Pressure Injuries

Author: SCIRE Community Team | *Reviewer: Susan Andrews* | *Published: 2 Nov 2017* | *Updated: ~*

Pressure injuries are a common and serious health problem after spinal cord injury (SCI). This page outlines basic information about pressure injuries and how to prevent and treat pressure injuries after SCI.

Key points

- A pressure injury is damage to the skin and underlying tissues caused by pressure, friction, or shear. Pressure injuries are common on weight-bearing areas of the body like the sit bones and tailbone.
- Pressure injuries are a common complication of SCI that can have serious consequences including reduced independence and life-threatening infections.
- People with SCI are at greater risk of developing pressure injuries because of changes to the body and how it is used after SCI.
- Preventing pressure injuries is very important and involves checking the skin regularly, pressure relief, staying healthy, and early treatment of potential injuries.
- The most important factor in treating a pressure injury is identifying and removing the cause of the injury.
- Pressure injuries are treated using several treatments, including wound care and dressings, medications, electrical and light stimulation, debridement, and surgery.

What are pressure injuries?

A *pressure injury* (also known as a pressure wound, pressure ulcer or bed sore) is a breakdown of the skin and the tissues under the skin that is caused by pressure, friction, or *shear*.

Pressure injuries are a common complication of SCI that happens because of changes to the body and how it is used after the injury. Pressure injuries usually happen on areas of the body that bear weight in sitting or lying, such as the sit bones, tailbone, heels, back of the knees, elbows, and shoulder blades.

Pressure injury (stage 3) on the side of the ankle.[1]

Why is it important to know about pressure injuries?

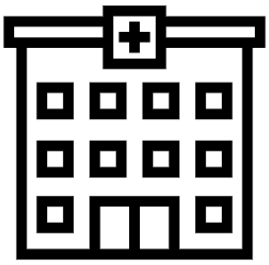
Pressure injuries are common

Pressure injuries are common after SCI. They can affect as many as one third of people with SCI each year and almost every person with an SCI experiences at least one pressure injury in their lifetime. The risk of pressure injuries increases over time when living with an SCI long-term.

Pressure injuries can have serious consequences

Pressure injuries can have serious consequences for health, function, and quality of life, including:

- Difficult and lengthy healing
- Infections, including severe infections that lead to a life-threatening condition called *sepsis*
- Long and costly hospital stays and re-hospitalizations
- Reduced independence and mobility during healing
- Inability to participate in work and school during healing
- Reduced life satisfaction and quality of life
- A greater need for assistance from caregivers and family during healing



Prevention is essential to reduce risk

The best management for pressure injuries is prevention. In fact, many pressure injuries are preventable through a combination of good self-care, staying healthy, and regular check-ins with your health team. It is essential to learn how to recognize, prevent, and treat pressure injuries as soon as possible after SCI to help reduce your risk.

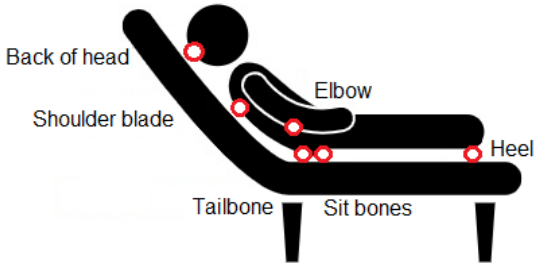
What causes pressure injury?

Pressure injuries happen because of many different factors from both inside and outside the body. There are a number of changes to the body after SCI that make pressure injuries more likely. These factors, combined with forces like pressure, friction, and shear, can cause pressure injury.

Pressure

Pressure injuries usually form on weight-bearing areas of the body that are in contact with supporting surfaces. This usually happens when sitting or lying in the same position for a long time or when positioned on a surface that does not support the weight properly (such as a hard chair).

Pressure usually happens in specific areas depending on the position, but most often affects the sit bones (*ischial tuberosities*), tailbone (*sacrum* and *coccyx*), heels, backs of the knees, elbows, back of the head, and shoulder blades.



