Pain After Spinal Cord Injury

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This page provides information about pain and outlines common treatments for pain after spinal cord injury (SCI).

Key points

- Pain is a common health concern after SCI.
- Pain can come from any part of the body, including the muscles, joints, organs, skin, and nerves.
- SCI-related nerve pain is called neuropathic pain, and is a common cause of chronic pain after SCI.
- There are a wide range of treatments for pain, including mind-body treatments, physical treatments, medications, and surgeries.
- Managing pain after SCI can be challenging. You may need to try several strategies before you find what works best for you.

Why is it important to know about pain after SCI?

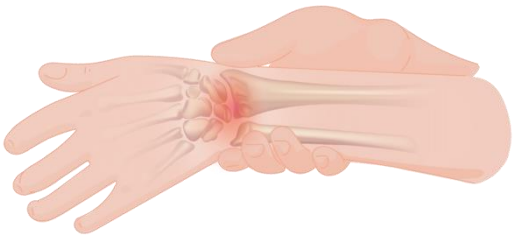
Pain is very common after SCI. Everyone experiences some form of pain after SCI and many people experience pain that is long-lasting and severe.

Pain can be very distressing and can get in the way of work, staying healthy, mood, and sleep. Because of this, pain is often considered to be the most challenging health problem to manage after SCI.

Pain after SCI can arise from any part of the body, but it is often nerve pain from the injury to the spinal cord itself that causes the most severe and troubling pain after SCI.

What types of pain are there?

Muscle, joint, and bone pain

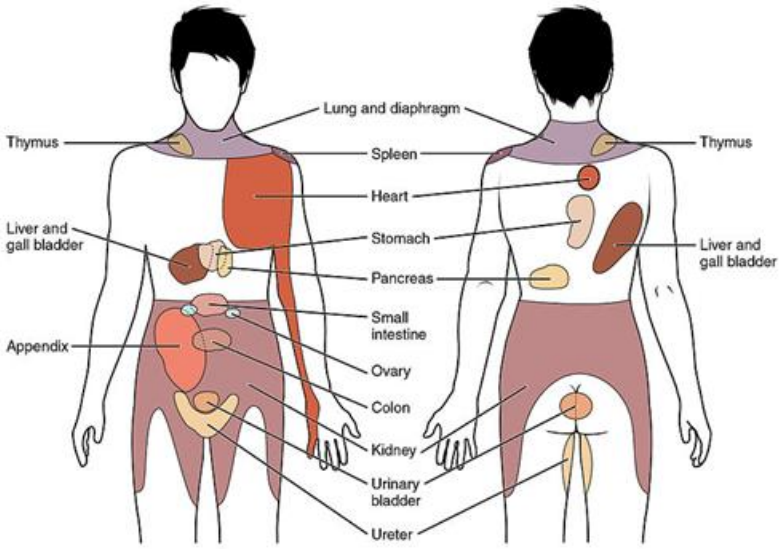


Wrist injuries are a common source of pain after SCI.[1]

Pain from the muscles, joints, and bones is called *musculoskeletal pain*. This type of pain is felt in areas where there is normal sensation, such as above the level of SCI in an individual who has a complete injury, and also below the level of SCI in an individual with an incomplete injury and preservation of sensation below the level of injury. Musculoskeletal pain may feel "dull", "achy", or "sharp" and usually happens during certain movements or positions. After SCI, musculoskeletal pain often comes from shoulder and wrist injuries, neck and back strain, or muscle spasms.

Internal organ pain

Pain from the internal organs (like the stomach, bladder, or heart) is called *visceral pain* (pronounced VISS-err-el). This type of pain can also be felt after SCI from areas with normal sensation. Visceral pain is usually felt in the abdomen, pelvis, or back but it is often hard to pinpoint exactly where it is coming from. This type of pain often feels "dull", "tender", or like "cramping". Visceral pain is often caused by problems like constipation, bladder overfilling, or bladder infections.



