NHS
North Bristol
NHS Trust

Service: **Orthoplastic Surgery**

Complex Limb Injury

Exceptional healthcare, personally delivered

Introduction

This information booklet aims to help you to understand the nature, treatment and likely outcome of your limb injury.

North Bristol NHS Trust is a recognised centre in the South West for the treatment of complex injuries to the lower limbs, and is one of the busiest units in the UK. Such injuries require input both from orthopaedic surgeons, who look after the healing of broken bones, and plastic surgeons who look after the remainder of the soft tissue injuries.

This combined approach, along with input from our team of nurses, physiotherapists and occupational therapists, is designed to ensure the best treatment for patients like you with such complex injuries.

Our goal is to assist you in achieving the best possible outcome following your injury. With your help we will treat your injury and enable you to carry on with your life. It is however important to understand that your injury is serious and potentially limb threatening and this is the reason why you have been referred to our unit. Our aim is to get you back to your normal routine or as close to it as possible.

Your injury

The reason for your referral to our service is that not only have you broken one or more bones but you have also damaged the tissues overlying the bones. These types of injury normally involve considerable force such as in a car or motorcycle accident or following a fall from a height. They can also be caused by much more innocuous injury such as simple slips or twists which are termed ‘fragility fractures’.

Your broken bones usually need to be fixed with an operation. The muscle and skin over the bone or bones is torn and damaged to such an extent that it cannot usually be sewn back together.

Assessing and treating the bony injury

We use a combination of x-rays and other scans, such as CT and MRI, to assess the bony injury. These investigations enable us to develop a plan of how to fix the bones.

There are several ways of fixing the bones.

Internal fixation: A metal plate is often used to temporarily hold the fractured bone together at the time of the first operation after cleaning of the wound. This plate is then removed during a second operation to allow for further cleaning of the wound and fixation of the fractured bone. Sometimes, at the time of the first operation a plaster cast alone is enough to hold the broken bones, particularly if the fracture involved the ankle joint.

During the second operation, the bones are stabilised with either:

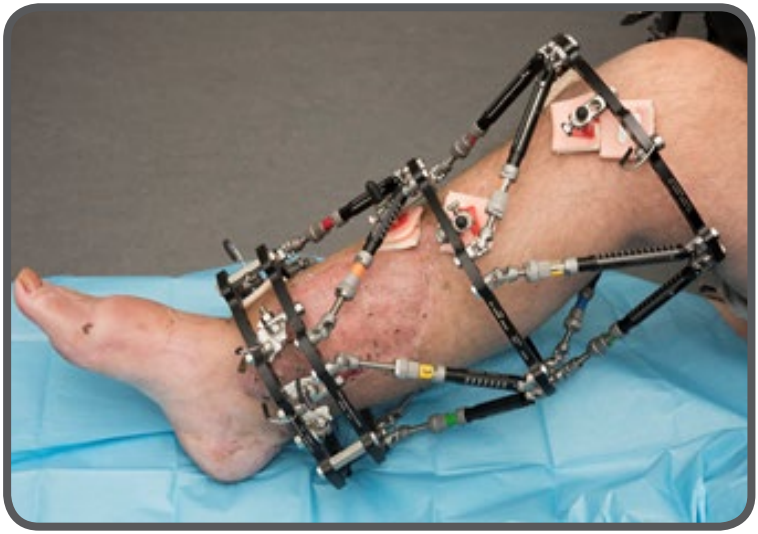
- A plate (or several plates) placed directly on the bone, held in place with screws, or
- An intramedullary nail, which is a hollow tube of metal that is inserted down the inside of the bone and held in place with screws.

External fixation: In some cases an external fixator may be applied at the time of the first of second procedures. This involves either:

- Several pins passed through the skin and into the bone, above and below the fracture with several rods holding everything in position, or
- Several pins and wires passed through the skin and through the bone, above and below the fracture, and a circular frame / cage is built to hold the bony fragments in the correct position.

It is important to ensure that you follow instructions about pin site care to reduce the risk of infection.

