The Evidence-Based Role of Acupuncture in Neurologic Rehabilitation.

Dr Barbara Royal *DVM, CVA, CVNN, FACVBM* **, Dr Sara Baldey** *BSc(Hons) BVSc, BVMS, CVA*

1. Introduction

Acupuncture is a branch of Traditional Chinese Medicine (TCM) which originated thousands of years ago.[1]

Today, veterinary acupuncture is used world wide and across many species such as companion animals (dogs and cats), agricultural animal (cattle and sheep), equids and avians.[2] Acupuncture is also reported in the treatment of exotic and zoo animals.

Originally based on TCM principles, modern science has been able to unveil some of the mechanisms in which acupuncture works, particularly with respect to neurophysiology.[1,3]

Acupuncture can be used to aid the treatment of companion animals with neurologic disease.[1,2] Acupuncture is a useful for its ability to reduce inflammation, promote analgesia and stimulate trophic factors for nerve repair.[4]

As part of a multimodal approach, acupuncture can be a valuable adjunctive modality in the rehabilitation of companion animals with neurologic disease.

2. What is acupuncture?

2.1 What is acupuncture?

Acupuncture involves the placement of very fine needles into specific parts of the body called acupuncture points, or 'acupoints'. This method is used to treat a wide range of health conditions and facilitate healing in the body.[2,3,5]

2.2 Composition of acupoints

Acupuncture points are typically found at superficial depressions in the skin where there is low electrical resistance and high electrical conductivity.[3] These areas are made up of free nerve endings, arterioles and venules, lymphatics and mast cells. Many of these points overlie myofascial trigger points.[5]

Acupuncture points are areas of high density innervation such as:

-somatic afferent/efferent fibres

-sympathetic (NE, norepinephrine) fibres

-parasympathetic (Ach, cholinergic acetylcholine) fibres

-increased ratio of myelinated to unmyelinated fibres compared to non-acupuncture points.[1]

From a TCM/TCVM perspective, acupuncture points are located along meridians (or channels) which run along the surface of the body and have connecting branches to the internal organs.[6] Put very simply, through the meridians flows 'Qi', (or life force). When Qi is blocked there is pain and disease.[5,6] The stimulation of acupuncture points promotes the smooth and harmonious flow of Qi in the body.[10]

In contrast, western medical acupuncture aims to restore physiologic homeostasis and utilise endogenous analgesic mechanisms.[5] From a western perspective, meridians are thought to be consistent with the peripheral nervous system and traverse fascial planes, involve the lymphatics and possibly also the interstitium.[5,7] The physiologic functions identified as common to all acupuncture points include fibroblast mechanotransduction, analgesia via neuromodulation, interaction with fascia, modification of microvasculature environments and lymphatic flow.[5,7]

2.3 Methods of acupoint stimulation

There are different methods of stimulating acupoints. Common techniques include:

- Dry needling – is the most common technique and involves the insertion of sterile needles into acupoints
- Electroacupuncture – is a modern technique and involves stimulation of inserted needles with electricity as a stronger method of point stimulation
- Aquapuncture – is the injection of sterile liquids into acupoints for prolonged stimulation of acupoints
- Moxibustion – is the heating of acupoints (either directly or over an inserted needle) by the burning of moxa (consisting of the herb Artemisia vulgaris, or mugort, bundled into a cigar-shaped stick).[1]

2.4 'De Qi' (mechanotransduction) – the inciting event

When an acupuncture needle is inserted into the skin it is manipulated to achieve "De Qi". To the patient, this may feel like an aching sensation around the needle. To the acupuncturist, this may feel like a tug or grasping of the needle.

Traditionally, De Qi is necessary for acupuncture to have a therapeutic effect. Needle grasp is due to the winding of connective tissue (fibroblasts) around the needle.