Visceral pain may be felt in certain areas of the body based on the organ involved.[2]

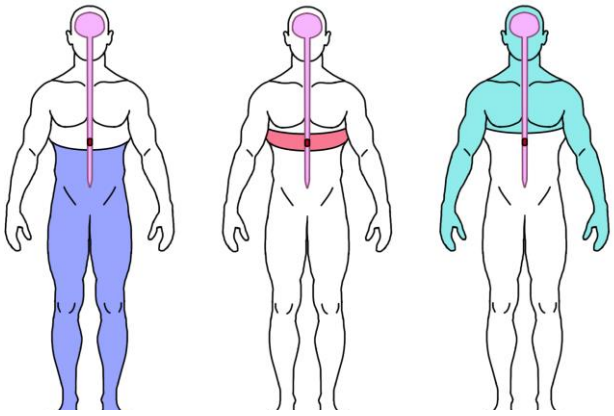
Nerve pain (neuropathic pain)

Pain from the nerves is called *neuropathic pain*. Neuropathic pain can be felt anywhere in the body, including below the level of SCI, even when there is no other feeling in the area. Neuropathic pain often has unique and unusual qualities compared to other types of pain:

- It may feel like it is "hot", "burning", "tingling", "pricking", "sharp", "shooting", "squeezing", or like "painful cold", "pins and needles", or "an electric shock".
- It may happen spontaneously ("out of the blue").
- It may happen in response to things that do not normally cause pain (like the brush of clothing on the skin).
- It may be felt in areas far away from where the damaged nerve is (such as pain in the hand from a nerve injury in the neck).

There are three main types of nerve pain after spinal cord injury:

- At-level SCI pain is nerve pain felt **at or near** the level of SCI, usually as a band of pain around the torso or neck, or along the arms or legs.
- Below-level SCI pain is nerve pain felt in any area **below** the SCI (including areas without other sensation).
- Other neuropathic pain is nerve pain that is unrelated to the SCI and is felt **above** the level of the SCI. For example, an injury to nerves outside of the spine like nerve compression at the level of the wrist (i.e., carpal tunnel syndrome).



Areas for nerve pain after SCI: below the level of injury (left), at the level of injury (centre), and other neuropathic pain (right).[3]

What is chronic pain?

Chronic pain, or *persistent pain*, is pain that is present for a long time (usually 6 months or more).

Chronic pain is very different from pain experienced right after an injury (called acute pain). Long term or unrelieved pain can change how pain is experienced in the nervous system. This can lead to pain that that is very complex and often challenging to treat. Chronic pain requires a very different approach to how it is understood and managed.

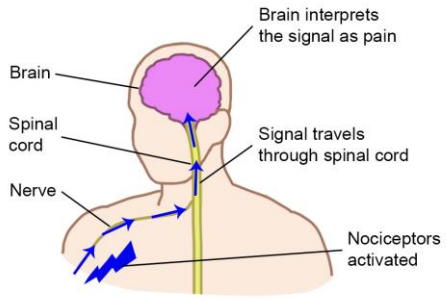
How does pain happen?

Pain happens differently depending on where it comes from in the body.

Pain from the body tissues

Nociceptors are special sensors in the body tissues (like the skin and muscles) that detect possible damage to the body.

When nociceptors are activated, they send signals through the nerves and spinal cord to the brain. In the brain, these signals are recognized and interpreted together with other nerve signals from the brain and body, resulting in the experience of pain.

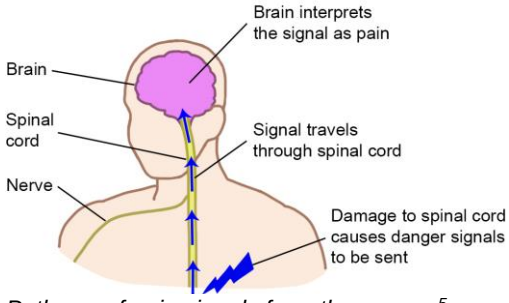


Pathway of pain signals from the body tissues.[4]

Pain from the nerves

Pain from the nerves is different. When the nerves themselves are injured, there are no nociceptors involved. Instead, the signals about potential damage come from somewhere along the pathway of nerves from the body to brain.

Damage to the nerves (including the spinal cord) can cause signals related to pain to be sent inappropriately, resulting in many of the unique features of neuropathic pain.



Pathway of pain signals from the nerves.[5]

Pain can be turned up or down

The pain pathway is complex. Pain signals are not static, but can be turned up or down (or *modulated*) by other nerve signals from both the body and brain. In other words, the pain experience can change depending on other factors, such as worsening during a urinary tract infection, or improving with distraction during enjoyable activities.