The external fixator is removed once the bone is fully healed and this can be a number of months after the injury.



Assessing the soft tissue Injury

Whilst we can get a good idea about the extent of the damage to the skin and muscle by looking at x-rays, scans and photographs we also need to inspect the injured tissue in the operating theatre. This helps us assess the damage to the skin and muscle and decide if the soft tissue will recover from the injury.

Reason for assessment

When tissue is subjected to a high energy impact it can be crushed and torn to such an extent that it no longer receives blood supply from the body. In this case the injured tissue must be removed. Failure to remove it may result in the wound becoming infected and this in turn can prevent the bones from healing.

Trip to the operating theatre

We will normally need to give you an anaesthetic to put you to sleep whilst we inspect your injury. We will wash your wound to remove any dirt and debris, which may cause infection. We will also remove any unhealthy skin, muscle and bone that will not heal if left in place. This process also allows us to decide on the best way to cover your wound with healthy tissue to allow it to heal.

Other examinations

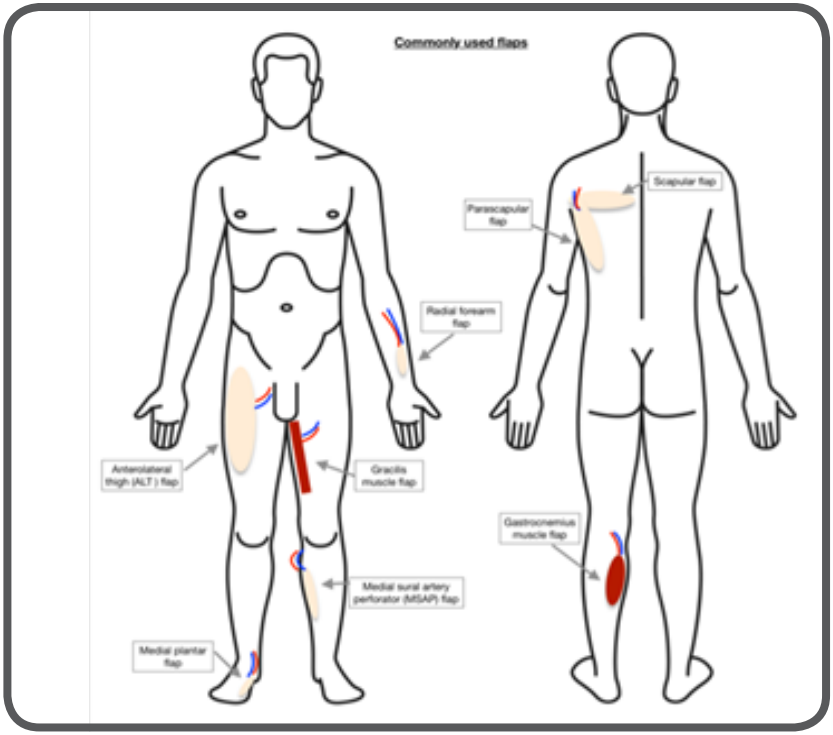
Because the flow of blood to the damaged area is extremely important we usually send you for a special scan called a CT angiogram to look at the blood vessels in the limb before deciding the best way to treat you. You will need an injection into a vein to allow us to see the blood vessels, but you do not need to be put to sleep for this. This scan is normally carried out in the days between your first operation and any further operations. Sometimes it will have been done at your initial assessment in the Emergency Department.

Further surgery

There is normally a planned period of several days between the first assessment of your wound and you returning to the operating theatre for the bones and soft tissues to be definitively repaired. Sometimes we will stabilise the bones and cover the wound with healthy tissue at the same time. Most often you will go to the operating theatre more than once for the whole reconstruction process to be carried out.

Between the operations, the wound will be covered by a special foam dressing connected to a suction pump which will help us to keep the wound sealed and clean from outside contamination.

Methods used to cover your wound



To allow your broken bones to heal they must be stabilised and covered with healthy tissue. There are a number of ways in which we can do this. The method chosen will normally be determined by your general health and fitness as well as the extent of your injury. Your age is not necessarily a factor in deciding the method of reconstruction.

