed in 73% of patients, with 28% describing severe debilitating pain and 50% reporting moderate pain. Musculoskeletal pain is the most common complaint, which is reported by 80% of SCI patients, while neuropathic pain and visceral pain is reported by 50–60% and 30% of long-term SCI survivors, respectively [12]. Pain can impede an individual's performance of basic and daily living activities, and approximately 5–45% of patients reported that the pain detracted from their quality of life [13]. The current pharmacological and anesthetic methods for pain management include intrathecal injection, opioids, anticonvulsants, antidepressants, and narcotics. These methods are moderately effective but are associated with adverse reactions such as sedative and anticholinergic side effects, toxicity, and the risk for addiction and abuse [4,14].

Currently, there is no consensus regarding the benefits of manual acupuncture for SCI-induced pain, despite the number of clinical trials that have been undertaken [15]. According to a review published in 2013, only two clinical trials of acupuncture therapy for SCI-induced pain were

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