Nerve signals from the body, such as those involved in touch, can alter pain signals. This is like how rubbing the skin over a sore area of the body makes it feel better. Nerve signals from the brain, like those involved in emotions and thoughts, can also affect feelings of pain. For example, fear can make pain worse but feeling calm or even distracted can reduce pain. This happens because of the many different nerve connections involved in the experience of pain.

How is pain measured?

Since pain is a personal experience, the only way to measure it is by asking you about your pain. One of the most common ways is to use a simple scale from 0 to 10 (0 is "no pain" and 10 is "the worst pain"). There are also a number of questionnaires and other rating scales used to measure pain.

Other common questions about pain may include:

- Where is the pain located?
- What does the pain feel like? (Is it sharp, dull, or achy, tingling, pins and needles, or burning?)
- What makes the pain worse or better?
- How does the pain change throughout the day?
- How easily is pain provoked and how long does it last once started?
- How much does the pain interfere with your life?

These questions can help your healthcare team to identify new pains, monitor changes over time, and determine if treatments are working.

The Wong-Baker FACES® Pain Rating Scale is a tool to measure pain intensity.[6]

How is pain after SCI treated?

There are many different treatment options for pain after SCI, ranging from conventional pain-relieving medications to a number of complementary and alternative practices.

Treatments for pain after SCI may include:

- Addressing the cause of the pain (such as emptying the bladder or relieving constipation)
- Psychological and mind-body therapies
- Personal pain management strategies (such as relaxation and distraction)
- Physical treatments (such as physical therapy, massage, and heat)
- Electrical and magnetic treatments (such as TENS)
- Exercise
- Medications
- Surgery
- Other treatments

Finding the right treatment often involves trial and error to find what works best. It is important to discuss your treatment options with your health providers, including possible side effects and risks, other options, and your personal preferences.

What medications are used for pain after SCI?

Medications are often the first treatments for managing pain after SCI. Speak with your health providers for detailed information about any medication you are considering taking.

Medications for muscle, joint, and bone pain

Except for spasticity (muscle spasms below the level of SCI), most musculoskeletal pain after SCI is treated with common medications such as over-the-counter pain relievers. Because of this, the research evidence supporting the use of these medications is often based on research done in people without SCI and on expert opinion.

Medications are one of the many ways pain can be managed after SCI.[7]

Acetaminophen

Acetaminophen (Paracetamol) works to reduce pain and fever through mechanisms in the nervous system that are not well understood. Acetaminophen is usually taken by mouth and is a common first treatment for musculoskeletal pain after SCI.

Non-steroidal anti-inflammatory drugs

Non-steroidal anti-inflammatory drugs (NSAIDs) like aspirin, ibuprofen, naproxen, and diclofenac reduce pain and inflammation by affecting chemicals in the inflammatory response. NSAIDs may be taken by mouth, or in some cases, applied to the skin over small areas. NSAIDs can sometimes worsen stomach problems, so they are used as a second-line treatment after SCI.

Corticosteroid injections

Corticosteroids mimic the effects of the hormone cortisol to reduce inflammation. Corticosteroids are injected into painful joints to relieve pain caused by inflammation, on an as-needed basis.

Antispasticity medications

Antispasticity medications such as Baclofen and Botulinum toxin (Botox) may be used to help relax painful muscle spasms caused by spasticity. Medications like Baclofen are usually taken by mouth. Medications can also be injected into the affected muscles (in the case of Botox) or into the spinal canal (in the case of Baclofen, via a pump that is surgically implanted).

Opioids

Opioid medications are a type of narcotic pain medication that binds to opioid receptors in the body, reducing pain messages sent to the brain. Opioids may be used for muscle, joint, and bone pain and sometimes for neuropathic pain after SCI. However, opioids can worsen constipation, induce sleep disordered breathing, and may be linked to dependence when used long-term. Therefore, although they are effective for managing pain in the short term, the goal is usually to get off opioids once the acute pain is controlled and avoid its use for chronic pain management.

Medications for neuropathic pain

Neuropathic pain is treated with different types of medications than musculoskeletal pain. The strongest evidence supports using the anticonvulsants Gabapentin and Pregabalin and the antidepressants Amitriptyline, Nortriptyline, and Desipramine (all the same class of drug) for treating neuropathic pain after SCI. There are also many other medications that need further study for pain after SCI.

Anticonvulsants

Anticonvulsants, originally used for epileptic seizures, are thought to reduce neuropathic pain by calming hyperactive nerve cells in the spinal cord.

