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Review Article

A Chinese Guideline for the Diagnosis and Management of Chronic Post-Traumatic Pain (2023 Edition)

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Abstract

With the rapid modernization of society, the incidence of traumatic events, including traffic accidents, industrial injuries, falls, and burn injuries has increased substantially, leading to a corresponding rise in the prevalence of chronic post-traumatic pain (CPTP). Chronic pain following trauma is predominantly neuropathic in nature, often involving central and peripheral sensitization mechanisms, and imposes a significant burden on patients' physical function, psychological well-being, sleep quality, and overall quality of life. Despite its growing clinical importance and socioeconomic impact, the diagnosis and management of CPTP remain insufficiently standardized across healthcare settings, with considerable variability in assessment tools, treatment protocols, and multidisciplinary coordination. To address this gap, the Expert Panel of the Special Capacity-Building Program for Pain Diagnosis and Treatment, organized by the National Health Commission Capacity Building and Continuing Education Center, systematically reviewed and critically appraised recent domestic and international evidence regarding the classification, prevention, diagnosis, and treatment of CPTP. High-quality evidence, including systematic reviews, meta-analyses, randomized controlled trials, clinical guidelines, and expert consensus statements, was evaluated using the GRADE methodology. Following repeated expert discussions and consensus voting, this guideline was developed to provide

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evidence-based, actionable recommendations for the standardized diagnosis and multidisciplinary management of CPTP. This guideline covers risk stratification, early intervention strategies, pharmacological and interventional therapies, psychological support, and rehabilitation approaches, with the ultimate aim of improving clinical practice consistency, enhancing patient outcomes, and reducing the long-term disability associated with chronic post-traumatic pain.

Keywords

Trauma, Chronic Post-traumatic Pain, Chronic Pain, Clinical Practice Guideline

1. Introduction

Chronic post-traumatic pain (CPTP) is defined as chronic pain that develops or worsens following tissue injury, including burn injuries and other forms of trauma [1]. Pain may remain localized to the injured tissue or radiate along the distribution of the affected nerve. Injuries involving deep somatic or visceral tissues may also produce referred pain in the corresponding cutaneous regions. Although CPTP frequently evolves into neuropathic pain, the *International Classification of Diseases, 11th Revision* (ICD-11) continues to classify it under chronic postsurgical or post-traumatic pain.

Virtually any traumatic event has the potential to result in persistent pain, which can profoundly impair patients' quality of life. With the rapid development of modern society, traumatic injuries resulting from traffic accidents, burns, and other causes have become increasingly common. Epidemiological studies indicate that the prevalence of chronic pain following multiple traumatic injuries ranges from 46% to 85% [2].

Despite its high prevalence, awareness of CPTP among healthcare professionals remains inadequate, and standardized diagnostic and therapeutic strategies are still lacking. To address this unmet clinical need, the Expert Panel of the National Health Commission Capacity Building and Continuing Education Center conducted a comprehensive literature review using major Chinese and international databases, including Wanfang Data, PubMed, and the Cochrane Library. Priority was given to high-level evidence, including systematic reviews, meta-analyses, randomized controlled trials (RCTs), expert consensus statements, and clinical practice guidelines.

The quality of evidence and strength of recommendations were evaluated using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework (Table 1). Following multiple rounds of expert discussion and online consensus voting, the present guideline was formulated to standardize the diagnosis and management of CPTP. According to the ICD-11 classification, CPTP is categorized into six major clinical subtypes: chronic pain after burn injury (CPABI), chronic pain following peripheral nerve injury, chronic pain following spinal cord injury, chronic pain following traumatic brain injury, chronic pain following whiplash injury, and chronic pain after musculoskeletal injury (CPAMSI).

Table 1. *GRADE system: Explanation of evidence quality and recommendation strength [2].*

Level	Strong Recommendation (1)	Weak Recommendation (2)
High Quality (A)	In most circumstances, the recommendation applies to most patients; very confident that the estimate of effect is close to the true value	The optimal decision may vary depending on setting, patient, and societal values; very confident that the estimate of effect is close to the true value
Moderate Quality (B)	In most circumstances, the recommendation applies to most patients; moderately confident in the estimate of effect: the estimate is likely close to the true value, but there is a possibility that it is substantially different	In some circumstances, alternative options may be better for certain patients; moderately confident in the estimate of effect: the estimate is likely close to the true value, but there is a possibility that it is substantially different
Low Quality (C)	The recommendation may change when higher-quality evidence becomes available; limited confidence in the estimate of effect: the estimate may be substantially different from the true value	Alternative options are equally reasonable; limited confidence in the estimate of effect: the estimate may be substantially different from the true value
Very Low Quality (D)	The recommendation may change when higher-quality evidence becomes available; very little confidence in the	Alternative options are equally reasonable; very little confidence in the estimate of effect: the estimate is very likely to be substantially different from the true value

Level	Strong Recommendation (1)	Weak Recommendation (2)
	estimate of effect: the estimate is very likely to be substantially different from the true value	

2. Pathophysiology

Chronic post-traumatic pain is mediated by both neuropathic and nociceptive mechanisms, which arise from injury to the nervous system and peripheral tissues, respectively.

Neuropathic pain is primarily driven by maladaptive neuroplasticity and involves four principal pathological processes. First, abnormal expression of ion channels occurs within dorsal root ganglion neurons. Upregulation of voltage-gated sodium and calcium channels, together with downregulation of potassium channels, results in neuronal hyperexcitability and ectopic discharges, thereby producing spontaneous pain, hyperalgesia, and allodynia [3]. Second, structural and functional remodeling of pain pathways develops through alterations in synaptic plasticity. Excitatory synapses are enhanced, whereas inhibitory synaptic transmission is diminished, leading to reorganization of neural circuits involved in pain processing [4, 5]. Third, dysfunction of the endogenous pain modulatory system contributes to persistent pain. Descending inhibitory pathways become impaired, while descending facilitatory pathways are excessively activated, amplifying nociceptive transmission [6]. Fourth, chronic pain is associated with functional and structural alterations in brain regions responsible for cognition and emotion, including the hippocampus and prefrontal cortex. These changes contribute to cognitive impairment and affective disturbances, which further exacerbate pain perception through dysregulation of central pain modulation [7]. Neuropathic mechanisms play a central role in virtually all forms of chronic post-traumatic pain. By contrast, nociceptive pain results from persistent activation of peripheral nociceptors secondary to ongoing tissue injury and inflammation and is particularly prominent in chronic pain following musculoskeletal injury (CPAMSI).

Recent evidence has further highlighted the critical contribution of neuroinflammation to chronic pain [8]. Activation of glial cells and overproduction of pro-inflammatory cytokines, including tumor necrosis factor-α (TNF-α) and interleukin-1β (IL-1β), increase neuronal excitability by regulating the expression of multiple ion channels. These cytokines also exert differential effects on synaptic plasticity across distinct CNS regions, such as enhancing excitatory transmission in the spinal dorsal horn and suppressing it in the hippocampus, and this bidirectional modulation ultimately contributes to both persistent pain and comorbid cognitive-emotional deficits. Furthermore, disruption of the blood-nerve barrier and blood-brain barrier following peripheral or central nervous system injury permits infiltration of peripheral immune cells into injured nerves and brain parenchyma, thereby promoting neuroinflammation and sustaining chronic pain.