If you are reading this booklet, it is likely that the severity and extent of your injury haven't allowed us to repair the soft tissue just by sewing it together and that you will probably need a more complex reconstruction.

We will now discuss the possible options:

Free tissue transfer

This method is the most frequently used in our unit. A piece of tissue, called a “free flap” is taken from one part of your body and transplanted to the site of your injury. This free flap is a piece of skin, muscle or bone detached with its artery and vein intact. In most cases this is taken from the thigh or the back. Occasionally it is taken from the forearm, calf or other sites in the body.

It is transplanted to the wound and its artery and vein are re-attached to blood vessels near the wound using a microscope and very fine stitches. The wound left from taking this flap is normally closed with stitches leaving a straight-line scar. Occasionally, if the wound needs a very large free flap to cover it, the donor site will require a skin graft to close it (see below for more information).

The free flap looks like normal skin, but will not have any sensation and will often be bulkier than the surrounding skin. The damaged or missing skin at the site of injury is often very thin, and your body does not have similarly thin other areas of skin that we can use. Once your bones have healed (usually some months later), we can safely consider further procedures to make the flap thinner. Despite this, it is likely that your injured limb will always be slightly bulkier than prior to your injury.

Free muscle transfer

In this technique we take a muscle and completely detach it along with its artery and vein. This is then transplanted to the wound and its artery and vein are re-attached to blood vessels near the wound using a microscope and very fine stitches. A skin graft is required to cover the surface of the muscle.

The site where the muscle is taken from can be closed with stitches leaving a straight-line scar. We always use a muscle which you can easily live without, or whose function is supplied by other muscles. Your ability to undertake normal daily activities should not be affected.

As with skin free flaps, the muscle free flap does not have sensation and will be bulkier than prior to your injury. It will initially look quite dramatic, and not at all like normal skin. With time, the skin graft and underlying muscle flap will look more and more like normal skin, and the contour and bulkiness will improve.

Pedicled skin flap

This technique involves raising a flap of skin from near to the wound, and transferring it to cover the exposed bones. It is left connected to it's blood supply throughout the procedure.

The most common instance in our practice is using skin from the instep of the foot to cover a wound near the ankle or heel. In this case it can still keep some sensation.

This method may cover the wound but will leave a new wound on the instep that needs to be covered with a skin graft. Our experience is that this procedure will not impact on how you walk, but it will change the sensation of your big toe, and your ability to sprint.

In extensive lower limb injuries it is often better not to use the tissue close to the injury itself because they might have been partially injured too. In those cases, we may not be able to use local skin flaps.

Pedicled muscle flap

We will sometimes use a muscle to cover an exposed bone or joint. One end of the muscle can be cut, to allow us to rotate the muscle to cover your wound. This can only be done in certain circumstances, most commonly in injuries around the knee joint.

Local flap

Occasionally, the best option for reconstruction will involve moving some of the skin from next to the wound without detaching it completely in order to cover the wound. Usually in this technique a skin graft is required to cover where the local flap has been moved from.

Skin graft

Skin grafts can be either ‘split-thickness’ of ‘full-thickness’.

A split thickness skin graft is a thin shaving of the outermost layer of the skin, that can be taken from many places on the body and placed on a raw wound to speed up the healing process. The most common donor site for a split-thickness skin graft is the upper outer thigh, Unfortunately this does not work well on exposed bone or tendon. We use these grafts on top of a muscle flap, or to cover the raw area left when a local flap of tissue is moved to cover a wound.

We also use this technique when you have such a big defect that the skin flap cannot cover the whole wound. In this instance, we prioritise covering structures such as bone, joints, nerves and blood vessels with the skin flap; the remainder of the wound will be covered with skin grafts. If you need a skin flap that is large enough that we cannot close the donor site (where the flap came from) with stitches and a straight-line scar we may need to use a skin graft to cover the donor site.