Certain areas of the skin become more vulnerable to pressure depending on the body position.[3]

Too much pressure can prevent blood from reaching the area, which is important for bringing oxygen and nutrients to the tissues. This can lead to skin damage or breakdown. Skin breakdown can happen quite quickly (in even 30 to 60 minutes) on a hard surface without changing positions regularly.

Friction and shear

The skin can experience friction and shear during wheelchair transfers.[4]

Pressure injuries can also be caused by friction and shear. Friction can happen when the skin is rubbed on a course surface, such as sitting on an uneven wrinkle of clothing or rough surface. This can cause injury to the surface of the skin which can lead to skin breakdown.

Shear is a type of force where the skin goes one way and the body goes the opposite direction. This usually happens when the skin is caught on a surface while the body is moved. For example, when transferring in bed, the skin might be pulled along the bed while the person shifts positions, which causes shear. Shear strains and injures the tissues close to the bone.

! Most pressure injuries result from combinations of pressure, friction, and shear that happen in the deep tissues close to the bone. This leads to deep tissue injury, rather than injury on the skin's surface.

Other factors that contribute to pressure injuries

There are many other factors from both inside and outside the body after SCI that make pressure injuries more likely to develop.

Changes to the skin

Spinal cord injury can affect the skin in various ways. The skin below the injury may become less elastic and weaker as a result of tissue changes caused by the SCI. In addition, people with injuries above T6 lose the ability to sweat below the injury, which means that body temperature is not regulated very well.

Loss of sensation

Sensation is important because it allows us to recognize discomfort and provides a cue to change position regularly. When sensation is reduced or absent, these cues are not present and we may sit in an uncomfortable position where there is too much pressure for too long.

Loss of movement

Loss of movement also contributes to pressure injuries. People with reduced movement often use a wheelchair as their main method of mobility, which may lead to long periods of sitting in one position. It may also be more difficulty to reposition in sitting or lying so pressure may be placed in one area for too long. As well, when the muscles are not used regularly, they shrink (called *muscle atrophy*), which means there is less padding between the skin and bone.

Moisture

Moisture makes the skin more vulnerable to injury and bacteria. Moisture may be present because of bladder or bowel problems after an SCI or in warm and humid climates.

Body weight

Changes to body weight, either being too thin or overweight, can increase the risk of pressure injuries. When a person is underweight, there is less padding between the skin and bone. When a person is overweight, the body is heavier, which creates more pressure in weight-bearing and can also make transfers more difficult, which may result in more shearing and friction.

Supporting surfaces

The characteristics of surfaces that support the body in regular positions are very important for distributing pressure. This includes wheelchair cushions, mattresses, couch cushions, car seats, commode or toilet seats, sports equipment, and any other surface that is regularly used for supporting the body. Hard or unsupportive surfaces can contribute to developing pressure injuries. It is important to also consider surfaces in unfamiliar settings, such as when travelling or when a hospital visit is needed. Airplane seats and hospital stretchers do not often provide enough protection for your skin following SCI and you may need a lightweight travel cushion when travelling or to request a specialized surface if you need to visit a hospital.

Supporting surfaces that are regularly used or used for long periods of time can contribute to pressure injuries.[5]

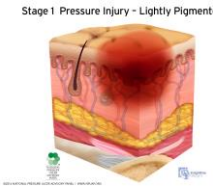
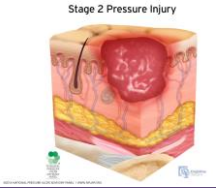
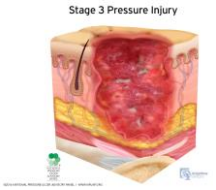
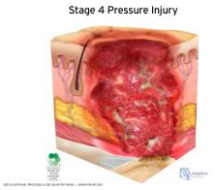
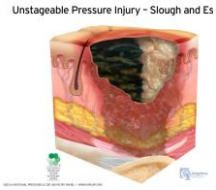
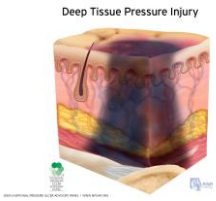
Other factors:

- Reduced ability to fight infections (reduced immune function)
- Medical conditions like infections, blood clots, spasticity and contractures
- Poor nutrition (especially if there is not enough calories or protein)
- Reduced physical activity
- Smoking
- Long periods of bed rest
- The sit bones (*ischial tuberosities*) may become flatter over time
- Higher level of injury and complete SCI
- Depression
- Reduced ability to perform behaviours that reduce risk, such as regular pressure relief, good skin care, and skin inspections

What are the stages of pressure injuries?