3. Disease Classification

3.1. Chronic Pain After Burn Injury (CPABI)

3.1.1. Definition and Classification

Pain following burn injury refers to the unpleasant sensory and emotional experience resulting from destruction of the skin, mucosa, and even deeper tissues caused by burns, which leads to injury, exposure, or irritation of cutaneous nerve endings, as well as pain associated with various diagnostic and therapeutic procedures during burn care [9]. Burn-related pain is characterized by high intensity, multiple pain phenotypes, and prolonged duration. Chronic pain after burn injury (CPABI) is typically caused by thermal, cold, electrical, chemical, frictional, or radiation injuries. It is defined as pain that persists for at least three months after wound healing, after excluding pain attributable to infection, malignancy, or pre-existing chronic pain conditions unrelated to the burn injury. CPABI frequently exhibits features of neuropathic pain, often accompanied by sensory dysfunction or sensory loss [10]. Based on the underlying mechanisms of nerve injury, burn-related neuropathic pain has been classified into four subtypes: direct nerve injury, nerve compression, electrical nerve injury, and neuropathy secondary to systemic injury [11].

3.1.2. Epidemiology

CPABI represents a major public health concern, with a reported prevalence ranging from 18% to 52% [1, 10]. Multiple factors contribute to the development of CPABI, including sociodemographic factors such as age, sex, and educational level; burn-related factors including total burn surface area, burn depth, time since injury, etiology of the burn, inhalation injury, routine wound care, and surgical interventions; and psychological factors including anxiety, depression, and post-traumatic stress disorder (PTSD) [12].

3.1.3. Clinical Manifestations

Patients commonly experience persistent pain, burning sensations, and skin tightness involving burn wounds, donor sites, or skin graft areas. These symptoms are frequently accompanied by pruritus, anxiety, and depression.

3.1.4. Diagnosis

A diagnosis of CPABI can be established when the following criteria are fulfilled: a documented history of burn injury, residual burn-related pathological changes such as scar formation or deformity, persistent pain involving the burn wound, donor site, graft site, or adjacent tissues, and pain persisting for more than three months after the initial injury.

3.2. Chronic Pain Following Peripheral Nerve Injury

3.2.1. Definition and Classification

Peripheral nerve injury commonly results from traumatic mechanisms such as traction, compression, laceration, or penetrating injury. Incomplete or inadequate neurological recovery following injury may lead to persistent chronic pain [13]. Chronic pain following peripheral nerve injury is defined as persistent or recurrent pain resulting from injury to the peripheral somatosensory nervous system [14]. According to the anatomical location of nerve involvement, this condition can be classified into phantom limb pain, residual limb (stump) pain, entrapment neuropathies, brachial plexus injury, and other peripheral nerve trunk injuries.

3.2.2. Epidemiology

The reported prevalence of chronic pain following peripheral nerve injury ranges from 8% to 26% [15].

3.2.3. Clinical Manifestations

Patients typically present with symptoms localized to the sensory distribution of the injured nerve, including hyperalgesia, allodynia, persistent spontaneous pain, and sensory abnormalities such as paresthesia or dysesthesia. Pain is most commonly described as burning, electric shock-like, stabbing, shooting, or lancinating in quality [16, 17]. Sleep disturbance, anxiety, and depressive symptoms frequently coexist with chronic neuropathic pain.

3.2.4. Diagnosis

The diagnosis is established based on the following criteria: a clearly documented history of traumatic peripheral nerve injury, a definite temporal relationship between the traumatic event and pain onset, pain and sensory abnormalities corresponding anatomically to the distribution of the injured peripheral nerve, and persistence of pain for more than three months.

3.3. Chronic Pain Following Spinal Cord Injury

3.3.1. Definition and Classification

Spinal cord injury (SCI) is characterized by structural and functional damage to the spinal cord resulting from trauma, disease, or congenital disorders. SCI causes varying degrees of motor, sensory, and autonomic dysfunction below the level of injury, frequently leading to partial or complete loss of functional independence. Chronic pain following spinal cord injury is among the most common and debilitating long-term complications of SCI, substantially impairing both physical and psychological health while imposing a considerable burden on daily activities and quality of life.

According to the International Spinal Cord Injury Pain (ISCIP) Classification, chronic pain following SCI is divided into four major groups, namely nociceptive pain, neuropathic pain, other pain syndromes (also known as functional pain disorders), and pain of unknown origin that defies classification into the aforementioned categories. Nociceptive pain encompasses musculoskeletal, visceral, and other nociceptive subtypes, while neuropathic pain includes pain at the neurological level of injury, pain below that level, and other neuropathic presentations. The third group comprises functional pain disorders such as irritable bowel syndrome, fibromyalgia, and interstitial cystitis-associated pain [18, 19].

3.3.2. Epidemiology

Longitudinal studies have reported that 65%-85% of patients with SCI experience chronic pain, with approximately one-third suffering from severe pain [20]. A recent meta-analysis demonstrated that among individuals with chronic SCI, the prevalence rates are 58% for neuropathic pain, 56% for musculoskeletal pain, 20% for visceral pain, and 45% for overall nociceptive pain [21].

3.3.3. Clinical Manifestations

Pain following SCI is often complex, persistent, and difficult to manage. Clinical features typically include hyperalgesia, allodynia, persistent spontaneous pain, and sensory disturbances involving dermatomes at or below the neurological level of injury. Patients frequently describe the pain as burning, stabbing, squeezing, electric shock-like, or shooting, with burning pain being the most commonly reported symptom. The lower extremities constitute the most frequent pain location [18, 22, 23]. Several factors have been associated with pain outcomes following SCI. Being unmarried and having more severe neurological injury have been reported as independent protective factors in one observational study, whereas low household income, lack of family support, and absence of analgesic treatment have been identified as independent risk factors for persistent chronic pain.

3.3.4. Diagnosis

The diagnosis of chronic pain following SCI is based on several clinical characteristics, including a well-documented history of spinal cord injury; delayed onset in most patients (typically occurring months or even years after SCI, although immediate onset may occur in a minority of cases); poorly localized, diffuse pain that frequently changes in distribution

within insensate regions below the neurological level of injury; highly variable pain characteristics with respect to quality, intensity, and frequency, predominantly presenting as spontaneous pain; and limited or absent response to conventional analgesic therapies, often accompanied by treatment tolerance, dependence, and frequent recurrence [24].

3.4. Chronic Pain Following Traumatic Brain Injury

3.4.1. Definition and Classification

Traumatic brain injury (TBI) is a neurological disorder caused by external mechanical forces that result in temporary or permanent structural damage and functional impairment of the brain, leading to physical, cognitive, emotional, and behavioral deficits. In China, the three leading causes of TBI are traffic accidents, falls, and violence-related injuries. Depending on injury severity, TBI is classified as mild, moderate, or severe, and may be accompanied by visual disturbances, cognitive dysfunction, chronic pain, sleep disorders, and post-traumatic epilepsy. Chronic pain developing after TBI is referred to as chronic pain following traumatic brain injury. The major pain syndromes include post-traumatic headache, musculoskeletal pain, and central neuropathic pain, among which post-traumatic headache is the most prevalent [25].

3.4.2. Epidemiology

The prevalence of chronic pain following TBI exceeds 50%, with post-traumatic headache representing the most common pain condition [26].

3.4.3. Clinical Manifestations

Pain following TBI is generally moderate in intensity. Headache is typically bilateral, predominantly involving the frontal region, and is commonly described as throbbing or pressing in quality. Patients frequently exhibit features of post-concussion syndrome, including persistent headache accompanied by dizziness, fatigue, cognitive impairment, emotional disturbances, and sleep disorders [27, 28]. Although headache is the predominant complaint, patients may also experience pain involving the back, upper extremities, lower extremities, and joints, with musculoskeletal pain representing the most common non-cephalic pain syndrome [29].