Antidepressants

Normally used to treat depression, certain types of antidepressants, for example a class of drugs called *tricyclic antidepressants* such as Amitriptyline, are also used for neuropathic pain. Antidepressants increase the availability of the chemicals norepinephrine and serotonin in the body that may help to control pain signals in the spinal cord.

Anaesthetic medications

Anaesthetic medications like Lidocaine and Ketamine provide short-term pain relief by blocking the transmission of nerve signals involved in sensation and pain. These may be applied directly to the skin or given by injection, catheter, or intravenous line.

Clonidine

Clonidine is a drug that is normally used for lowering blood pressure. Clonidine may also stimulate parts of the spinal cord that decrease pain signals.

Capsaicin

Capsaicin is a chemical compound found in hot peppers that may reduce pain. Capsaicin reduces the action of a molecule called substance P that transmits pain signals in the body. Capsaicin is applied to the skin to reduce pain in small areas.

Cannabinoid medications

Cannabinoid medications like Nabilone contain chemicals called *cannabinoids* that are present in cannabis (marijuana). Cannabinoids also occur naturally in the body and play a role in reducing pain signals in the nervous system. Cannabinoid medications may be taken by mouth or inhaled.

Refer to our article on Cannabis for more information.

What physical treatments are used for pain after SCI?

Physical treatments like exercise, massage, and electrotherapy may be used as part of physical or occupational therapy sessions or at home. Research evidence suggests that regular exercise, shoulder exercise, acupuncture, and TENS may help reduce some types of pain after SCI. However, many of

the other physical treatments have not been studied extensively among people with SCI and we do not know for sure how effective they are.

Regular exercise

Regular exercise, such aerobic exercise, strength training, and exercise programs, can help a person stay healthy, reduce stress, and improve mood, which can help to treat pain.

Exercise provides various health benefits including pain reduction.[10]

Exercise for shoulder pain

Exercise is often used to treat pain from shoulder injuries. Shoulder exercise focuses on strengthening, stretching, and improving movement of the shoulder joint.

Massage

Massage is commonly used to help manage muscle pain.

Manual therapy

Hands-on techniques that involve mobilizing the soft tissues and joints to restore movement and reduce pain may be used for musculoskeletal pain. *Manipulation techniques* ('thrust' techniques) are not usually done after SCI because they can increase the risk of broken bones.

Heat

Heat is a common treatment for pain from the muscles and joints. Heat may reduce pain by stimulating sensory pathways that dampen pain signals. Heat should be used cautiously (or not used at all) in areas of reduced sensation or sensitive skin to avoid burns.

Acupuncture and dry needling

Acupuncture is an alternative practice derived from traditional Chinese medicine that involves insertion of needles into specific points on the body. Acupuncture may help to stimulate the release of chemicals in the nervous system that reduce pain.

Thin needles are inserted in specific acupuncture points to treat pain.[11]

Refer to our article on Acupuncture for more information!

Dry needling (sometimes called *intramuscular stimulation*) is a technique for releasing muscle tension by stimulating sensitive points with an acupuncture needle.

Transcutaneous electrical nerve stimulation (TENS)

Transcutaneous electrical nerve stimulation (*TENS*) is the most common form of electrotherapy used in rehabilitation settings. TENS delivers electrical stimulation through electrodes placed on an area where pain is felt. The electrical stimulation may help to block pain signals in the spinal cord.

Refer to our article on TENS for more information!

Epidural stimulation

Epidural stimulation or spinal cord stimulation involves the surgical placement of electrodes on the spinal cord. While the mechanism is unclear, it is thought that the electric currents produced by the electrodes stimulate areas of the spinal cord to interrupt the pain signals being sent to the brain. Weak evidence suggests that only some individuals receive pain reduction, with the greatest reduction seen in individuals with an incomplete SCI.

Refer to our article on Epidural Stimulation for more information!

A study reported that satisfaction for epidural stimulation in pain reduction significantly drops off over time, with only 18% of participants being satisfied after 3 years. The research for epidural stimulation in pain reduction is still limited, with relatively few studies specifically focused on individuals with SCI.

Future treatment options

Transcranial electrical stimulation and *transcranial magnetic stimulation* are treatment options that have been researched extensively but are not regularly available at this time. These treatments are both supported by strong evidence to be effective for treating neuropathic pain after SCI.