Pressure injuries are classified by how severe they are as "stages" of injury. These stages can range from just a small amount of redness on the skin to a wound that travels all the way down to the bone. Determining which stage a pressure injury is at can help you and your health team to measure the extent of a wound and figure out how to treat it.

Stages of Pressure Injuries (National Pressure Ulcer Advisory Panel)[2]

Stage 1		The skin is intact with an area of redness that does not go away after being off of it for 20 to 30 minutes.
Stage 2		There is a partially open wound that is the thickness of the skin (shallow) and typically red-pink in colour.
Stage 3		There is a full skin thickness opening (deeper than skin level) that has a mostly red or pink base with no bone or tendon visible. Minimal slough or it is called unstageable.
Stage 4		Full thickness skin opening which includes exposed bone, tendon and muscle and possibly slough. Both Stage 3 and 4 wounds may have tunnels or open areas that run under the skin.
Unstageable		A wound that is covered with slough or black skin so it not open and the base of it cannot be seen. This type of sore is impossible to stage.
Deep tissue injury		A wound that is dark purple or a blood filled blister. If the cause is addressed quickly these injuries can resolve without tissue loss but they can also develop into stage 4 pressure injuries depending on the extent of injury to the tissues.

How are pressure injuries diagnosed?

To identify a pressure injury early you need to check your skin once or twice daily using a mirror or with the help of a care provider.

Physical examination

The main way that pressure injuries are diagnosed is with a visual skin check. Checking by feel is not enough, because it only identifies open areas that can be felt. Early pressure injury can be as simple as red or purple discoloration to the skin.

If there is an open wound, you may need to be seen by a physician and referred to a nurse for a wound assessment. This may involve starting a treatment plan that should include trying to identify the cause of the pressure injury.

The nurse will observe the wound and take note of its appearance (such as its edges, colour, and shape) and look for signs of inflammation or infection. The nurse may take measurements of the length, width, and depth of the wound. These can help determine the stage of the wound and be used as a comparison as it heals. Sometimes, the nurse may take photos for assessment purposes. A swab of the pressure sore is only taken if infection is suspected. Infection is suspected if there has been increased redness, odour or drainage or if pain has increased if you have sensation.

It is often helpful to have an occupational therapist or physiotherapist involved to help figure out the cause of tissue damage.

Wounds may be measured and photographed to keep track of changes over time.[7]

Other testing

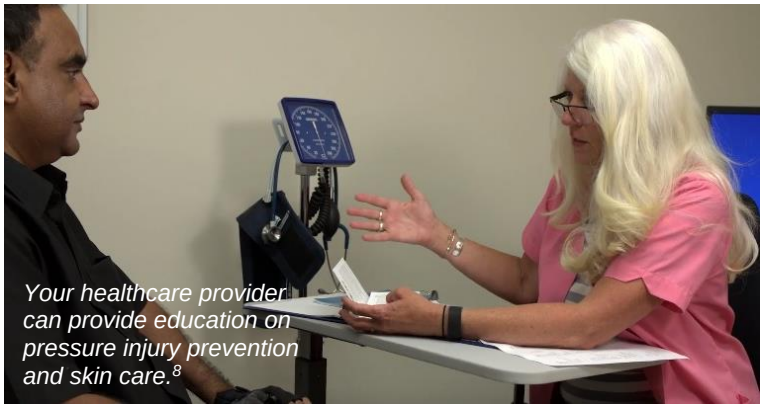
- Blood tests may be used to identify if there is an infection.
- *Ultrasound* is an imaging technique that may be used in some facilities. Ultrasound imaging uses sound waves to detect injuries deep within the skin. It may be used to detect suspected pressure injuries that are not easily seen.