3.4.4. Diagnosis

The diagnosis is established based on a documented history of traumatic brain injury, characteristic clinical manifestations of chronic pain following TBI, and supportive findings from appropriate neurological and imaging examinations when indicated.

3.5. Chronic Pain Following Whiplash Injury

3.5.1. Definition and Classification

Whiplash injury refers to injury of the cervical spine, cervical spinal cord, and surrounding soft tissues caused by rapid acceleration-deceleration forces that produce excessive flexion and extension of the neck [30]. It is most frequently associated with rear-end motor vehicle collisions, sports-related trauma, and physical assault. Chronic pain following whiplash injury is defined as persistent pain involving the head, neck, shoulders, or related regions that continues beyond the acute stage of whiplash injury. Based on the underlying pathophysiological mechanisms, chronic whiplash-associated pain can be categorized into four subtypes: cervical facet joint injury, cervical ligament injury, cervical muscle injury, and temporomandibular joint (TMJ) dysfunction [31].

3.5.2. Epidemiology

Acute pain occurs in virtually 100% of patients immediately following whiplash injury, whereas 20%-60% subsequently develop chronic pain [31-33]. The most common source of persistent pain is injury to the cervical facet joints, particularly the C2-3 and C5-6 facet joints [32]. The reported prevalence of cervical facet joint injury ranges from 54% to 60% [33]. Temporomandibular joint dysfunction develops in approximately 44% of affected individuals, while 20%-35% experience pain involving the scapular region or lower back [31].

3.5.3. Clinical Manifestations

Symptoms usually develop within six hours after injury, although some patients experience only mild symptoms initially, followed by gradual worsening over several days. Common manifestations include neck pain, headache, neck and shoulder pain, low back pain, radiating pain to the upper extremities, and anterior chest pain, whereas additional symptoms may comprise temporomandibular joint dysfunction, dizziness, torticollis, dysphagia, visual disturbances, and cognitive and psychological abnormalities.

3.5.4. Diagnosis

A diagnosis of chronic pain following whiplash injury can be established based on a documented history of whiplash injury, compatible clinical manifestations, and relevant imaging or other ancillary investigations when appropriate.

3.6. Chronic Pain After Musculoskeletal Injury (CPAMSI)

3.6.1. Definition and Classification

Chronic pain after musculoskeletal injury (CPAMSI) refers to persistent pain developing after injury to muscles, bones,

tendons, ligaments, or joints [1]. CPAMSI is generally classified into three categories. The first is bone pain, which most commonly develops after fractures, with severe acute post-fracture pain or inadequate early pain control increasing the risk of chronicity. The second category encompasses muscle, tendon, and ligament pain: muscle injury induces local inflammation, edema, reduced blood flow, muscle spasm, and myofascial trigger points, whereas pain involving tendons and ligaments is commonly caused by sprains, excessive stretching, or other traumatic injuries. The third category is joint pain, which may result from traumatic joint injury and manifest as persistent joint stiffness, swelling, and pain, including post-traumatic osteoarthritis and related disorders.

3.6.2. Epidemiology

Approximately 18.7% of patients attending pain clinics experience chronic pain secondary to musculoskeletal injury [1].

Following fractures involving the ankle or knee, the prevalence of chronic pain reaches 61.7%, of whom nearly 30% develop chronic neuropathic pain [34]. Several factors have been identified as increasing the risk of CPAMSI, including age greater than 40 years, severe pain at the time of injury, post-traumatic stress disorder (PTSD), medical comorbidities, and fear of movement (kinesiophobia) [35, 36].

3.6.3. Clinical Manifestations

The most common symptoms include localized pain, joint stiffness, fatigue, sleep disturbance, and a subjective sensation of muscle "twitching" or spasm. Pain may be aggravated by posture or movement and may also exhibit neuropathic characteristics, including burning, electric shock-like, and stabbing sensations. Importantly, symptom severity and pain intensity do not necessarily correlate with the extent of musculoskeletal tissue damage [37]. Patients with chronic pain following fractures often experience not only impaired musculoskeletal function but also psychological and neurological complications, including depression, anxiety, cognitive impairment, and complex regional pain syndrome (CRPS) [38].

3.6.4. Diagnosis

At present, no universally accepted diagnostic criteria for CPAMSI have been established. However, traumatic musculoskeletal pain can generally be distinguished from non-traumatic musculoskeletal pain by three key features, namely a clearly identifiable traumatic event preceding symptom onset, anatomical correspondence between pain distribution and the site of trauma-induced injury, and a substantial role of post-traumatic stress symptoms in driving both the onset and chronicity of pain.

4. Management of Chronic Post-Traumatic Pain

4.1. General Principles

The management of chronic post-traumatic pain (CPTP) should be individualized, multidisciplinary, and mechanism-based, with the primary objectives of alleviating pain, restoring functional capacity, improving psychological well-being, and enhancing quality of life. Because CPTP is a heterogeneous condition involving neuropathic, nociceptive, inflammatory, and psychosocial mechanisms, treatment should be tailored according to the underlying pain subtype, severity, comorbidities, and patient-specific characteristics. A comprehensive management strategy integrating pharmacological therapy, physical rehabilitation, psychological interventions, minimally invasive procedures, and surgical treatment when indicated is recommended.

4.2. Pharmacological Management (Table 2)

Drug therapy remains the cornerstone of CPTP management. For neuropathic post-traumatic pain, first-line pharmacological options include calcium-channel α2δ ligands such as gabapentin and pregabalin, together with topical agents including 5% lidocaine patches where appropriate. Depending on the pain mechanism and clinical presentation, additional agents, including antidepressants, anticonvulsants, topical analgesics, or combination therapy, may also be considered. For musculoskeletal post-traumatic pain, non-steroidal anti-inflammatory drugs (NSAIDs) remain the preferred first-line medications. Topical NSAIDs are recommended whenever appropriate because they provide effective analgesia while minimizing systemic adverse effects. Acetaminophen may be used for mild pain, whereas individualized multimodal analgesia should be considered for moderate-to-severe pain. bPharmacological treatment should be regularly reassessed to maximize efficacy while minimizing adverse reactions, drug tolerance, and long-term dependence.

Table 2. *Pharmacological treatment of chronic post-traumatic pain.*

Pain Type	Medication	Evidence Level	Recommendation Strength
Chronic pain following peripheral nerve injury	Gabapentin [39]	A	1
	Mirogabalin [40, 41]	A	1

Pain Type	Medication	Evidence Level	Recommendation Strength
Chronic pain following spinal cord injury	5% Lidocaine patch [42]	A	2
	Bulleyaconitine A [43]	A	1
	Dexamethasone palmitate [44, 45]	B	1
	Pregabalin [46-52]	A	1
	Gabapentin [46-49, 52]	A	1
	Mirogabalin [53]	A	1
	8% Capsaicin patch [54]	B	2
	Botulinum toxin type A [52, 55, 56]	B	2
	Intrathecal baclofen [57]	B	2
Chronic pain following whiplash injury	Duloxetine [52]	A	1
	Pregabalin [58]	A	1
	Loxoprofen sodium patch [59]	A	1
	Topical NSAIDs [60]	B	1
Chronic pain after musculoskeletal injury	Acetaminophen [61]	B	2
	5% Lidocaine patch [62]	B	2
	Huoxue Zhitong soft capsules [63]	A	1
	Xuanqi Jiangu tablets [64]	A	1
	Tetrandrine tablets [65, 66]	B	1
	Compound Fushang Tong capsules [67, 68]	B	2

4.3. Physical Rehabilitation (Table 3)

Physical rehabilitation represents an essential component of CPTP management. Evidence supports the use of individualized rehabilitation programs, such as therapeutic exercise, stretching and range-of-motion training, muscle strengthening, functional rehabilitation, manual therapy, transcutaneous electrical nerve stimulation (TENS), repetitive transcranial magnetic stimulation (rTMS), non-invasive brain stimulation, and other evidence-based physiotherapy interventions. Early rehabilitation is strongly encouraged to improve physical function, reduce disability, and prevent chronic pain progression.

