

Understanding peripheral nerve injuries of the arm and hand

The purpose of this information leaflet is to help you understand the implications of your nerve injury and the pattern of recovery you can expect. The recovery from nerve damage is a long slow process – you need to become an expert in your own condition in order to achieve the best possible outcome in the long term.



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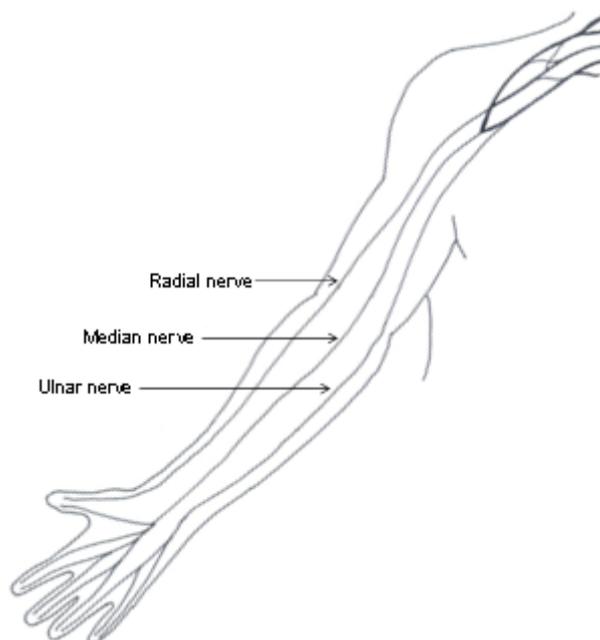
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Peripheral nerve injuries of the arm and hand

The peripheral nervous system refers to the nerves of your body beyond the nerves of the brain and spinal cord. The peripheral nerves branch out from the spinal cord and travel down your arms and legs to your hands and feet.

There are 3 main nerves in the arm. These are:

1. the radial nerve
2. the median nerve
3. the ulnar nerve



Each of these nerve supplies a particular group of muscles to give movement, and a particular area of skin to give feeling. If there is damage to any of these nerves we know what the pattern of loss in movement and feeling (sensation) will be. This will be different for each nerve and will also vary depending where along the length of the nerve the damage occurred. The nerve may be damaged at the level of the fingers – this is known as a digital nerve injury. Injuries can occur to one or more nerves. You need to understand from your hand surgeon and therapist which nerve, or nerves, you have injured.

What is a nerve?

The structure of a nerve is well illustrated by an electric cable. The nerve fibres are similar to the copper wires, grouped together into bundles. Motor nerves carry electrical impulses to the muscles to make them contract and move. Sensory nerves carry electrical impulses to the brain and send information about sensation, pain, temperature and pressure; they are connected to the skin by nerve endings.

What happens when a nerve is damaged?

Nerves are fragile and can be damaged by crushing, stretching or cutting.

When the nerve is damaged, the nerve fibres furthest away from the injury (and the brain) die. The undamaged nerve above the level of injury (that is closer to the brain) does not die and over time new nerve fibres should grow back down the arm and hand.

Our brain's response to a nerve injury

Your brain is used to getting constant information from your hands and all this information is stored and processed in a special part of your brain. After a nerve injury the messages from your injured hand to your brain stop and it is easy for your brain to forget about the parts of your hand that it can no longer feel. Whilst you are waiting for your nerves to regrow, your therapist will give you some exercises to keep your brain active – ready for the new nerves to use.

How do nerves re-grow and recover?

The nerve fibres start to re-grow across the repair site after 3 to 4 weeks. They grow back at a rate of approximately 1mm per day (1 inch per month). However, re-growth of the nerves is a difficult and hazardous process. Very few people achieve a 100% recovery. Progress can be hindered by a number of factors including:

- **scar tissue** – scar tissue can hinder the re-growth and passage of new nerves. The more scar tissue you have the more likely the nerve is to get lost or stuck.
- **your age** – children can expect a very good recovery, especially before the age of 6. After the age of 20, recovery will be reduced. The likelihood of recovery reduces as you get older and is very poor after the age of 60.
- **the level and type of injury** i.e. how much of the nerve has been damaged. The more nerve damage that has occurred, the worse the outcome. This means that the extent of nerve damage and the higher up the arm the level of injury is, the worse will be the long-term outcome.
- **smoking** reduces the blood supply to the hand and arm resulting in less oxygen and nutrients for the recovering nerves.
- **poor diet and nutrition** affects healing. Ensure you eat a good healthy balanced diet with protein, fruit and vegetables.
- new nerves may form into a ball at the site of the cut, creating a nerve scar called a '**neuroma**' – this can be painful and cause an electrical tingling feeling when touched.