This engagement of the needle and surrounding connective tissue is the critical mechanical event which leads to biochemical signalling and the physiologic responses in the body attributable to acupuncture.[5,6]

Direct nerve stimulation at acupoints causes physiologic responses from the peripheral, central and autonomic nervous systems (Paksoy et al, 2024)

3. Acupuncture and neuroinflammation

3.1 Neural injury and neuroinflammation

There are two main processes which occur following the injury. The first is primary trauma at the site of injury which causes cell death due to stromal cellular dysfunction. This is followed by secondary tissue destruction which typically occurs down stream. Neural (Wallerian) degeneration occurs due to loss of axonal function and connectivity of neurons.[4]

Neuroinflammation: is inflammation of the nervous tissue and can occur in the central and peripheral nervous systems.[8]

Neuroinflammation which ensues from initial neural injury can exacerbate the progression of neurodegeneration[9] and lead to poorer functional recoveries.[4]

3.2 Neuroinflammation and spinal cord injury (SCI)

Neuroinflammation is modulated by chemokines and cytokines produced by astrocytes and microglia. Astrocytes: can have a restorative function in the SCI and act to preserve the blood brain barrier, stimulate glutamate absorption and limit the spread of tissue destruction. Microglia: are recognised to exacerbate neural damage by producing proinflammatory mediators, increasing free radicals and glutamate. The role of microglia in mediating neuroinflammation has been the focus of many research studies into spinal cord injury.[4]

A study by Choi *et al*, 2010, demonstrated the neuroprotective benefits of acupuncture in experimental mice models following SCI, by attenuating microglial activation and reduced expression of pro-inflammatory mediators and cytokines (TNF-a, IL-1b, MMP-9, NO synthase and COX-2). There was also significantly improved functional recovery after SCI in mice which received acupuncture, compared with control groups.[9]

Choi *et al* were able to demonstrate that acupuncture inhibits apoptotic cell death of neurons (and oligodendrocytes) by inhibiting microglial activation and thereby improving functional recovery after (SCI) injury.[9] Thus, acupuncture can reduce the development and progression of neurodegeneration by reducing neuroinflammation to enable better functional outcomes.[4]

There are no pharmacologic treatments that protect the spinal cord from secondary degeneration in veterinary patients and this is where acupuncture may potentially fill a void in treatment options.[4]

4. Acupuncture and pain

4.1 Definition of pain

As per the International Association for the Study of Pain (ISAP), pain is defined as an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage.[10]

4.2 Steps in the pain pathway

There are 4 described steps in the pain pathway:

- Transduction – conversion of noxious stimuli into pain signals at the site of the painful stimulus

- Transmission – propagation of nociceptive signals from the site of pain to the CNS
- Modulation – the regulation/alteration of pain signals within the CNS
- Perception – the conscious experience of pain, combining cognitive and emotional responses to that of the noxious stimulus[11]

Acupuncture acts on all levels of the pain pathway.[1]

4.3 Local effects of acupuncture

Acupuncture needle insertion causes the release of adenosine triphosphate (ATP) from stretched fibroblasts and keratinocytes. ATP quickly degrades to adenosine which then binds with adenosine A1 receptors, inducing a local analgesic effect. This is referred to as purinergic signalling.[12] Acupuncture can induce the degranulation of mast cells which release histamine and adenosine, which has also been shown to have an analgesic effect.

Acupuncture has effects on local nerve fibres as well as the local immune cells involved in inflammation. There is interaction between activated nerve fibres and immune cells to create both local analgesic and anti-inflammatory effects. This can be referred to as neuroimmune crosstalk. [13]

Acupuncture induces the release of endogenous opioids from lymphocytes, macrophages and granulocytes, which dampens the propagation of pain signals at peripheral nerve endings.[3,5]
There is also a decrease of inflammatory cytokines in response to these endogenous opioids.[3]
The upregulation of endogenous opioids can also up regulate the expression of TRPV1 receptors (which are important in the regulation of inflammation and pain) at peripheral nerve endings which actually impedes pain transmission locally.[5]

4.4 Spinal (or segmental) effects of acupuncture

The dorsal horn (DH) of the spinal cord is where afferent nerve fibres terminate. This is where much of the modulation of pain signals occurs. The Substantia Gelatinosa (SG) cells located in the DH control the passage of pain impulses from the periphery to the brain. Stimulation of fast A-delta fibres by acupuncture (which signal potential or actual tissue damage) leads to the stimulation of encephalinergic interneurons in the SG. These interneurons then act to inhibit ascending pain impulses coming from slow C fibres, thus blocking onward transmission of these signals.[14,15]

A-beta nerve fibres (which transmit non-painful signals such as touch) can close the SG pain gates in the DH. A high amount of signalling from A-beta fibres can block pain impulses coming from afferent A-delta and C fibres and prevent these from reaching the brain. This is referred to as the 'gate control theory'.[5]