Table 3. *Physical therapy for chronic post-traumatic pain.*

Pain Type	Physical Therapy Modality	Evidence Level	Recommendation Strength
Chronic pain following peripheral nerve injury	Repetitive transcranial magnetic stimulation (rTMS) [69]	B	2
	Transcranial direct current stimulation (tDCS) [69]	B	2
Chronic pain following spinal cord injury	Transcutaneous electrical nerve stimulation (TENS) [70, 71]	A	1
	Non-invasive brain stimulation (NIBS) [72]	B	2
	Transcranial electrical stimulation (TES) [73]	B	2
	Repetitive transcranial magnetic stimulation	A	2

Pain Type	Physical Therapy Modality	Evidence Level	Recommendation Strength
	(rTMS) [74]		
	Exercise [75, 76]	A	1
	Mirror therapy [71]	B	2
	Transcranial magnetic stimulation (TMS) [77]	B	2
Chronic pain following traumatic brain injury	Repetitive transcranial magnetic stimulation (rTMS) [78-80]	B	2
	Hyperbaric oxygen therapy [81]	B	1
Chronic pain following whiplash injury	Specific neck exercises [82, 83]	B	2
	Exercise [84]	B	2

4.4. Minimally Invasive Interventional Therapy (Table 4) [85-88]

Interventional pain management should be considered in patients who obtain insufficient pain relief with conservative treatment.

Table 4. *Minimally Invasive Interventions for Chronic Post-Traumatic Pain.*

Pain subtype	Intervention	Level of Evidence	Strength of Recommendation
Chronic pain following peripheral nerve injury	Dorsal root ganglion (DRG) neuromodulation	B	Strong (Grade 1)
Chronic pain following peripheral nerve injury	Peripheral nerve stimulation (PNS)	A	Strong (Grade 1)
Chronic pain following whiplash injury	Radiofrequency neurotomy	B	Moderate (Grade 2)
Chronic pain following whiplash injury	Nerve block	B	Strong (Grade 1)

4.5. Other Non-pharmacological Therapies (Table 5) [89-105]

A variety of adjunctive non-pharmacological therapies have demonstrated clinical benefit for selected CPTP subtypes.

Table 5. *Other Therapeutic Modalities for Chronic Post-Traumatic Pain.*

Pain subtype	Recommended therapy	Evidence	Recommendation
Chronic pain after burn injury	Virtual reality (VR) therapy	A	Grade 2
	Hypnosis	C	Grade 2
	Distraction therapy	A	Grade 2
	Aromatherapy	C	Grade 2
Chronic pain following spinal cord injury	Virtual reality (VR)	B	Grade 1
	Cognitive behavioral therapy (CBT)	B	Grade 1
	Mindfulness-based therapy	B	Grade 2
	Meditation and guided imagery (CMI)	B	Grade 2
	Music therapy	C	Grade 2
	Acupuncture	B	Grade 1

Pain subtype	Recommended therapy	Evidence	Recommendation
Chronic pain following traumatic brain injury	Virtual reality (VR)	B	Grade 2
	Acupuncture	B	Grade 1
Chronic pain following whiplash injury	Cognitive behavioral intervention	B	Grade 2
Chronic pain after musculoskeletal injury	Hypnosis	B	Grade 2

4.6. Surgical Management (Table 6) [106-108]

Surgical intervention should be reserved for carefully selected patients in whom comprehensive conservative treatment has failed and who have well-defined structural or neurological indications.

Table 6. Surgical Treatment for Chronic Post-Traumatic Pain.

Pain subtype	Surgical procedure	Evidence	Recommendation
Chronic pain following peripheral nerve injury	Dorsal Root Entry Zone (DREZ) lesioning	B	Grade 2
Chronic pain following spinal cord injury	Dorsal Root Entry Zone (DREZ) lesioning	B	Grade 2
Chronic pain following whiplash injury	Cervical spinal fusion	B	Grade 2

5. Prevention and Health Education

Prevention and patient education constitute indispensable components of CPTP management. Effective prevention requires early identification of high-risk individuals, prompt and adequate pain control following trauma, standardized rehabilitation, and continuous multidisciplinary follow-up. Patients should receive education regarding the importance of maintaining regular physical activity, participating in individualized functional rehabilitation programs, preventing recurrent injuries, and adhering to prescribed treatment and rehabilitation plans. For example, patients with chronic post-traumatic headache following traumatic brain injury should be advised to avoid factors known to exacerbate headache symptoms, including fatigue, exposure to cold, and emotional stress. In addition, psychological interventions—including cognitive behavioral therapy (CBT), mindfulness-based therapy, acceptance and commitment therapy (ACT), and exercise-based rehabilitation—may facilitate functional recovery and improve long-term outcomes. Overall, appropriate preventive strategies and comprehensive health education contribute substantially to rehabilitation and quality of life in patients with chronic post-traumatic pain.

Abbreviations

ACT	Acceptance and Commitment Therapy
CBT	Cognitive Behavioral Therapy
CMI	Meditation and Guided Imagery
CPABI	Chronic Pain After Burn Injury
CPAMSI	Chronic Pain After Musculoskeletal Injury
CPTP	Chronic Post-traumatic Pain
CRPS	Complex Regional Pain Syndrome
DREZ	Dorsal Root Entry Zone
DRG	Dorsal Root Ganglion
GRADE	Grading of Recommendations Assessment, Development and Evaluation
ICD-11	International Classification of Diseases, 11th Revision
IL-1β	Interleukin-1β
ISCIP	International Spinal Cord Injury Pain
NIBS	Non-invasive Brain Stimulation
NSAIDs	Non-steroidal Anti-inflammatory Drugs
PNS	Peripheral Nerve Stimulation
PTSD	Post-traumatic Stress Disorder
RCTs	Randomized Controlled Trials
rTMS	Repetitive Transcranial Magnetic Stimulation
SCI	Spinal Cord Injury
TBI	Traumatic Brain Injury
tDCS	Transcranial Direct Current Stimulation

TENS	Transcutaneous Electrical Nerve Stimulation
TES	Transcranial Electrical Stimulation
TMJ	Temporomandibular Joint
TMS	Transcranial Magnetic Stimulation
TNF-α	Tumor Necrosis Factor-α
VR	Virtual Reality

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Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Schug SA, Lavand'homme P, Barke A, et al. IASP taskforce for the classification of chronic pain. The IASP classification of chronic pain for ICD-11: chronic postsurgical or posttraumatic pain [J]. Pain, 2019, 160(1): 45-52. https://doi.org/10.1097/j.pain.0000000000001413

[2] Xing D, Yu NS, Zhang CQ. Interpretation and methodological evaluation of the recommendations in the "Clinical Practice Guideline for the Treatment of Knee Osteoarthritis with Intra-articular Injection of Platelet-Rich Plasma (2018 Edition)" [J]. Chinese Journal of Joint Surgery (Electronic Edition), 2018, 12(4): 6-10. https://doi.org/10.3877/cma.j.issn.1674-134X.2018.04.002