Osteomyelitis (bone infection)

When pressure injuries are severe and reach all the way to the bone (stage 4), there is a risk of developing a serious bone infection called *osteomyelitis*. If your health team is concerned that you might have osteomyelitis, you may have additional testing such as x-rays, an MRI, or blood tests to diagnose this condition.

What can be done to prevent pressure injuries?

The most important part of managing pressure injuries is preventing them from happening in the first place. Many different techniques may be used to prevent pressure injuries. Some of these are a part of self-care and others involve working together with your health team.



Your healthcare provider can provide education on pressure injury prevention and skin care.[8]

Learning how to prevent pressure injuries

Early on in your care, your health providers will speak to you about how to prevent pressure injuries. This may be a part of one-on-one care or as a part of a group education class. Prevention education is a very important part of reducing risk. You will learn how to identify skin concerns early on and the best techniques for you to keep your skin healthy.

Maintaining good skin care

Regular skin care is an important part of preventing pressure injuries. Many of these techniques you will learn as a part of skincare education.

Regular skin checks

Checking the skin for changes in color and texture is important to recognize areas of risk and to identify any changes early. The main areas to check are bony areas, like the sit bones, tail bone, side of the hips, and heels. A mirror or assistance from a caregiver may be needed to check some areas. Any areas of redness, bruising, or injury should be discussed with your health providers immediately. Skin checks are recommended once or twice daily or after activities like prolonged bed rest or trying new equipment.

Keeping the skin healthy

Regular skin care should be done using a gentle pH-balanced skin cleanser and moisturizer. The skin should always be treated gently and not rubbed or massaged forcefully. The skin should be kept dry using loose fitting clothes made of light weight fabrics and protecting the skin from excess moisture. Avoid clothing with thick seams or pockets like denim that can contribute to tissue damage.

Excess moisture can make the skin more vulnerable to injury and bacteria.[9]

Regular pressure relief

Pressure relief techniques are positions and movements that remove pressure and give the tissues a chance to regain proper blood flow. You should discuss with your health providers about which positions are best for you and how often and for how long they should be done for. Keep in mind that moving into pressure relieving positions should not involve pulling or shearing of the skin while re-positioning.

Depending on your level of injury, some people are able to re-position themselves or need a small amount of assistance. People with higher level SCI can use the functions of their wheelchairs or equipment to weight shift or may rely more on caregivers and family to provide assistance.

Pressure relief techniques

Pressure can be relieved by lifting the buttocks off the seat.[10]

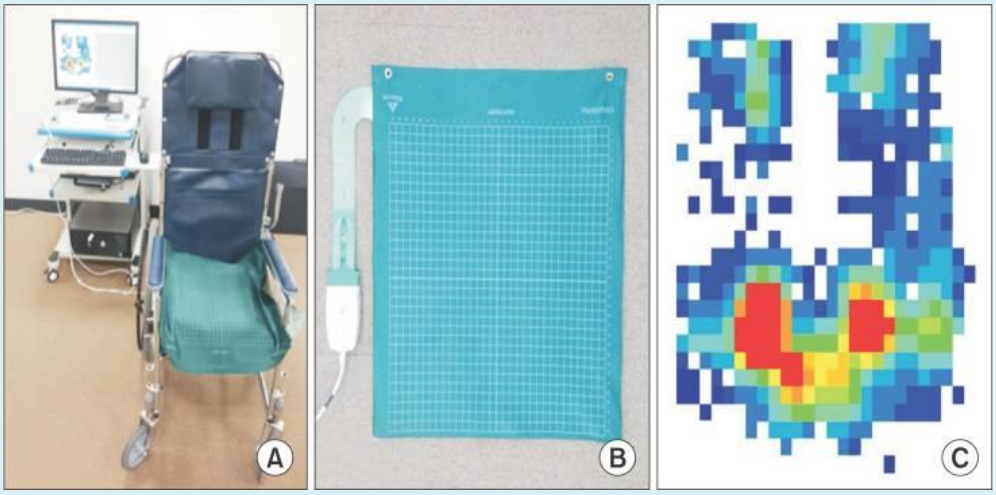
- For power wheelchair users, tilting or reclining the chair backwards for a period of time
- For manual wheelchair users, techniques such as leaning forward and propping the elbows onto the knees, lifting the buttocks off the seat by straightening your arms on the armrests, or leaning to one side
- When in bed, techniques such as turning every 2-3 hours, placing pillows between knees and behind the back when lying on your side, and using a suitable pressure relieving surface.

