

# Nerve Pain

*Professor Turo Nurmikko, Consultant in Pain Relief at The Pain Relief Foundation's Pain Research Institute, tells us about nerve pain and the role of anticonvulsants*

To detect pain, our bodies are equipped with a highly specialised network consisting of several miles of nerves that send messages to the brain when an injury occurs or is likely. The brain receives the pain messages in the form of nerve impulses which result from a harmful stimulus. This system is extremely effective: both in warning of imminent danger, and in promoting healing by encouraging rest when injured.

Pain has many forms, and the type of pain a person feels depends on the nature of the injury. A specific type of pain results when the nervous system itself is affected. The nervous system is made up of the nerves, spinal cord and brain.

## **Why nerve pain is different**

When did you last hit your funny bone? Do you remember the sudden surge of electric sensation to your fingers, and a sensation of pins and needles? Or when you woke up with your arm numb from your weight, and the experience of painful tingling when sensation and muscle power returned? These are examples of what you feel when the nerves themselves have been disturbed.

The tingling is the direct result of excessive activity in the affected nerve fibres (and not the return of blood in the arm). The nerve fibres tend to start firing indiscriminately if their metabolism or blood supply is disturbed. When sufficient fibres are affected, they generate a barrage of nerve impulses, which race at speeds of over two hundred miles an hour to the brain to be converted into the experience of pain. The brain interprets them as if they were coming from the part of the body the injured nerves normally supply.

Nerve pain is not felt exactly at the site of its origin. Patients with sciatica complain of pain going down their leg, though the

offending structure is in the spine and pressing on the nerve root. Wrong localisation is very common in this type of pain.

Nerve pain is also perceived as different from common tissue injury pain, such as sunburn or sprain. This is due to the unique disorganised pattern of firing that occurs in the nerves when they are directly affected.

## **The nervous system may go awry**

There are several diseases that affect the nervous system and lead to this type of disorganised firing. Inflammation of the nerves, such as shingles, typically causes intense aching, throbbing and smarting. Patients with neuralgia experience sudden electric-shock type sensations, tingling, burning and itching.

Sometimes, for example in diabetes and kidney disease, the affect on the nerves is so severe that some fibres die, making the part of the body served by the nerves go numb. The surviving fibres may develop highly irregular firing patterns. This results in a seemingly paradoxical condition in which the patients experience the numb part of the body hurting.

Those unfortunate enough to have sustained injuries to the spinal cord or the brain report bizarre sensations, such as intense heat or cold, a feeling of swelling of limbs out of proportion, and phantom pain. All these sensations can be tracked down to abnormal activity in the nervous system itself.

In these conditions the pain has no useful role. It is just a futile source of suffering, devoid of any role for warning or protection. Similarly to burglar alarms that have gone off on their own, the injured nerve bombards the brain with repetitive painful impulses, although there is no injury in the body. Our brain cannot ignore the pain impulses any more than it can ignore the impulses from the endless shrill of the alarm. Nerve pain will repeat itself unless it can be switched off. Where it can not be switched off, the pain becomes chronic.

Not all nerve pain is due to increased impulse activity. Some results from an adjustment of the rest of the nervous system to the

injury. A remarkable feature of the nervous system is its ability to form new connections and circuits if the existing ones are injured, severed or impaired.

While this ability of the nervous system is crucial for memory and learning, it works against the individual so far as pain is concerned. In response to damage, nerve fibres form new sprouts that lack orientation and end up in a mesh of nerve endings, all hugely sensitive. This sensitivity means that minimal, everyday activities are able to ignite new nerve impulses resulting in pain. Also nerve cells which specialise in reacting to specific incoming messages, ignoring the rest, change their behaviour. They develop new contacts with formerly alien nerve fibres. The end result is something resembling a wiring job gone wrong, with nerve impulses induced by touching, speaking, moving, or just about anything. Now life will have become a misery as practically anything one does will develop into an attack of pain.

## **Chemistry goes all wrong**

Scientists have recently imitated this cascade of events in the laboratory and shown they are a result of chemical reactions in the nervous system. Some of these chemical changes reduce the excessive firing in nerves, while some increase it. Recent research has shown that many substances have a role in this chain of events. They act as messengers between communicating nerve cells or change the quality of nerve fibre conductivity. The end result is variable, but in nerve injury pain two major things occur: nerve fibres increase their excitability and the spinal cord amplifies incoming painful messages, instead of toning them down as it usually does. This can be explained by changes in the chemistry of the affected pathways.

The changes are strikingly similar to those seen in epilepsy. In epilepsy, nerve cells in the brain fire spontaneously, resulting in loss of consciousness and convulsions. In pain, the same happens but is restricted to the sensory nerves and those parts of the spinal cord and brain which are not concerned with muscle

activity or consciousness. Hence pain and no fits.