[3] Moldovan M, Alvarez S, Romer Rosberg M, et al. Axonal voltage-gated ion channels as pharmacological targets for pain [J]. Eur J Pharmacol, 2013, 708(1-3): 105-112. https://doi.org/10.1016/j.ejphar.2013.03.001

[4] Kuner R, Flor H. Structural plasticity and reorganisation in chronic pain [J]. Nat Rev Neurosci, 2016, 18(1): 20-30. https://doi.org/10.1038/nrn.2016.162

[5] Liu Y, Zhou LJ, Wang J, et al. TNF-α differentially regulates synaptic plasticity in the hippocampus and spinal cord by microglia-dependent mechanisms after peripheral nerve injury [J]. J Neurosci, 2017, 37(4): 871-881. https://doi.org/10.1523/JNEUROSCI.2235-16.2016

[6] Ossipov MH, Morimura K, Porreca F. Descending pain modulation and chronification of pain [J]. Curr Opin Support Palliat Care, 2014, 8(2): 143-151. https://doi.org/10.1097/SPC.0000000000000055

[7] Ong WY, Stohler CS, Herr DR. Role of the prefrontal cortex in pain processing [J]. Mol Neurobiol, 2019, 56(2): 1137-1166. https://doi.org/10.1007/s12035-018-1130-9

[8] Liu XG. Normalization of neuroinflammation: a new strategy for treatment of persistent pain and memory/emotional deficits in chronic pain [J]. J Inflamm Res, 2022, 15: 5201-5233. https://doi.org/10.2147/JIR.S379093

[9] Editorial Board of the Chinese Journal of Burns. Guidelines for pain management in adult burn patients (2013 Edition) [J]. Chinese Journal of Burns, 2013, 29(3): 225-231. https://doi.org/10.3760/cma.j.issn.1009-2587.2013.03.002

[10] Feng Y, Xu JJ, Lin XQ, et al. Chronic postsurgical or posttraumatic pain [J]. Chinese Journal of Pain Medicine, 2021, 27(4): 241-245. https://doi.org/10.3969/j.issn.1006-9852.2021.04.001

[11] Klifto KM, Hultman CS, Dellon AL. Nerve pain after burn injury: a proposed etiology-based classification [J]. Plast Reconstr Surg, 2021, 147(3): 635-644. https://doi.org/10.1097/PRS.0000000000007639

[12] Liu LB, Zhong YH. Research progress on influencing factors of chronic pain after burns [J]. Journal of Nurses Training, 2021, 36(21): 1958-1961. https://doi.org/10.16821/j.cnki.hsjx.2021.21.008

[13] Wang ML, Rivlin M, Graham JG, et al. Peripheral nerve injury, scarring, and recovery [J]. Connect Tissue Res, 2019, 60(1): 3-9. https://doi.org/10.1080/03008207.2018.1489381

[14] Scholz J, Finnerup NB, Attal N, et al. Classification committee of the neuropathic pain special interest group (neuPSIG), the IASP classification of chronic pain for ICD-11: chronic neuropathic pain [J]. Pain, 2019, 160(1): 53-59. https://doi.org/10.1097/j.pain.0000000000001365

[15] Aziguli Aji, Wu ZY, Chen X, et al. Correlation between painful neuropathy and peripheral nerve conduction velocity in patients with type 2 diabetes mellitus [J]. Chinese Journal of Pain Medicine, 2023, 29(3): 219-225. https://doi.org/10.3969/j.issn.1006-9852.2023.03.010

[16] Bouhassira D. Neuropathic pain: definition, assessment and epidemiology [J]. Rev Neurol (Paris), 2019, 175(1-2): 16-25. https://doi.org/10.1016/j.neurol.2018.09.016

[17] Cohen SP, Vase L, Hooten WM. Chronic pain: an update on burden, best practices, and new advances [J]. Lancet, 2021, 397(10289): 2082-2097. https://doi.org/10.1016/S0140-6736(21)00393-7

[18] Dijkers MP, Bryce TN. Introducing the international spinal cord injury pain (ISCIP) classification [J]. Pain Manag, 2012, 2(4): 311-314. https://doi.org/10.2217/pmt.12.35

[19] Zhao HX, Zhang JR. Discussion on the classification of pain after spinal cord injury [J]. Chinese Journal of Rehabilitation, 2015(3): 225-228. https://doi.org/10.3870/zgkf.2015.03.022

[20] Siddall PJ, McClelland JM, Rutkowski SB, et al. A longitudinal study of the prevalence and characteristics of pain in the first 5 years following spinal cord injury [J]. Pain, 2003, 103(3): 249-257. https://doi.org/10.1016/S0304-3959(02)00452-9

[21] Hunt C, Moman R, Peterson A, et al. Prevalence of chronic pain after spinal cord injury: a systematic review and meta-analysis [J]. Reg Anesth Pain Med, 2021, 46(4): 328-336. https://doi.org/10.1136/rapm-2020-101960

[22] Hatch MN, Cushing TR, Carlson GD, et al. Neuropathic pain and SCI: identification and treatment strategies in the 21st century [J]. J Neurol Sci, 2018, 384: 75-83. https://doi.org/10.1016/j.jns.2017.11.018

[23] Majedi H, Safdarian M, Hajiaghahbaei M, et al. Characteristics of neuropathic pain in individuals with chronic spinal cord injury [J]. Neurosciences (Riyadh), 2018, 23(4): 292-300. https://doi.org/10.17712/nsj.2018.4.20180223

[24] Rosner J, Negraff M, Belanger LM, et al. Characterization of hyperacute neuropathic pain after spinal cord injury: a prospective study [J]. J Pain, 2022, 23(1): 89-97. https://doi.org/10.1016/j.jpain.2021.06.013

[25] Grandhi R, Tavakoli S, Ortega C, et al. A review of chronic pain and cognitive, mood, and motor dysfunction following mild traumatic brain injury: complex, comorbid, and/or overlapping conditions? [J]. Brain Sci, 2017, 7(12): 160. https://doi.org/10.3390/brainsci7120160

[26] Robayo LE, Govind V, Vastano R, et al. Multidimensional pain phenotypes after traumatic brain injury [J]. Front Pain Res (Lausanne), 2022, 3: 947562. https://doi.org/10.3389/fpain.2022.947562

[27] Leung A. Addressing chronic persistent headaches after MTBI as a neuropathic pain state [J]. J Headache Pain, 2020, 21(1): 77. https://doi.org/10.1186/s10194-020-01133-2

[28] Ashina H, Iljazi A, Al-Khazali HM, et al. Persistent post-traumatic headache attributed to mild traumatic brain injury: deep phenotyping and treatment patterns [J]. Cephalalgia, 2020, 40(6): 554-564. https://doi.org/10.1177/0333102420909865

[29] O'Neil ME, Carlson KF, Holmer HK, et al. Chronic pain in veterans and servicemembers with a history of mild traumatic brain injury: a systematic review [Internet]. Washington (DC): Department of Veterans Affairs (US), 2020.