Transcranial electrical stimulation

Transcranial electrical stimulation involves electrodes placed on the scalp to deliver electrical stimulation to areas of the brain that may help to reduce pain.

Transcranial magnetic stimulation

Transcranial magnetic stimulation (TMS) involves the use of an electromagnetic coil placed over the head to produce magnetic pulses that stimulate areas of the brain to reduce pain.

TMS is a non-invasive technique that may be used to treat neuropathic pain.[12]

What psychological and mind-body therapies are used for pain after SCI?

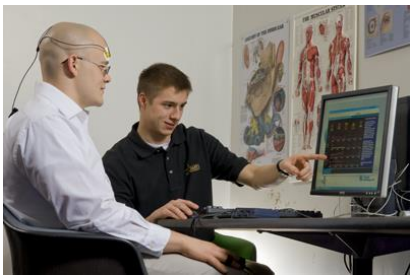
Psychological and mind-body therapies are used to address the many non-physical contributors to pain. These can range from treatment from a psychologist or physician to a number of complementary therapies. These treatments have an important and often underused role in pain management. Most of the psychological and mind-body therapies have not been studied extensively for pain after SCI and need further study before we know how effective they are.

Cognitive behavioural therapy (CBT)

Cognitive behavioural therapy (*CBT*) is a psychological therapy that is usually done with a therapist or other health provider. Cognitive behavioural therapy aims to change personal beliefs and coping skills through practices involving thoughts, emotions, and behaviours.

Biofeedback

Biofeedback involves electrically monitoring bodily functions so the individual can learn to regain voluntary control of this function. Electroencephalography (EEG), a non-invasive technology measuring electrical brain activity, has been used to provide feedback on brain states related to chronic pain.



Biofeedback provides information about your body's responses.[13]

Visual imagery

Visual imagery techniques guide individuals through a series of images to change perceptions and behaviours related to pain.

Hypnosis

Hypnosis is an alternative treatment for chronic pain.

Other treatments

Other psychological and behavioural treatments for chronic pain after SCI, such as meditation, mindfulness, and relaxation techniques, have not yet been studied. Treatments for substance abuse, depression, anxiety, and post-traumatic stress disorder may also have an important role in pain management.

How is surgery used for pain after SCI?

Surgery for pain is not common and is usually only considered when other treatments have not worked. The risks of surgery should be discussed carefully with your health team before going forward with any procedure. Research on surgery is challenging to conduct and each case is different so support is often based on weak evidence and expert opinion.

Surgery for the cause of the pain

If the pain has clear physical cause (such as a spinal instability or a torn muscle) surgery to correct the problem may help to reduce pain. This is done on a case-by-case basis depending on the problem.

Dorsal rhizotomy (DREZ procedure)

Dorsal rhizotomy (DREZ procedure) is a surgical procedure where parts of the nerves close to the spinal cord are cut to interrupt pain signals from being sent to the brain. This is a permanent procedure that can be used for management of neuropathic pain after SCI.

Myelotomy

Dorsal longitudinal T-myelotomy is a surgical procedure where a small cut is made down the length of a thoracic spinal cord segment to disrupt nerve signals that cause spasticity and pain.

How does aging affect pain after SCI?

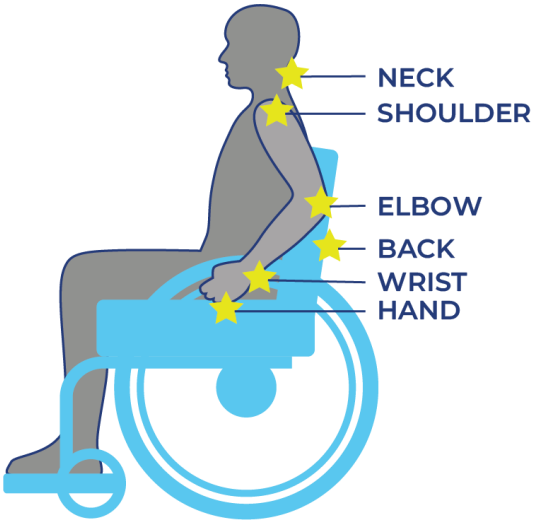
Most people are familiar with the increase in aches and pains as they age. The gradual weakening and degeneration of the muscles, bones, ligaments, and tendons that comes with aging can eventually result in pain. However, the early stages of this degeneration do not usually have obvious symptoms. Pain can also happen because of other health conditions/disease (e.g. cancer, arthritis). Levels of pain can also be affected by mood, stress, and social support of family and friends.