Each form of pain demands its own form of treatment. Recent developments in our understanding of how the injured nerve fibres work have allowed doctors to develop techniques to evaluate which treatment is likely to be most successful. Doctors estimate the degree of injury in the pain pathways by assessing the patient's sensitivity to warm and cold. These messages are carried in the same fibres as pain. Also, doctors administer minute electric shocks to elicit nerve impulses, which travel through the nerves, spinal cord and brain and can be measured with the help of several electrophysical tests. Not long ago, German scientists developed a technique to measure minute chemical changes in the skin of patients with nerve pain.

New imaging techniques have improved chances of finding out if pain is due to a trapped nerve. In the last decade, the research group headed by Professor Miles at the Pain Relief Foundation has shown that the majority of patients with trigeminal neuralgia have a blood vessel sitting on the nerve, causing pain and changes in the sensitivity of the skin. When an operation is done to push the offending blood vessel aside, pain goes and sensation reverts to normal.

In most cases treatment is not operative, though. Some people are helped by various stimulation therapies. The majority of nerve pain conditions are treated with carefully chosen medication.

#### **The role of anticonvulsants in nerve pain**

There are no true nerve pain killers on the market yet. Fortunately, some drugs which were developed for other conditions, can be used to ameliorate nerve pain. Amongst the most useful drugs are anticonvulsants, originally designed for the treatment of epilepsy. They work by reducing abnormal excitability in the nervous system.

Anticonvulsants have been rigorously tested around the world, to see whether they indeed relieve nerve pain. Tests have included comparisons with other drugs as well as dummy drugs

(usually called placebo) in a large number of patients. The conclusion is that they provide considerable help in a large percentage of patients, but the degree of benefit depends on the pain condition and individual.

In a recent study in the United States a new drug, gabapentin, was shown to be an effective treatment for diabetic neuropathy (nerve degeneration associated with diabetes) and postherpetic neuralgia (pain following shingles). We have effectively treated many cases of mechanical nerve injury pain, and it looks promising in central nervous system pain as well. Gabapentin is by and large well tolerated among patients and it does not interfere with other medication. In the United States, it is being prescribed more for pain than epilepsy.

Another new anticonvulsant, lamotrigine, appears effective in the treatment of trigeminal neuralgia according to results from a clinical trial to which the Pain Research Institute recently contributed. An Italian research group has shown it to be effective in pain related to disease or injury of the central nervous system. Though well tolerated, lamotrigine may cause a severe rash unless it is started at a very low dose, and the dose slowly increased to that required for relief. Older anticonvulsant drugs, carbamazepine, phenytoin and sodium valproate all have a role in the treatment of pain, but their use is reducing because of side effects. They may cause sedation, and problems with concentration and memory at doses required to control pain. Gabapentin and lamotrigine have proved to be less troublesome in this regard.

#### **Safety issues and addiction**

Patients prescribed these drugs will want to know if there are any long-term safety issues, or risk of addiction. Thankfully, long-term side effects are usually mild, after the body has adjusted to the drug. Though safety is always a concern with any drug, anticonvulsants are by their very nature designed for long-term use, even in children. Rarely they may cause changes in the production of blood cells or alter the function of the liver, but these problems affect only a small minority.

Anticonvulsants are not known to cause addiction, and they can be stopped any time without fear of withdrawal symptoms. However, they should be stopped slowly over a period of a few weeks, to allow the body to adjust.

#### **What next?**

There is growing realisation that pain not only causes a lot of misery, but also is one of the biggest drains on NHS resources. At the same time, the pharmaceutical industry is recognising the potential of providing safe and effective treatment for pain. The time may have come to switch off the alarm that has been going for far too long.

#### **FIGHTING PAIN THROUGH RESEARCH**

The Pain Relief Foundation is a registered charity leading research into pain relief. You can help the Foundation fight pain through research by sending your donation to: The Pain Relief Foundation, Clinical Sciences Centre, University Hospital, Aintree, Liverpool L9 7AL, tel. 0151 529 5820. The Foundation will benefit even more if you donate by gift aid. Contact them for further details.

#### **COPING WITH PAIN**

The Pain Relief Foundation has produced a series of CDs and audio tapes to help you cope with pain. They are *Coping with Pain*, *Coping with Back Pain*, *Coping with Headaches and Migraine*, *The Relaxation Kit* and *Feeling Good* (about improving your self esteem and assertiveness). In the CDs/tapes, doctors and psychologists describe the techniques used on the pain management programme at the Walton Pain Clinic. Details from Talking Life, PO Box 1, Wirral, Merseyside L47 7DD, tel. 0151 632 1206 (enquiries), 0151 632 0662 (credit card sales), [www.talkinglife.co.uk](http://www.talkinglife.co.uk)



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