N-methyl-d aspartate (NDMA) receptors are associated with hyperalgesia and neuropathic pain. Acupuncture decreases NDMA receptor activity in the DH by increasing levels of serotonin, noradrenaline and endogenous opioids. Serotonin in the spinal cord also enhances the ability of the inhibitory neurotransmitter gaba aminobutyric acid (GABA) to reduce the transmission of pain signals.[3,5] Acupuncture also inhibits the release of substance P in the spinal cord grey matter and down regulates TRPV1 receptor expression in the DH.[3]

4.5 Suprasegmental (or brain) effects of acupuncture

Essentially, acupuncture "tricks" the brain into mounting pain-relieving responses as though there has been significant tissue damage, when in reality there has only been microtrauma induced by needle insertion. [14,15,16]

Acupuncture signals coming from the DH of the spinal cord ascend via the spinothalamic tract to the brain. These signals affect areas of the brain such as the limbic system, periaqueductal grey (PAG) and nucleus raphe magnus (NRM). This leads to the release of various neurotransmitters (including beta-endorphins, serotonin and noradrenaline) which act both humorally and via descending inhibitory pathways to elicit analgesic effects at every spinal cord segment and throughout the body. These mechanisms are also referred to as the heterosegmental effects of acupuncture.[15]

Acupuncture can exert centrally mediated anti-inflammatory effects. This is by causing the hypothalamic-pituitary adrenal (HPA) axis to reduce COX-2 and PGE2 levels (in the DH of the spinal cord and peripherally), and by increasing the sympathetic nervous system to cause the peripheral release of opioids.[12,16]
Acupuncture also enhances the release of catecholamines from the adrenal gland which act on peripheral dopamine D1 receptors to produce systemic anti-inflammatory effects.[12, 16]

Acupuncture deactivates the limbic system (the emotional core) in the brain. This is the area of the brain associated with emotions and is overactive in chronic pain. Functional magnetic resonance imaging (MRI) studies have been able to demonstrate acupuncture mediated deactivation of the limbic system, and thus the reduced emotional component of pain.[14,15]

There is evidence to support that acupuncture can affect brain neuroplasticity. Chronic pain is considered a maladaptive change in neuroplasticity in which the CNS enables pain transmission. There is evidence to support that acupuncture can induce positive neuroplasticity in the brain, which can prevent and reverse the changes in the CNS caused by chronic pain.[3,5]

4.6 Chronic pain and emotion and cognition

Chronic pain is pain which persists or recurs and is associated with significant emotional distress or functional disability. Chronic pain will lead to maladaptive neuroplastic changes in the nervous system which amplify pain signals, and alter pain perception and emotional processing.[10]

The corticolimbic system in the brain (which is the broader regulatory network which includes limbic structures and cortical regions) incorporates pain, emotion with cognition (including decision making and memory) and involves the pre-frontal cortex, amygdala, hippocampus and is connected to the HPA axis.[10]

There is overlap in neural circuitry for pain and emotion in these areas of the brain. This is why there is often negative behaviours associated with chronic pain (hypothesised to be due to overlapping neuroplastic changes) and is why pain affects cognition/behaviour, and vice versa.[10]

And so, if we can alleviate pain, we may potentially alleviate negative behaviours associated with pain.

4.7 Neuropathic pain

Neuropathic pain: is a subcategory of chronic pain[10] and is pain caused by a primary disease or lesion which leads to damage or dysfunction of the nervous system.[17]

Chronic neuropathic pain develops due to altered sensory processing caused by abnormal peripheral input and abnormal central processing. Chronic neuropathic pain is thought to greatly diminish quality of life compared to other types of pain. History taking is important as signs of chronic neuropathic pain can be intermittent or not obvious.[17]

Common types of neuropathic pain include:

- Spontaneous Pain
- Paraesthesia (tingling, prickling)
- Dysaesthesia (unpleasant burning sensation)
- Allodynia (pain produced from a stimulus which is not normally painful, eg light touch, pain induced by a normally non-painful stimulus)
- Hyperalgesia (exaggerated pain response to normally painful stimulus)[17]

Common conditions associated with neuropathic pain include:

- IVDD
- Degenerative lumbosacral stenosis
- Meningoencephalitis (of unknown origin)
- Discospondylitis
- Trauma
- Syringomyelia

Neuropathic pain may present with the following clinical signs:

- Scratching or attacking an area of the body
- Frequent looking at the same area
- Hiding, reluctance to walk
- Yelping for no obvious reason
- Yelping when petted
- Exaggerated response to a stimuli that would normally cause mild discomfort[17]

4.8 Key mechanisms of neuropathic pain

Science has indicated the following key mechanisms involved in neuropathic pain:

- Ectopic afferent nerve activity – in which there is aberrant firing of hyperexcitable afferent nerves and along the nociceptive pathway[17]

- Peripheral sensitisation – in which there is decreased threshold and increased excitability of peripheral nociceptor terminals[17]
- Central sensitisation – in which nociceptive signals are amplified in the CNS. This occurs when abnormal nociceptive processing occurs in the DH (due to the release of excitatory molecules) enables normally innocuous tactile stimuli to cause pain. and activates second order nociceptive neurons[17]
- Pathologic activation of microglia – in which microglia in the CNS are pathologically activated and release inflammatory mediators which sensitize to neuropathic pain[17]
- Impaired inhibitory modulation – in which there is reduced centrally mediated inhibition of pain to the dorsal horn of the spinal cord[10]

Acupuncture can be used as a non-pharmacological modality in the treatment for neuropathic pain.[17]

4.9 Acupuncture studies in neuropathic pain

There are a large number of scientific models which explore the effects of electroacupuncture on neuropathic pain. These have been reviewed in a recent publication by Zhou *et al*, 2023, and include studies on:

-chronic constrictive injury

-spared nerve injury

-spinal nerve ligation

-chemotherapy induced pain

-spinal cord injury

-post herpetic neuralgia

-morphine induced hyperalgesia

-brachial plexus injury[19]

The mechanisms in which electroacupuncture can alleviate neuropathic pain is diverse, targeting multiple levels and pathways of the CNS:

- Endogenous opioid pathway: for example, via enhanced spinal and supraspinal endogenous opioid production
- Excitatory amino acid neurotransmitters: for example, via reducing the release of excitatory amino acid transmitters such as glutamate, glutamine and aspartate and promoting the release of inhibitory amino acid transmitters including glycine, GABA and taurine in the spinal cord.
- Serotonin/norepinephrine signalling pathway: for example, via regulating the levels of serotonin and norepinephrine (NE – main neurotransmitter involved in the descending inhibition of pain) in the spinal cord and brain

- Endocannabinoid system pathway: for example, by regulating the expression of CB1R receptors (reported to be found in the DRG, spinal cord and brain) which have anti-nociceptive activity
- Purinergic signalling pathway: for example, by regulating receptors involved in purinergic pain signalling
- Glial cells and cytokine signalling pathway: for example, by inhibiting spinal cord microglia and astrocyte activation and suppressing inflammatory mediator production.[19]

In another recent article by Ma *et al* (2023), who looked at human and mice studies, the authors proposed the following mechanisms for how acupuncture inhibits neuropathic pain, in relation to the sympathetic nervous system and peripheral nerve injury:

-inhibition/reduction of sympathetic nerve sprouting in the DRG which mediate pain (sympathetic nerves affect pain perception)

-inhibition of the abnormal firing of neurons which signal pain

-acts to relieve pain by acting on areas of the brain which respond to nociceptive stimuli and SNS input, eg anterior cingulate cortex (ACC), insular cortex (IC), periaqueductal gray (PAG), hypothalamus

-acts to reduce the release of inflammatory factors (eg TNF-a, IL-1b) and thereby suppressing neuronal excitability.[20]

5. Acupuncture and neuroplasticity and neuroregeneration

5.1 Acupuncture and neuroplasticity

Neuroplasticity: refers to the ability of the CNS to alter both its chemical and structural organisation in response to chronic stimulation.[3]

Chronic neuropathic pain can cause maladaptive neuroplastic changes in the CNS which facilitate pain transmission. Acupuncture combats this by inducing *beneficia*l neuroplasticity and prevents, or reverses, the changes caused by chronic neuropathic pain. This neuroprotective effect is achieved through the production of neurotransmitters, decreasing microglial activation and inflammation.[5]

In humans, following ischaemic stroke, there is spontaneous recovery and functional reconstruction of the brain which relies on neuroplastic processes. The WHO recommends acupuncture as a complimentary modality in the treatment of stroke. This is based on the ability of acupuncture to promote neuroplastic changes in the brain after stroke. In particular, acupuncture can stimulate neurogenesis, activate axonal regeneration and sprouting and improve the structure and function of synapses. These processes are related to the release of a variety of neurotrophic factors, such as brain derived neurotrophic factor (BDNF) and nerve growth factor (NGF).[21]