This is not a complete or instructive list of pressure relief techniques. Speak to your health provider for detailed instructions on how to perform pressure relief techniques. How-to instructions for some techniques are illustrated on the Spinal Cord Essentials website.

Pressure relief is usually recommended every 15 to 30 minutes to replenish blood flow to vulnerable areas of the skin and held for at least 1 to 2 minutes.

Pressure mapping

Pressure mapping is a technique that involves the use of a pressure-sensitive mat and computer system to identify areas of increased pressure. Pressure mapping may help your health provider make recommendations about reducing pressure, including selecting appropriate equipment and finding out which pressure relief positions work best for you.



Pressure map placed on a wheelchair (left), flexible pressure map (center), and diagram of pressure of a person's buttocks in sitting (right). Areas of pressure are indicated from high pressures in red (around the sit bones) to lower pressures in blue.[11]

Using appropriate equipment and seating

Appropriately fitted equipment like wheelchairs, cushions, and bedding can help to maintain healthy skin. During rehabilitation, you may work with your health providers or attend a special clinic where you receive advice on selecting equipment and the correct use of the equipment.

Refer to our article on Wheelchair Seating for more information!

The team will recommend seat cushions, backrests, commodes, and mattresses to help manage pressure in at-risk areas. Regular check-ins at the clinic may also be needed. Most equipment needs to be reviewed and replaced periodically. For example, a padded raised toilet seat that has rips or is worn out can be a cause of a pressure injury.

Keeping a healthy lifestyle

A healthy diet, regular exercise, and avoiding smoking are simple steps to help maintain healthy skin.

Nutrition

A healthy diet with enough fluids, calories, and protein provides the nutrients and vitamins needed to maintain healthy skin. It also helps in maintaining a healthy body weight. A dietician can help you learn how to eat well to prevent pressure injuries and can advise you on the nutrition you need for healing should you develop a pressure injury.

Avoiding smoking

Smoking is a risk factor for pressure injuries because smoking prevents oxygen from reaching the tissues and worsens overall health.

Exercising regularly

Exercise helps to increase circulation (which carries oxygen and nutrients throughout the body) and maintain overall health. Exercise may also help to maintain muscle bulk which creates padding between the skin and bone.

Regular exercise can help decrease your risk of developing pressure injuries.[12]

Electrical stimulation

Although it may seem strange, electrical stimulation is a treatment which may help to prevent pressure injuries. Electrical stimulation on its own can help to increase blood flow and oxygen supply to the body tissues. Electrical stimulation during exercise (functional electrical stimulation) may help to maintain muscle mass that pads areas under the skin.

Refer to our article on FES for more information!

How can I find the time and resources to do prevention?

Many people avoid doing regular pressure injury prevention because it can be time-consuming and difficult. If you are having trouble finding the time to fit these techniques in, it may be time to get support. Speak to your health providers about this issue and see if you can work together to come up with ways that you can make pressure relief and skin care part of your daily activities so you have enough time to participate in everything that is important to you. Some people find the following tips helpful:

- Make skin care a regular part of your routine, just like brushing your teeth – have everything you need (a mirror, skin care supplies) easily available where you can use them each day and do your routine at the same time every day.
- Ask for help from caregivers and family for help with techniques or reminders to maintain good skin care.
- Put a timer on your phone or watch to remind you to shift positions regularly.

Peer support

Many places also have peer support programs where people living with SCI can connect and support one another. Peers can offer firsthand knowledge and experience that may help you find the right techniques for your lifestyle. Online support groups and apps may also help you connect with support from people living with SCI.

How are pressure injuries treated?

There are a number of different treatments for pressure injuries. Treatments may be used to reduce pressure or shearing to the wound, keep the wound clean and protected to reduce the risk of infection, and aid circulation and healing. Treatment for pressure sores is the responsibility of the whole health team, so you may work with many different professionals.