However, you can help your nerve to recover by:

- not smoking
- eating a good healthy balanced diet
- learning how to use your hand, even though you cannot feel anything.

The whole process of nerve re-growth and recovery is extremely slow. We expect most of the recovery to have happened after 5 years. However there are many therapeutic tools and everyday activities which you can use to make the best possible recovery.

How do we assess nerve damage?

Nerves have 3 main functions:

1. **Motor** – providing an electrical supply to the muscles.
2. **Sensory** – receiving feelings from the hand and arm – sensation.
3. **Autonomic** – these are easily described as the “automatic” functions in the hand and arm and cover tasks such as blood flow, hair growth and sweating.

At the beginning of your treatment your therapist will want to assess your nerves to find out which nerves are working and how much they are working. This is very much like an electrician trying to find an electrical fault in your house. This first assessment forms a baseline from which the recovery of your nerve can be charted. Your therapist will expect to see evidence of slow but steady recovery in your nerve over a long period of time. It is quite common for some of the

functions of the nerve to return before others such as sweating function to return before muscle activity. Your therapist can assess each of these functions

Therapy treatment for nerve injuries

The therapy for your nerve injury will also take into consideration any other injuries you may have sustained at the same time such as injury to the tendons, ligaments, joints and bones. The healing of these other structures may govern the treatment of your hand in the early stages. After 6 – 12 weeks these other structures will have healed. However, your nerve will take much longer, with healing taking place over 1- 5 years. After major hand injuries most patients regain good recovery in the tendons, giving movement and grip. For most patients, the long-term problems relate to the damage that has occurred to the nerve. This often results in problems with:

- loss of dexterity and manipulative skills in the hand.
- loss of full sensation in the hand.
- cold intolerance.

The therapy in relation to the nerve injury is directed towards five main goals:

1. maintenance of the soft tissues around your joints, such as ligaments, tendons and small muscles, whilst waiting for possible recovery of muscle activity.
2. learning how to care for your hand that has little or no sensation.
3. learning how to encourage every possible sensory recovery.
4. learning how to use your hand again.
5. learning how to live with cold intolerance.

Goal 1: Maintenance of your joints

When there is damage to a nerve, the muscles supplied by that nerve will be paralysed, until (and if) the nerve recovers sufficiently to restore an electrical supply to the muscle. There is no therapy that can be used to maintain muscle strength during the period that the muscles are paralysed. We expect to see the muscles waste away. You may notice that your arm becomes thinner and hollows develop in your hand where the small muscles used to provide shape and bulk. This is more evident in people who have naturally skinny hands. You will lose movement in the joints worked by those muscles – this is called loss of active range of movement. Active range of movement is the movement that can be achieved by unassisted voluntary movement.

You will, however, continue to use the muscles that are working normally. This will result in an imbalance between the normal muscles and the paralysed ones. This can lead to some typical patterns of deformity. For example; after damage to the radial nerve it may become impossible to raise the wrist. However, the wrist can still bend down and the fingers are still able to grip. This lead to a pattern of deformity called 'wrist drop'.



Whilst the joint is unable to move actively through its normal full range of movement, there is a risk that the ligaments, which support the joint, could become shortened. If the joint itself becomes stiff and cannot move freely this is known as loss of passive range of movement. Passive range of movement is movement of the joint by an external force. It is important to keep the joints supple so that if, and when the muscle recovers the joint is able to return to normal active movement. You will be taught by your therapist how to apply this external force to yourself, so you can keep the full passive range of movement in your joints. These are known as passive stretches. It is helpful if someone else can also do this for you occasionally. In this case your therapist will teach your partner or friend how to undertake these stretches.

In the same way that joint ligaments are at risk of becoming tight, paralysed muscles and skin can also become contracted and shortened – especially around the thumb web space. As well as being taught passive stretches for your joints, you will also be taught passive stretches for muscles and other soft tissues.

Joints, muscles and other soft tissues can also be maintained by using splints, if necessary. These are usually made for you by your therapist with very specific treatment goals. For example, following an ulnar nerve injury, the ring and little fingers can rest in a bent posture, due to muscle imbalance. As a result the finger joints are at risk of becoming stiff and unable to fully straighten. A simple splint used at night can ensure that the full range of movement of these joints is maintained.