Neurotrophins, such as nerve growth factor (NGF), brain derived neurotrophic factor (BDNF) and neurotrophin-3 (NT-3), promote neuroplasticity which stimulate neuronal cell survival and axonal growth.[22] In the peripheral nervous system, Schwann cells play a crucial role in the regeneration of peripheral nerves after injury.[23] At the site of peripheral nerve injury, Schwann cells migrate and proliferate and release a variety of neurotrophic factors to preserve injured neurons, promote nerve fibre regeneration and re-myelination[23] and the formation of new synapses.[24] Nerve growth factor is

a neurotrophic factor produced by Schwann cells in response to nerve damage to favour axonal regeneration and connection between axons.[24]

Electroacupuncture has been shown to promote the growth of Schwann cells and increase the production of NGF and is believed to play a role strengthening new axonal connections.[24]

Electroacupuncture has been shown to increase neurotrophin-3 (NT-3) levels and promote the differentiation of transplanted mesenchymal stromal cells into oligodendrocyte-like cells and also promote remyelination and nerve conduction in the demyelinated spinal cord.[24]

In a recent study by Ji *et a*l (2023), acupuncture was shown to promote nerve regeneration in mice with sciatic nerve injury. Mice with experimentally induce sciatic nerve crush injury were treated with two acupuncture points (GB30 and GB34) daily for 6 out of 7 days for 2 weeks and then compared with control groups (mice who did not receive acupuncture)

Gait analysis showed significantly improved motor function in the mice who received acupuncture. Morphologic assessment of the sciatic nerve showed that nerve fibres were more regularly arranged and there were significantly more myelinated nerve fibres in the mice who received acupuncture. Electrophysiologic testing and immunostaining showed acupuncture significantly promoted nerve regeneration. In the mice treated with acupuncture there was also 1) significant increase in the expression of a co-factor ($P75^{NTR}$) for several neurotrophins (nerve growth factor, brain derived neurotrophic factor and neurotrophin-3 - which all regulate development, survival and plasticity of neurons, and 2) significantly increased expression of a neuronal phosphoprotein (GAP-43) – which enhances axonal regeneration and functional recovery following nerve injury.[23]

6. Acupuncture and IVDD

6.1 Acupuncture and IVDD

The major acupuncture points used in the treatment of IVDD can be based on TCVM or WMA principles. Interestingly, point selection is likely the same with respect to IVDD.

The principles of peripheral and central neuromodulation apply in the treatment of IVDD.

Treatment commonly involves the use of points along the limbs and spine.

Points can affect lymphatic flow, microvasculature environment and neuromodulation

6.2 Distal acupoints for IVDD

Distal acupoints are highly innervated. Sympathetic and sensory fibres becomes denser and finer as they move more distally along the limb. This allows enables distal acupoints to elicit a stronger autonomic response when stimulated.[7]

Lymphatic streams and channels within the interstitium of the distal limb progressively become more diffuse and disorganised, the lower along the limb. Arteriovenous anastomoses within these areas of the interstitium are involved in the movement of fluid between the microvasculature, interstitium and lymphatics. Distal points can influence the flow of lymph between these structures and regulate immunomodulation.[7]

Acupoints at the level of the elbow and stifle are where the first major lymphatic structures are found. Acupoints found at these locations generally have a stronger immunologic effect than more proximal or distal points.[7]

6.3 *Paraspinal needling for IVDD*

Paraspinal needling (needling either side of the spinal veterbrae) involves both *local* and *regional* neuromodulation. *Local* neuromodulation: occurs at *Hwato Jiaji* points which are located directly over the emerging dorsal spinal nerve arising from the relevant spinal segment being needled. *Hwato Jiaji* points are referred to as being *homo-segmental*, and are useful as a *local* treatment for acutely painful points.[7]

Regional neuromodulation: occurs at Bladder meridian acupoints (located caudolateral to the dorsal spinous process of the relevant spinal vertebrae), as needling also affects spinal nerve input 2-3 spinal segments cranial to the acupoint. For example, needling BL23 (located between L2-L3) will also treat spinal nerves from approximately T13-L1, and needling BL18 (between T10-11) will also treat spinal nerves from approximately T8-9.[7]