Dressings

Wound dressings help to protect the wound, absorb drainage from the wound, and prevent bacteria from entering while allowing it to breathe. Many different types of dressings may be used for pressure sores. Your nurse will help to decide which dressings to use and how often they need to be changed.

Medications

Antibiotics are used as needed to treat infections in the soft tissues or when *osteomyelitis* (bone infection) is present. Topical antimicrobial treatments are sometimes applied to the wound to reduce bacteria to try to prevent infection and support healing.

Energy-based therapies

A number of different energy-based therapies may also be used to treat pressure injuries. These treatments are done to help increase circulation, kill bacteria, and promote healing.

Electrical stimulation

Electrical stimulation may be applied to pressure injuries through electrodes connected to a small device. Studies suggest that electrical stimulation works to help with healing of severe wounds (stage 3 and 4) after SCI.

Ultraviolet C light

Ultraviolet C light is applied to a wound using special light bulbs and equipment. Ultraviolet C light has antibacterial effects on wounds. Research suggests it is effective for treating pressure injuries after SCI.

Debridement

Debridement is a method of removing dead tissue and debris from wounds. There are several methods used to debride wounds and your wound care nurse or physician will choose the method that is right for you. Types of debridement may include:

- S*urgical debridement* by a surgeon under anesthesia
- *Sharp debridement* using sterile scissors performed by a wound care nurse
- *Maggot therapy*, which involves using maggots to selectively remove only the dead tissue
- *Enzymatic debridement*, which involves using enzymes to help dissolve the dead tissue
- *Autolytic debridement*, where moisture is added to the wound as needed to help the dead tissue debride from the wound

Debridement promotes healing by removing unhealthy tissue from the wound.[15]

Debridement is only needed if there is slough or unhealthy yellow black tissue in the wound base and should only be done when there is enough circulation for healing to occur.

Flap reconstruction surgery

Surgery may be an option if the wound does not improve with other treatments. This is typically only used for stage 3 or stage 4 injuries. The procedure for closing these wounds is called *flap reconstruction* surgery. Flap reconstruction involves removing the wound and surrounding tissue and covering it with other nearby tissues, such as muscles and skin. After this type of surgery, careful procedures must be followed before you can get up and moving safely.

Amputation

Amputation may sometimes be necessary if a wound gets severely infected and the infection moves into nearby tissues. This is more commonly seen in legs and feet.

Negative pressure treatments

Negative pressure wound treatments involve the use of a vacuum which applies suction to a wound that is covered with a wound dressing. This helps to manage drainage and increase circulation. A negative pressure dressing should only be used when the wound is clean and pink healthy tissue and when the cause of the pressure injury has been addressed.

Other pressure injury treatments

There are many other medical, alternative, and physical treatments that may be used in the treatment of pressure injuries. Speak to your wound care team about any treatments you are considering trying.

The bottom line

Pressure injuries are a common and serious complication of SCI. Many pressure injuries are largely preventable through a combination of regular skin care, pressure relief, staying healthy, and early treatment of potential injuries.

Treatment of pressure sores may involve wound care, electrical and light stimulation, prevention and treatment of infections that may occur, and surgery for severe wounds. Speak with your health providers to discuss your prevention and treatment options to find out which ones are best for you.

Related resources

SCIRE Community. Pressure Mapping

Spinal Cord Essentials: Skin Care Handouts – Information on pressure relief and skin care

Northwest Regional Spinal Cord Injury System: How to do pressure reliefs (weight shifts)

Organizations that may offer peer support can be found on our Organizations and Associations Resource page

Abbreviated reference list

Parts of this page have been adapted from the SCIRE Professional "Pressure Ulcers" Module:

Hsieh J, McIntyre A, Wolfe D, Lala D, Titus L, Campbell K, Teasell R. (2014). Pressure Ulcers 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. 1-90.
Available from: scireproject.com/evidence/skin-integrity-and-pressure-injuries/

Full reference list available from: community.scireproject.com/topic/pressure-injuries/#reference-list
Glossary terms available from: community.scireproject.com/topics/glossary/

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