Goal 2: Learning how to care for your hand

Without sensation you are at considerable risk of damaging your skin by burning, pressure and friction. You will lack the normal warning signals of pain that alert you to tissue damage. Clearly this is a big problem, especially if there is an extensive loss of sensation in the hand, such as following an injury to both the median and ulnar nerves.

Due to the loss of normal autonomic nerve function in your hand, you will also notice changes in the texture of your skin. Skin that has no nerve supply loses normal sweating and becomes dry. In your finger pulps you will notice that you lose your finger prints. It will become difficult to pick up small items which will feel slippery – everything will feel like trying to pick up silk. The loss of sweating increases the risk of injury from burning as dry skin will burn even quicker. This means that everyday activities that you used to be able to do safely, now become a risk of burning such as holding a mug of hot coffee, eating fish and chips by hand.

You will need to learn to think about the risks of every activity. You will need to check your skin condition regularly, looking for signs of redness or blisters. If you have areas of intact sensation in your hand you will need to learn how to use these as a clue to the possible risk of developing tissue damage in areas without sensation. Sadly, most people with a significant amount of sensory loss in the hand experience one deep burn before they truly appreciate how easy it is to burn skin that has no sensation. Due to the changes in autonomic function, any burns will take much longer to heal than normal.

Dry skin can be helped by regularly moisturising. Many creams are suitable for this task, especially those with reduced perfumes such as E45 cream, aqueous cream. To avoid burning,

be sure to use sun creams (50 factor plus) when going out in the sun.

Depending on your nerve damage, you may notice other changes in your hands and nails, which cannot be controlled. This is most common in people with injuries to the median and/or ulnar nerves. You will lose the natural fat pads in your hand, especially around the pulps of your fingers – you will notice this as your fingers become thinner. It is common for nails to become ridged and brittle. You may notice that the skin in the area of your hand without sensation is a different colour – it may appear red or mottled. These are common observations and nothing to worry about. It is often possible to ‘see’ the area of sensory loss, indicated by these changes in skin texture and appearance. All these changes are due to the alteration of the autonomic nerves in the hand and skin.

In the normal course of recovery, one of the first aspects of sensation that returns is an awareness of pain and recognition of cold. Recognition of heat comes a little later. Many people recover enough sensation to give them at least some ability to protect their hand from damage – this is known as protective sensation. Many people learn how to assess that, if an object does not feel cold, it could well be hot and therefore they need to check.

Goal 3: Learning how to encourage sensory recovery

The aim of sensory re-education is:

- to keep active the area in the brain that is dedicated to the hand.
- to maximise and encourage sensory recovery of the hand.

Much of the re-learning process is achieved by using your hand in everyday activities, using your eyes and vision to guide your hand and to help you to understand your sensations. However, to enhance this process further there are specific exercises for sensory re-education, which you can use with guidance from your therapist.

Early phase – when you have little or no sensation in the injured area of your hand. To keep the image of the hand within the brain’s sensory cortex you need to give your brain the illusion that your hand has sensation. During this period, your hand may be in splints and you will be unable to move it. These exercises focus on imagining feeling and movement. You can do this with the following exercises:

- imagined movements – imagine moving your hand into different positions and grips to create a strong visual picture in your head.
- watch other people using their hands during everyday tasks. Think about the feeling of normal touch when handling different textures, objects, shapes, weights and temperatures.
- whilst watching and concentrating on your hand, use your uninjured hand to touch or tap the areas of your injured hand or arm that have no sensation.
- whilst watching and concentrating on your hand, ask someone else to touch the areas of your injured hand or arm that have no sensation.
- stroke different textured materials across your hand and think about how each one feels, such as soft, fluffy, scratchy, rough.

wrapping a rubber band near the nib of the pen to improve grip.

The ability to manipulate and move small objects within the hand is a big problem following injury to the ulnar nerve. This results in loss of dexterity in the hand. This makes tasks such as handling money and sorting out change very difficult. If this is your problem you will need to change how you do things, for example swapping money into a different pocket. Many people have to learn to undertake dexterous tasks with their non-dominant hand and find themselves becoming ambidextrous following injury to their dominant hand.