6.3 Common acupoints used for IVDD

GV14 is located on the midline between the dorsal spinous processes of the last cervical and the first thoracic vertebrae. GV14 is locate at the origin of the sympathetic chain and has a strong neuromodulatory effect due to interaction with autonomic innervation in this area. GV14 has significant macro-fascial effects due to its relationship with fascial sheets which penetrate the thoracic region.[7]

Yao Bai Hui is located on the dorsal midline in the depression at the lumbosacral junction. YBH is located at the terminus of the sympathetic chain and the transition to the sacral innervation, and thus has significant neuromodulatory effects. YBH has macro-fascial effects due to its relationship with the longissimus muscle group and attachment to the hips and sacrum. Due to its proximity to the sacral Bladder points, YBH can exert visceral input with urination and defaecation functions in patients.[7]

BL40 is located in the center of the popliteal fossa, (the femoral artery and vein and the tibial nerve are deep to this point). BL40 has a strong effect on lymphatic flow, and is a useful point in hindlimb paralysis cases which rely on motor activity for lymphatic flow. BL40 also has significant immune and pain modulating effects.[7]

BL11, BL18 and BL23 all emerge from the fascial plane between the longissimus and iliocostalis muscle groups. BL11 (located caudolateral to the spinous process of T1), is where the cervical muscle coalesce onto the thorax and has motor and fascial effects to the neck and forelimbs. BL18 (located caudolateral to the spinous process of T10) influences the latissimus dorsi muscle group. BL23 (located caudolateral to the spinous process of L2) influences the iliopsoas muscle as it attaches to the ventral aspect of the lumbar vertebral bodies. All three points are involved in pain modulation and can also exert visceral neuromodulation (to the lungs, liver and kidneys, respectively).[7]

KID is located in the center of the plantar surface of the hind foot, at the caudal margin of the metatarsal footpad. KID1 is a distal point and has a strong neurostimulatory effect. KID1 is located

along the fibular nerve and is a useful point when recruiting flexor groups to combat increased extensor tone in spinal patients.[7]

6.4 IVDD studies where acupuncture enhanced recovery

In an article by Hayashi *et al* (2007) involving 50 dogs with symptoms of thoracolumbar IVDD, dogs treated with acupuncture showed a significantly faster time to ambulation and deep pain perception than those not treated with acupuncture.[25]

In an article by Han *et a*l (2010), involving 80 paraplegic dogs with thoracolumbar IVDD, the combination of acupuncture and prednisolone resulted in a significantly more effective return to ambulation compared to prednisolone alone.[26]

In an article by Joaquim *et al* (2010), involving 40 paralysed dogs with IVDD, neurologic improvement was significantly higher in dogs treated with acupuncture (either alone, or in combination with hemilaminectomy) compared to dogs treated with hemilaminectomy only.[27]

In a study by Antonucci *et al* (2025), dogs receiving acupuncture and electroacupuncture techniques as part of post-operative rehabilitation following thoracolumbar hemilaminectomy for IVDD, were statistically more likely to regain ambulation. Thus, supporting the inclusion of acupuncture and electroacupuncture in rehabilitation protocols.[28]

6.5 Aacupuncture scientific studies

The use of veterinary acupuncture in other neurologic conditions is reported in the literature (cervical IVDD, cervical spondylomyelpathy, brachial nerve plexus injury. Much of the readily available published research is performed either in laboratory animals or humans.

Many of the published studies have limitations in their research design and do not meet the standards of robust scientific testing (randomised double-blind controlled prospective studies), however there are multiple challenges in designing acupuncture studies which adhere to this framework.

Limitations of acupuncture studies are acknowledged in publications and build the case for further research into the mechanisms and applications of acupuncture in neurorehabilitation.

7. Conclusion

Acupuncture can reduce neuroinflammation and the progression of neurodegeneration, leading to improved functional outcomes in the neurologic patient. Acupuncture can also reduce pain and promote positive neuroplastic changes and neuroregenerative pathways which improve tissue repair following nerve injury.

Acupuncture may be useful early in the course of neurologic disease to maximise benefits of reducing pro-inflammatory mediators and enhancing the release of plasticity promoters. Acupuncture can also be an option in cases of acute inflammation when other modalities are not yet an option. Acupuncture should be used as part of a multimodal approach to neurorehabilitation.

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