A full-thickness skin graft is a piece of skin that can be taken from almost any part of the body. It comprises the full thickness of the skin and the resultant defect is closed with stitches and a straight-line scar. Common places to take full thickness skin graft from are the inside of the forearm or arm, the side of the neck, groin or the elbow crease.

The skin graft gradually develops a blood supply from the wound that it is put on to within five to seven days. We will usually take the dressings down on the 5th day after the operation to check that the graft is developing up a blood supply well.

The most important factors influencing how well a skin graft will heal are keeping swelling to a minimum, minimising the risk of infection, and stopping any movement or rubbing of the graft. The donor site of skin graft usually heals like a graze, in about two weeks.

Complications of surgery

Although normally you will have more than one operation we will always try to stabilise the broken bones and cover the wound with healthy tissue at the same time. Your surgery can take many hours to perform because the methods we have to use are complicated. There is always the possibility of complications from such surgery and these can occur in theatre and afterwards once you are back on the ward.

Bleeding

Bleeding is one of the main complications following surgery. It can prevent your wound from healing. Bleeding can cause a collection of blood under the flap and this can mean the flap is at risk of failing. When this happens we may take you back to the operating theatre to remove the trapped blood and stop the bleeding.

Infection

Infection can either be acute - developing within the first days / weeks following your operation - or chronic where infection develops at a period of weeks, months or sometimes even years following your operation. A chronic or deep-seated

infection within the wound can not only stop the soft tissues from healing but also prevent the bones from healing.

We will monitor you closely for any signs of infection after your operation by checking your wounds, your temperature and taking blood samples. If an infection develops, you will be treated with antibiotics and often these are given through a cannula (a small plastic tube placed through the skin into a vein). You may need antibiotics sometimes for weeks or months after we have covered your wounds.

Flap failure

When we use a free flap we rely on the blood vessels to flow once they have been reconnected. Sometimes they do not and there are signs we look for to tell us if this is happening. We will look at the flap every half hour in the early period in order to check its colour, temperature and to look for swelling. We usually listen to the pulse in the flap regularly with a Doppler probe (similar to one used to listen to a baby's heart in the womb) placed on the skin.

We will try to keep the limb as warm as possible, and we will give you fluid into your veins through a cannula. This encourages the blood flow through the flap. We also need to monitor the amount of urine you are passing and we use a catheter into the bladder to do this. This is usually inserted at the time of your operation whilst you are asleep.

On the first night after your operation you will have a disturbed night's sleep as we carry out these checks every half hour. We will keep you in bed for the first four days during this critical time.

If we find there are problems with the flap we may need to return you to theatre to correct the problem. This can happen at any time following your operation but is most likely within the first 5 days. In many cases we are able to salvage the flap. However, in some cases this is not possible.

If the flap does fail we may have to remove it and carry out another operation to replace it with another flap or skin graft.

Several factors, that you can influence, can reduce the flap's chance of success by reducing the blood flow within it:

- cold
- caffeine
- cigarettes

We will keep the flap warm but you must avoid smoking (including vaping, nicotine patches, and passive smoking), and food or drinks containing caffeine for at least two weeks after your surgery.

DVT

There is also a risk of a blood clot forming in your leg, known as a Deep Vein Thrombosis (DVT). Smokers have a higher risk of developing DVT. To avoid this, you will wear compressive stockings on the uninjured side and will receive an injection to thin your blood every day until you are independently mobile.

Pain

Injuries such as yours are painful and we are very mindful of this. We will provide you suitable pain killers to keep you as comfortable as possible. Immediately after your operation we will normally provide you with painkillers through a cannula that you can control directly via a press-button. We call this 'patient-controlled analgesia' or PCA. We can give you further pain relief on top of this if you need it.

We work closely with a specialist pain team who can advise us on the best treatment for you. You may continue to need pain killers when you have left hospital and the pain team can advise us on these as well.