[30] Park AL, Hwang EH, Hwang MS, et al. Cost-effectiveness of Chuna Manual Therapy and usual care, compared with usual care only for people with neck pain following traffic accidents: a multicenter randomized controlled trial [J]. Int J Environ Res Public Health, 2021, 18(19): 9994. https://doi.org/10.3390/ijerph18199994

[31] Qiu H, Suo FJ, Cao CF, et al. Research progress of whiplash injury [J]. Journal of Cervicodynia and Lumbodynia, 2015, 36(6): 508-510. https://doi.org/10.3969/j.issn.1005-7234.2015.06.003

[32] Cooper G, Bailey B, Bogduk N. Cervical zygapophysial joint pain maps [J]. Pain Med, 2007, 8(4): 344-353. https://doi.org/10.1111/j.1526-4637.2006.00201.x

[33] Bogduk N. On cervical zygapophysial joint pain after whiplash [J]. Spine (Phila Pa 1976), 2011, 36(25 Suppl): S194-199. https://doi.org/10.1097/BRS.0b013e3182387f1d

[34] Friesgaard KD, Gromov K, Knudsen LF, et al. Persistent pain is common 1 year after ankle and wrist fracture surgery: a register-based questionnaire study [J]. Br J Anaesth, 2016, 116(5): 655-661. https://doi.org/10.1093/bja/aew069

[35] Pierik JG, IJzerman MJ, Gaakeer MI, et al. Incidence and prognostic factors of chronic pain after isolated musculoskeletal extremity injury [J]. Eur J Pain, 2016, 20(5): 711-722. https://doi.org/10.1002/ejp.796

[36] Alkassabi O, Voogt L, Andrews P, et al. Risk factors to persistent pain following musculoskeletal injuries: a systematic literature review [J]. Int J Environ Res Public Health, 2022, 19(15): 9318. https://doi.org/10.3390/ijerph19159318

[37] El-Tallaay SN, Nalamasu R, Salem GI, et al. Management of musculoskeletal pain: an update with emphasis on chronic musculoskeletal pain [J]. Pain Ther, 2021, 10(1): 181-209. https://doi.org/10.1007/s40122-021-00235-2

[38] Zhao Y, Zhang H, Li N, et al. Chronic pain after bone fracture: Current insights into molecular mechanisms and therapeutic strategies [J]. Brain Sci, 2022, 12(8): 1056. https://doi.org/10.3390/brainsci12081056

[39] Gordh TE, Stubhaug A, Jensen TS, et al. Gabapentin in traumatic nerve injury pain: a randomized, double-blind, placebo-controlled, cross-over, multi-center study [J]. Pain, 2008, 138(2): 255-266. https://doi.org/10.1016/j.pain.2007.12.011

[40] Kimura Y, Yamaguchi S, Suzuki T, et al. Switching from pregabalin to mirogabalin in patients with peripheral neuropathic pain: a multi-center, prospective, single-arm, open-label study (MIROP Study) [J]. Pain Ther, 2021, 10(1): 711-727. https://doi.org/10.1007/s40122-021-00255-y

[41] Nikaido T, Takatsuna H, Tabata S, et al. Efficacy and safety of add-on mirogabalin to NSAIDs in lumbar spinal stenosis with peripheral neuropathic pain: a randomized, open-label study [J]. Pain Ther, 2022, 11(4): 1195-1214. https://doi.org/10.1007/s40122-022-00410-z

[42] Correa-Illanes G, Roa R, Piñeros JL, et al. Use of 5% lidocaine medicated plaster to treat localized neuropathic pain secondary to traumatic injury of peripheral nerves [J]. Local Reg Anesth, 2012, 5: 47-53. https://doi.org/10.2147/LRA.S31868

[43] Xiao H, Ma K, Huang D, et al. Expert consensus of the Chinese Association for the Study of Pain on the clinical use of bulleyaconitine A [J]. Pain Ther, 2022, 11(4): 1121-1137.

[44] Chinese Society of Pain Medicine, Chinese Medical Association. Expert consensus on the use of dexamethasone palmitate for peripheral neuropathic pain [J]. National Medical Journal of China, 2019, 99(15): 1133-1137. https://doi.org/10.3760/cma.j.issn.0376-2491.2019.15.003

[45] Qiao CF, Yang ZL, Chen JT, et al. Clinical study of epidural injection of dexamethasone palmitate for cervical radiculopathy [J]. Journal of Practical Painology, 2013, 9(2): 109-112. https://doi.org/10.3969/j.issn.1672-9633.2013.02.007

[46] Davari M, Amani B, Amani B, et al. Pregabalin and gabapentin in neuropathic pain management after spinal cord injury: a systematic review and meta-analysis [J]. Korean J Pain, 2020, 33(1): 3-12. https://doi.org/10.3344/kjp.2020.33.1.3

[47] Asgardoon MH, Jazayeri SB, Behkara A, et al. Pharmacologic therapies of pain in patients with spinal cord injury: a systematic review [J]. Spinal Cord Ser Cases, 2022, 8(1): 65. https://doi.org/10.1038/s41394-022-00529-3

[48] Tong C, Zhengyao Z, Mei L, et al. Pregabalin and gabapentin in patients with spinal cord injury-related neuropathic pain: a network meta-analysis [J]. Pain Ther, 2021, 10(2): 1497-1509. https://doi.org/10.1007/s40122-021-00302-8

[49] Mei L, Fengqun M, Zhengyao Z, et al. Efficacy and safety of different drug treatments in patients with spinal-cord injury-related neuropathic pain: a network meta-analysis [J]. Spinal Cord, 2022, 60(11): 943-953. https://doi.org/10.1038/s41393-022-00804-y

[50] Onakpoya IJ, Thomas ET, Lee JJ, et al. Benefits and harms of pregabalin in the management of neuropathic pain: a rapid review and meta-analysis of randomised clinical trials [J]. BMJ Open, 2019, 9(1): e023600. https://doi.org/10.1136/bmjopen-2018-023600

[51] Canavan C, Inoue T, McMahon S, et al. The efficacy, adverse events, and withdrawal rates of the pharmacological management of chronic spinal cord injury pain: a systematic review and meta-analysis [J]. Pain Med, 2022, 23(2): 375-395. https://doi.org/10.1093/pm/pnab140

[52] Ling HQ, Chen ZH, He L, et al. Comparative efficacy and safety of 11 drugs as therapies for adults with neuropathic pain after spinal cord injury: a Bayesian network analysis based on 20 randomized controlled trials [J]. Front Neurol, 2022, 13: 818522. https://doi.org/10.3389/fneur.2022.818522

[53] Ushida T, Katayama Y, Hiasa Y, et al. Mirogabalin for central neuropathic pain after spinal cord injury: a randomized, double-blind, placebo-controlled, phase 3 study in Asia [J]. Neurology, 2023, 100(11): e1193-e1206. https://doi.org/10.1212/WNL.0000000000201709

[54] Olusanya A, Yearsley A, Brown N, et al. Capsaicin 8% patch for spinal cord injury focal neuropathic pain, a randomized controlled trial [J]. Pain Med, 2023, 24(1): 71-78. https://doi.org/10.1093/pm/pnac104

[55] Han ZA, Song DH, Oh HM, et al. Botulinum toxin type A for neuropathic pain in patients with spinal cord injury [J]. Ann Neurol, 2016, 79(4): 569-578. https://doi.org/10.1002/ana.24605

[56] Li G, Lv CA, Tian L, et al. A randomized controlled trial of botulinum toxin A for treating neuropathic pain in patients with spinal cord injury [J]. Medicine (Baltimore), 2017, 96(20): e6919. https://doi.org/10.1097/MD.0000000000006919