Sometimes special hand splints can be used to help improve hand function. In some cases a simple splint can lead to a great improvement. For example, following damage to the radial nerve, which results in a wrist drop, a simple wrist brace will significantly improve hand function. However, splints have limited value in restoring complex dexterity skills to a hand. Splints may be useful in helping to solve hand function in relation to a specific activity. You should discuss this with your therapist.

It has to be said that the best way for you to learn to use your hand again is through determination and practice from the beginning. You will have to accept that in the beginning it will take longer to do activities and you will get frustrated by how clumsy and slow your hand has become. However, your brain has a tremendous capacity to relearn. But, be warned – your brain can also learn how not to use your injured hand. If you do not learn how to use your injured hand from the very beginning, it is very difficult to do this later. We strongly believe that the earlier you learn to use your hand; the better will be your long term outcome.

Most patients return to their original job following nerve injury, although they may need some adaptations, possibly special equipment, and general support from their employer at first. Your therapist will be able to help you consider the specific tasks you need to achieve at work and how to solve any difficulties. It may well be helpful for you and your therapist to visit your place of work. This will enable you to discuss possible problems with your employer. It will also help your employer to understand the nature of your injury and what you will and will not be able to do.

Some people cannot return to their original job, especially where the physical demands are high, for example the need to work at speed or in cold environments. In these situations it may be necessary to explore options for alternative work within the same company. For a few people, this may mean a change of direction into new careers and retraining opportunities. If this is necessary, your local job centre will be able to help with advice from the Disability Employment Advisor at your local job centre. Your local training college will be able to tell you about access to an adult careers advisor.

Goal 5: Learning how to live with cold intolerance

Cold intolerance is a common complication of nerve injury. On exposure to a cold environment you may experience pain, discomfort, stiffness, pins and needles, tingling or changes in skin colour. One or more of these symptoms may be present. Cold intolerance is an abnormal reaction to cold and an exaggerated response to a cold environment. Some patients report that these symptoms can occur with mild cold, when handling cold objects or with a change of temperature. Examples of this are standing under a shady tree on a hot day or wind blowing over the hand.

Most patients experience cold intolerance problems during the first winter following their

injury. For some people, this may be some months after the original injury and can come as an unpleasant surprise. Patients need to be reassured that it is a common problem and does not indicate that anything is going wrong with the recovery of the hand.

How long will cold intolerance last for?

It is very difficult to predict how long you will suffer from cold intolerance. For some patients cold intolerance may be a problem for only the first winter after their hand injury. Other patients may continue to experience cold intolerance for many years or even the rest of their life, although possibly with some reduction in the severity of symptoms. Smoking is more likely to make the problem worse, because smoking reduces the blood supply, especially to the hand.

What can I do to help myself?

The main way that you can help to reduce the symptoms of cold intolerance is by keeping warm – keeping both your hand and your body warm. It is important to wear enough clothes to keep your body warm such as body warmers, thermal vests, wool jumpers. This may be more than you would normally wear. If you keep your body warm, your blood system will not need to divert the blood supply from your arms and hands to keep your internal organs warm. As a result, this will ensure that the blood supply to your hand is maintained.

Thermal insulating gloves will help to keep your hands warm. There are many types of gloves available, especially from outdoor shops such as garden centres and fishing shops. However, there are also specialist gloves including silver gloves, neoprene gloves (used by divers) and electrically heated gloves. You will need to experiment with all the different options to find a style that works for you.

Heat pads can be a very convenient way of warming up your hand. There are different styles of heat pads that are readily available from outdoor shops and chemists. Most of the heat pads work by pressing a small button on the pad which sets up a chemical reaction. The chemical reaction releases heat for a period of 20 – 30 minutes, which can be enough to give some relief from pain symptoms. The pads are usually designed to be re-useable such as by boiling them up in a pan of water. However, caution must be taken to avoid burning areas of skin that lack feeling.

Cold intolerance can have a major impact on the use of your hand. If the problem is persistent and long-term you may need to reconsider your employment and hobbies.

Conclusion

You will now begin to understand that recovery from a peripheral nerve injury is a complex and slow process. You will be the most important person in determining your long term outcome, although you will have to work within the limitations imposed on you by nature. For this reason you need to fully understand the process of recovery so you can become an expert to manage the journey ahead.

However, don't forget there are other people to help you along the way. You will need to seek support from family, friends, and your hand surgeon and hand therapist.

Contact details

Hand Therapy - 01722 345530

Wessex Rehabilitation Centre - 01722 336262 ext 2370