Recovery

You will have x-rays after your surgery but not until a four day period of strict bed rest has passed at the earliest. This way the orthopaedic team can assess the position of the bones and how they are likely to heal. After four days we will start the process of getting you out of bed and increasing your mobility. We take this very slowly at first. Initially we only let you dangle your leg out of bed for a few minutes at a time so that your flap becomes gradually accustomed to the effects of gravity.

We gradually build this up under the guidance of our physiotherapists who will help you to get out of bed on mobility aids such as frames or crutches. Initially you cannot put any weight on your injured leg. All flap reconstructions require two weeks of non-weight bearing, after which you may be allowed to start weight-bearing. This depends on the type of bone fixation you have had and the rate of healing. Some injury patterns require longer periods without putting weight through the affected limb. The orthopaedic team and physios will guide you through this.

On the next page you will find a summary of the protocol we use after the reconstruction of a complex lower limb injury. You will require a minimum of one week in our unit following your operation.

Be mindful that every patient is different, therefore, this can vary slightly on some occasions.

Flap Observa

	Flap observation	Catheter	Oxygen
Day of of op	1/2 hourly	IN	Mask
Day 1	1/2 hourly	IN	Nasal Specs
Day 2	1 hourly	IN	Nasal Specs
Day 3	1 hourly	IN	Nasal Specs
Day 4	2 hourly	OUT	Stop
Day 5	Dressings removed for ward round Flap checks 4 hourly		
Day 6	Dressing review		
Day 7	Dressing review		

tions

Movement	Warming blanket	IV fluids/urine output	Blood tests
Bed rest & Leg elevation	Continue	Continue IVI. Target - 0.5 - 1 ml/kg/hr	
Bed rest & Leg elevation	Continue	Eat and drink. Stop IVI if adequate urine output	✓
Bed rest & Leg elevation	Continue	Target = 0.5 - 1 ml/kg/hr	
Bed rest & Leg elevation	Continue	Target = 0.5 - 1 ml/kg/hr	
Dangling	Stop	Target = 0.5 - 1 ml/kg/hr	✓
Mobilising non-weight bearing			✓
Mobilising non-weight bearing			
Mobilising non-weight bearing			

Loss of your limb

Whilst we always do our utmost to save your leg, it is extremely important that you know that we may not always be able to do so. We will always discuss with you and your family the possibility of an amputation. We will only perform an amputation after such discussion has taken place and you have given your consent. If we recommend an amputation this is because, based on our experience of your type of injury, this is the best option available to you.

Post traumatic stress disorder

In some people traumatic experiences set off a reaction that can last for months or years. This is called Post Traumatic Stress Disorder (PTSD). The symptoms can start immediately or within 6 months of the traumatic event. Many people feel grief-stricken, depressed, anxious, guilty or angry after a traumatic experience. They can also suffer from other non-specific symptoms such as muscle aches and pains, irregular heartbeats, diarrhoea and headaches.

Just as there are both psychological and physical aspects to PTSD, so there are both physical and psychological treatments for it. Please let one of the team know about any such symptoms you are having, so we can refer you to a specialist psychologist for more information if needed.

When we need to carry out free tissue transfer you can expect to be in hospital for at least seven days after your reconstruction. Please remember that you may be in hospital for several days before your reconstruction as well. When the surgery is less complex you may be able to leave sooner.

Once you leave hospital we will continue to monitor your progress in our dressing clinic and in our lower limb clinic where you will see plastic and orthopaedic surgeons, as well as specialist nurses and physiotherapists.

We will monitor your progress and look for any signs of infection, problems with the skin or your bones failing to heal. We can offer advice or further surgery to improve this healing, if needed. You may want us to adjust your flap, for example if it is too bulky and preventing you from wearing normal footwear or clothes. We would not usually consider doing this until the bones are healed and your scars are maturing which usually takes at least six months, and often longer.

Leaving hospital

PATIENT APPROVED

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If you or the individual you are caring for need support reading this leaflet please ask a member of staff for advice.

Southmead Hospital Charity

southmeadhospitalcharity.org.uk

Southmead Hospital Charity raises funds for departments and wards throughout the Trust, meaning you can support an area close to your heart