[57] Kumru H, Benito-Penalva J, Kofler M, et al. Analgesic effect of intrathecal baclofen bolus on neuropathic pain in spinal cord injury patients [J]. Brain Res Bull, 2018, 140: 205-211. https://doi.org/10.1016/j.brainresbull.2018.05.013

[58] Nikles J, Keijzers G, Mitchell G, et al. Pregabalin vs placebo to prevent chronic pain after whiplash injury in at-risk individuals: results of a feasibility study for a large randomised controlled trial [J]. Pain, 2022, 163(2): e274-e284. https://doi.org/10.1097/j.pain.0000000000002362

[59] Zhao D, Chen Z, Hu S, et al. Efficacy and safety of loxoprofen hydrogel transdermal patch versus loxoprofen tablet in Chinese patients with myalgia: a double-blind, double-dummy, parallel-group, randomized, controlled, non-inferiority trial [J]. Clin Drug Investig, 2019, 39(4): 369-377. https://doi.org/10.1007/s40261-019-00756-x

[60] Shi C, Ye Z, Shao Z, et al. Multidisciplinary guidelines for the rational use of topical non-steroidal anti-inflammatory drugs for musculoskeletal pain (2022) [J]. J Clin Med, 2023, 12(4): 1544. https://doi.org/10.3390/jcm12041544

[61] Freo U, Ruocco C, Valerio A, et al. Paracetamol: a review of guideline recommendations [J]. J Clin Med, 2021, 10(15): 3420. https://doi.org/10.3390/jcm10153420

[62] Hans G, Joukes E, Verhulst J, et al. Management of neuropathic pain after surgical and non-surgical trauma with lidocaine 5% patches: study of 40 consecutive cases [J]. Curr Med Res Opin, 2009, 25(11): 2737-2743. https://doi.org/10.1185/03007990903282297

[63] Shi GY, Zhang WA, Dong JW, et al. Multicenter clinical study of Huoxue Zhitong soft capsules in the treatment of chronic soft tissue injury (qi stagnation and blood stasis syndrome) [J]. China's Naturopathy, 2018, 26(13): 30-32. https://doi.org/10.19621/j.cnki.11-3555/r.2018.1318

[64] National Medical Products Administration. 2021 Annual Drug Evaluation Report [EB/OL]. (2022-06-01): https://www.nmpa.gov.cn/xxgk/lfwj/gzwj/gzwjyp/20220601110541120.html

[65] Chinese Aging Well Association. Expert consensus on the diagnosis and treatment of chronic musculoskeletal pain [J]. Orthopedics, 2021, 12(5): 389-395. https://doi.org/10.3969/j.issn.1674-8573.2021.05.001

[66] Wei W, Zhu YJ, Gao GD. A controlled study on efficacy and safety of tetrandrine tablets combined with diclofenac sodium tablets in the treatment of osteoarthritis [J]. Chinese Journal of Primary Medicine and Pharmacy, 2018, 25(13): 1724-1728. https://doi.org/10.3760/cma.j.issn.1008-6706.2018.13.024

[67] Li D, Dong XJ, Cheng H, et al. Treatment of 35 cases of traumatic knee synovitis with Compound Fushangtong Capsules [J]. Chinese Journal of Traditional Medical Traumatology & Orthopedics, 2016, 24(9): 22-24.

[68] Zhang ZC, Mao DR, Zhang LL. Clinical observation of Compound Fushangtong Capsules in promoting fracture healing [J]. Contemporary Medicine, 2018, 24(4): 29-31. https://doi.org/10.3969/j.issn.1009-4393.2018.04.012

[69] Bonifacio de Assis ED, Martins WKN, de Carvalho CD, et al. Effects of rTMS and tDCS on neuropathic pain after brachial plexus injury: a randomized placebo-controlled pilot study [J]. Sci Rep, 2022, 12(1): 1440. https://doi.org/10.1038/s41598-022-05254-3

[70] Yang Y, Tang Y, Qin H, et al. Efficacy of transcutaneous electrical nerve stimulation in people with pain after spinal cord injury: a meta-analysis [J]. Spinal Cord, 2022, 60(5): 375-381. https://doi.org/10.1038/s41393-022-00776-z

[71] Kannan P, Bello UM, Winser SJ. Physiotherapy interventions may relieve pain in individuals with central neuropathic pain: a systematic review and meta-analysis of randomised controlled trials [J]. Ther Adv Chronic Dis, 2022, 13: 20406223221078672. https://doi.org/10.1177/20406223221078672

[72] Li L, Huang H, Yu Y, et al. Non-invasive brain stimulation for neuropathic pain after spinal cord injury: a systematic review and network meta-analysis [J]. Front Neurosci, 2022, 15: 800560. https://doi.org/10.3389/fnins.2021.800560

[73] Mehta S, Orenczuk K, McIntyre A, et al. Neuropathic pain post spinal cord injury part 1: systematic review of physical and behavioral treatment [J]. Top Spinal Cord Inj Rehabil, 2013, 19(1): 61-77. https://doi.org/10.1310/scj1901-61

[74] Saleh C, Ilia TS, Jaszczuk P, et al. Is transcranial magnetic stimulation as treatment for neuropathic pain in patients with spinal cord injury efficient? A systematic review [J]. Neurol Sci, 2022, 43(5): 3007-3018. https://doi.org/10.1007/s10072-022-05978-0

[75] Todd KR, Lawrason SVC, Shaw RB, et al. Physical activity interventions, chronic pain, and subjective well-being among persons with spinal cord injury: a systematic scoping review [J]. Spinal Cord, 2021, 59(2): 93-104. https://doi.org/10.1038/s41393-020-00550-z

[76] Zhang YH, Hu HY, Xiong YC, et al. Exercise for neuropathic pain: a systematic review and expert consensus [J]. Front Med (Lausanne), 2021, 8: 756940. https://doi.org/10.3389/fmed.2021.756940

[77] Leung A, Shirvankar P, Chen R, et al. Transcranial magnetic stimulation for pain, headache, and comorbid depression: INS-NANS expert consensus panel review and recommendation [J]. Neuromodulation, 2020, 23(3): 267-290. https://doi.org/10.1111/ner.13094

[78] Li X, Lu T, Yu H, et al. Repetitive transcranial magnetic stimulation for neuropathic pain and neuropsychiatric symptoms in traumatic brain injury: a systematic review and meta-analysis [J]. Neural Plast, 2022, 2022: 2036736. https://doi.org/10.1155/2022/2036736

[79] Choi GS, Kwak SG, Lee HD, et al. Effect of high-frequency repetitive transcranial magnetic stimulation on chronic central pain after mild traumatic brain injury: a pilot study [J]. J Rehabil Med, 2018, 50(3): 246-252. https://doi.org/10.2340/16501977-2321

[80] Leung A, Shukla S, Fallah A, et al. Repetitive transcranial magnetic stimulation in managing mild traumatic brain injury-related headaches [J]. Neuromodulation, 2016, 19(2): 133-141. https://doi.org/10.1111/ner.12364

[81] Ablin JN, Lang E, Catalogna M, et al. Hyperbaric oxygen therapy compared to pharmacological intervention in fibromyalgia patients following traumatic brain injury: a randomized, controlled trial [J]. PLoS One, 2023, 18(3): e0282406. https://doi.org/10.1371/journal.pone.0282406

[82] Landén Ludvigsson M, Peterson G, Peolsson A. Neck-specific exercise may reduce radiating pain and signs of neurological deficits in chronic whiplash - analyses of a randomized clinical trial [J]. Sci Rep, 2018, 8(1): 12409. https://doi.org/10.1038/s41598-018-30556-w