Watch SCIRE's video about managing pain as you age.

Aging and pain in SCI

Nerve (or neuropathic) pain is the most common type of pain after an SCI. There is some evidence that in general, neuropathic pain is stable as people with SCI age. However, experiences of neuropathic pain for people with SCI are incredibly varied and individual. Over time, one may experience increases, decreases, or new neuropathic pain.

Musculoskeletal pain is caused by problems in the muscles, joints or bones. It is a common problem for all people as they get older, including those with SCI. Most people aging with SCI experience increased musculoskeletal pain in the upper extremities (shoulder and arm). Other common pain spots include the elbows, wrists, and hands. Issues with posture and seating can cause neck and back pain.



Overuse injuries develop with age from many years of transfers, pressure relief maneuvers, wheelchair use, and other movements that require weight-bearing and repetitive strain. Because the upper extremities are not designed for such a high physical load, people develop injuries (e.g., tendonitis, bursitis) and pain from overuse.

Refer to our article on Shoulder Injury and Pain for more information!

Research shows that on average, people with SCI experience more arthritis and joint breakdown in the shoulder than the general population.

Pain is also commonly caused by other aging-related health conditions like osteoarthritis of joints beyond that described of the shoulder, skin breakdown, and constipation, etc.

Managing changes in pain with age

To manage changes in musculoskeletal pain from aging with SCI, consult with your doctor, as well as physical and occupational therapists. They can conduct an injury assessment and help find ways to reduce and prevent pain.

Strategies may include:

- Modifying and optimizing movements and wheelchair skills to prevent injury and reduce pain.
- Strength exercises and stretching to stabilize the shoulder joint and improve muscle imbalances.
- Changes in use of assistive devices and technology to prevent further injury/pain and rest the affected joints/muscles.
- Changes in the work and home environment to reduce effort and pain in daily activities.
- Changes in wheelchair setup for propulsion efficiency and ease.
- Medication to relieve pain.
- Cognitive behavioral therapy and mindfulness.

If experiencing a change in neuropathic pain, consult with a health care provider to determine together what may be causing the change and how to manage it.

Refer to the "What physical treatments are used for pain after SCI?", and "What psychological and mind-body therapies are used for pain after SCI?" sections above for more information on managing pain.

The bottom line

There are many different treatments for pain after SCI. The type of treatment depends on the type of pain experienced. The research evidence suggests that several types of medications, including anticonvulsants and antidepressants, are effective for treating neuropathic pain after SCI. Other treatments like exercise, TENS, and cognitive behavioural therapy may also be useful additional therapies for pain after SCI.

It is important to discuss your treatment options in detail with your health team to find the best treatment options for you.

For a list of included studies, please see the Reference List. For a review of how we assess evidence at SCIRE Community and advice on making decisions, please see SCIRE Community Evidence.

Related resources

SCIRE Community. Transcutaneous Electrical Nerve Stimulation (TENS): community.scireproject.com/topic/tens/

SCIRE Community. Acupuncture: community.scireproject.com/topic/acupuncture/

SCIRE Community. Cannabis (Marijuana) and Cannabinoids: community.scireproject.com/topic/cannabis/

SCIRE Community. Depression After Spinal Cord Injury: community.scireproject.com/topic/depression/

SCIRE Professional. Pain Management Module: scireproject.com/evidence/pain-management/

New South Wales Agency for Clinical Innovation: Pain Management Network - Spinal Cord Injury Pain: http://www.aci.health.nsw.gov.au/chronic-pain/spinal-cord-injury-pain

Abbreviated reference list

This page has been adapted from the SCIRE Professional “Pain Management” Module:

Mehta S, Teasell RW, Loh E, Short C, Wolfe DL, Hsieh JTC (2014). Pain Following Spinal Cord Injury. In Eng JJ, Teasell RW, Miller WC, Wolfe DL, Townson AF, Hsieh JTC, Connolly SJ, Noonan VK, Loh E, McIntyre A, editors. Spinal Cord Injury Rehabilitation Evidence. Version 5.0: p 1-79.
Available from: scireproject.com/evidence/pain-management/

Full reference list available from: community.scireproject.com/topic/pain/#reference-list
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