[83] Ludvigsson ML, Peterson G, Peolsson A. Neck-specific exercise for radiating pain and neurological deficits in chronic whiplash, a 1-year follow-up of a randomised clinical trial [J]. Sci Rep, 2020, 10(1): 6758. https://doi.org/10.1038/s41598-020-62722-4

[84] Chrcanovic B, Larsson J, Malmström EM, et al. Exercise therapy for whiplash-associated disorders: a systematic review and meta-analysis [J]. Scand J Pain, 2021, 22(2): 232-261. https://doi.org/10.1515/sjpain-2021-0064

[85] Kretzschmar M, Reining M, Schwarz MA. Three-year outcomes after dorsal root ganglion stimulation in the treatment of neuropathic pain after peripheral nerve injury of upper and lower extremities [J]. Neuromodulation, 2021, 24(4): 700-707. https://doi.org/10.1111/ner.13222

[86] Helm S, Shirsat N, Calodney A, et al. Peripheral nerve stimulation for chronic pain: a systematic review of effectiveness and safety [J]. Pain Ther, 2021, 10(2): 985-1002. https://doi.org/10.1007/s40122-021-00306-4

[87] Curatolo M. Pharmacological and interventional management of pain after whiplash injury [J]. J Orthop Sports Phys Ther, 2016, 46(10): 845-850. https://doi.org/10.2519/jospt.2016.6906

[88] Lord SM, Barnsley L, Wallis BJ, et al. Chronic cervical zygapophysial joint pain after whiplash. A placebo-controlled prevalence study [J]. Spine (Phila Pa 1976), 1996, 21(15): 1737-1744; discussion 1744-1745. https://doi.org/10.1097/00007632-199608010-00005

[89] Gillum M, Huang S, Kuromaru Y, et al. Nonpharmacologic management of procedural pain in pediatric burn patients: a systematic review of randomized controlled trials [J]. J Burn Care Res, 2022, 43(2): 368-373. https://doi.org/10.1093/jbcr/irab167

[90] Garrido-Ardila EM, Santos-Dom ńguez M, Rodr ǵuez-Mansilla J, et al. A systematic review of the effectiveness of virtual reality-based interventions on pain and range of joint movement associated with burn injuries [J]. J Pers Med, 2022, 12(8): 1269. https://doi.org/10.3390/jpm12081269

[91] Norouzkhani N, Chaghian Arani R, Mehrabi H, et al. Effect of virtual reality-based interventions on pain during wound care in burn patients; a systematic review and meta-analysis [J]. Arch Acad Emerg Med, 2022, 10(1): e84. https://doi.org/10.22037/aaem.v10i1.1756

[92] Proven ҫal SC, Bond S, Rizkallah E, et al. Hypnosis for burn wound care pain and anxiety: a systematic review and meta-analysis [J]. Burns, 2018, 44(8): 1870-1881. https://doi.org/10.1016/j.burns.2018.04.017

[93] Ma HZ, Zhang J, Yao M, et al. Effects of aromatherapy on pain, anxiety and sleep in adult burn patients: a meta-analysis [J]. Chinese Evidence-Based Nursing, 2022, 8(24): 3303-3307. https://doi.org/10.12102/j.issn.2095-8668.2022.24.006

[94] Chi B, Chau B, Yeo E, et al. Virtual reality for spinal cord injury-associated neuropathic pain: systematic review [J]. Ann Phys Rehabil Med, 2019, 62(1): 49-57. https://doi.org/10.1016/j.rehab.2018.09.006

[95] Tran Y, Austin P, Lo C, et al. An exploratory EEG analysis on the effects of virtual reality in people with neuropathic pain following spinal cord injury [J]. Sensors (Basel), 2022, 22(7): 2629. https://doi.org/10.3390/s22072629

[96] Burke D, Lennon O, Blake C, et al. An internet-delivered cognitive behavioural therapy pain management programme for spinal cord injury pain: a randomized controlled trial [J]. Eur J Pain, 2019, 23(7): 1264-1282. https://doi.org/10.1002/ejp.1402

[97] Hearn JH, Cross A. Mindfulness for pain, depression, anxiety, and quality of life in people with spinal cord injury: a systematic review [J]. BMC Neurol, 2020, 20(1): 32. https://doi.org/10.1186/s12883-020-1619-5

[98] Hearn JH, Finlay KA. Internet-delivered mindfulness for people with depression and chronic pain following spinal cord injury: a randomized, controlled feasibility trial [J]. Spinal Cord, 2018, 56(8): 750-761. https://doi.org/10.1038/s41393-018-0090-2

[99] Zanca JM, Gilchrist C, Ortiz CE, et al. Pilot clinical trial of a clinical meditation and imagery intervention for chronic pain after spinal cord injury [J]. J Spinal Cord Med, 2022, 45(3): 339-353. https://doi.org/10.1080/10790268.2021.1970894

[100] Wood C, Cutshall SM, Lawson DK, et al. Music therapy for anxiety and pain after spinal cord injury: a pilot study [J]. Glob Adv Health Med, 2021, 10: 21649561211058697. https://doi.org/10.1177/21649561211058697

[101] He K, Hu R, Huang Y, et al. Effects of acupuncture on neuropathic pain induced by spinal cord injury: a systematic review and meta-analysis [J]. Evid Based Complement Alternat Med, 2022, 2022: 6297484. https://doi.org/10.1155/2022/6297484

[102] Varma A, Naqvi WM, Mulla S, et al. A systematic review of randomized controlled trials on virtual reality application in pediatric patients [J]. Cureus, 2022, 14(10): e30543. https://doi.org/10.7759/cureus.30543

[103] Sodders MD, Martin AM, Coker J, et al. Acupuncture use for pain after traumatic brain injury: a NIDILRR traumatic brain injury model systems cohort study [J]. Brain Inj, 2023, 37(6): 494-502. https://doi.org/10.1080/02699052.2023.2187088

[104] Andersen TE, Ravn SL, Mejldal A, et al. Values-based cognitive behavioural therapy for the prevention of chronic whiplash associated disorders: a randomized controlled trial [J]. Eur J Pain, 2022, 26(6): 1256-1268. https://doi.org/10.1002/ejp.1945

[105] Langlois P, Perrochon A, David R, et al. Hypnosis to manage musculoskeletal and neuropathic chronic pain: a systematic review and meta-analysis [J]. Neurosci Biobehav Rev, 2022, 135: 104591. https://doi.org/10.1016/j.neubiorev.2022.104591

[106] Liu RC, Ni B, Hu YS, et al. Efficacy and influencing factors of dorsal root entry zone lesioning for neuropathic pain after brachial plexus injury: a report of 105 cases [J]. Chinese Journal of Neurosurgery, 2020, 36(4): 385-389. https://doi.org/10.3760/cma.j.cn112050-20191010-00429

[107] Mehta S, Orenczuk K, McIntyre A, et al. Neuropathic pain post spinal cord injury part 2: systematic review of dorsal root entry zone procedure [J]. Top Spinal Cord Inj Rehabil, 2013, 19(1): 78-86. https://doi.org/10.1310/scj1901-78.

[108] Nystrom B, Svensson E, Larsson S, et al. A small group Whiplash-Associated-Disorders (WAD) patiets with central neck pain and movement induced stabbing pain, the painful segment determined by mechanical provocation: fusion surgery was superior to multimodal rehabilitation in a randomized trial [J]. Scand J Pain, 2016, 12: 33-42. https://doi.org/10.1016/j.sjpain.2016.03.003