

Secondary Conditions  
Prevention & Treatment:  
A Series—No. 1

# Pressure Sores

The Research  
and Training  
Center on  
Independent  
Living



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*Abstract:* Pressures sores, also called pressure ulcers, bedsores, or decubitus ulcers, are areas of skin or soft tissue damage caused by excessive pressure or pressure of long duration. Pressure cuts off blood supply to the skin and kills tissue cells. For those with impaired mobility or sensation, pressure sores are a major cause of hospitalization. Pressures sores usually occur in either a superficial ulcer involving skin alone (or skin and fat below the skin) or a sore beneath the skin with little or no surface ulceration. A sore beneath the skin can create widespread damage in a cone shape through all tissue layers and into the bone. Once the pressure area breaks the protective skin barrier, contamination from incontinence or other bacterial sources often occurs, resulting in infection. Antibiotic treatment may not work because of the poor circulation in the pressure sore area. Antibiotics given on the area may not work because bacteria can develop resistance to the drugs. Harsh disinfectants may harm healthy tissue.

To prevent bedsores, relieve pressure and avoid prolonged pressure on any area of body. Do this by doing wheelchair push-ups (using hands to push up) every 30 minutes, be turned in bed every one to two hours, shift weight to arms, be more mobile, try a water mattress, avoid sliding that cuts off blood flow, have soft bed sheets, keep dry, have good nutrition, inspect skin for sore signs, and look into pressure-reducing equipment.

Words to know:

- Ablation: Removal of damage by surgery
- Anoxia: Oxygen deficiency
- Cellulitis: Inflammation of cellular or connective tissue
- Cyanosis: Bluish, grayish discoloration of skin from lack of oxygen
- Debridement: Enlargement of wound during surgery to remove dead tissue
- Ischemia: Temporary anemia because of obstruction of blood circulation to body area
- Necrosis: Death of tissue or bone area surrounded by healthy parts
- Sepsis: Infection, sometimes referred to as blood poisoning
- Slough: Loose, stringy, dead tissue.

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## **Pressure Sores — A Major Problem**

Pressure sores (also called pressure ulcers, bedsores or decubitus ulcers) are areas of skin or soft tissue damage caused by excessive pressure or pressure of long duration. This pressure cuts off the blood supply to the skin and kills the tissue cells.

Because pressure is the culprit, pressure sores usually develop over a bone that sticks out, such as the ischia (sitting bones) or sacrum (tailbone). People with spinal cord injuries are especially vulnerable to pressure sores because the normal sensation of the body—which sends a signal to shift position or weight — is gone. That allows the bony point to squeeze or pinch the skin and tissue between the wheelchair seat or mattress and begin the development of a sore.

Pressure sores usually occur in either of two major forms. One is a superficial ulcer involving skin alone, or a combination of skin and the fat beneath the skin. The other, less common form develops beneath the skin with little or no surface ulceration. This second type of sore can create widespread damage in a cone shape through all layers of tissue and into the bone. For example, the bone presses the muscle into the skin, which creates an internal sore that spreads to the skin.

The medical field usually groups pressure sores into four categories or grades, ranging from Grade 1 (minor) to Grade 4 (severe). Once the pressure area breaks the protective barrier of the skin, contamination from incontinence or other bacterial sources often occurs, resulting in infection. Doctors, nurses, and the patients themselves can become frustrated at this point because antibiotics often aren't effective.

Systemic (in the system) antibiotic treatment may not work because of poor circulation to the pressure sore area, which means the bloodstream can't carry the germ-fighting drug to the infection. Topical (at the site) antibiotics may not work because bacteria can develop resistance to the drugs and become even more virulent. Finally, use of disinfectants such as sodium hypochlorite or povidone-iodine is controversial because they are harmful to healthy tissue.

### **Pressure sores costly in dollars and lives**

For those with impaired mobility or sensation, pressure sores are a major cause of hospitalization. One 1987 study in *Rehabilitation Nursing* (January) found that 30% of all spinal cord injured persons will develop a pressure sore during each year following initial discharge; however, not all of these sores will be severe, with only 5-7% requiring hospitalization. More recent research indicates that each year about one-quarter to one-third of all SCI survivors will have a pressure sore. Recent estimates put the death rate at 60,000 Americans each year from pressure sores. The cost in monetary terms is high, too. The 2002 Centers for Disease Control Injury Fact Book said pressure sores in the United States cost an estimated \$1.2 billion.

### **Predicting who's most at risk**

Medical experts know that quadriplegics and paraplegics are vulnerable to pressure sores. But researchers have tried to isolate the factors that might predict which persons are most at risk. Several risk assessment scales have been developed since 1975, including the Norton Scale,

Gosnell Scale, Knoll Scale, and Waterlow Scale. The most commonly used measure is the Braden Scale for Predicting Pressure Sore Risk, which was created in 1987 and has six categories: sensory perception, moisture, activity, mobility, nutrition, and friction.

The Braden Scale takes into account different risk factors, such as degree of mobility, exposure to moisture, and ability to change body position. The real purpose of the scale is not to merely identify those most at risk of developing pressure sores but to help medical personnel implement prevention programs.

The Braden Scale was developed primarily for use in hospitals and related institutions. Nevertheless, the Braden Scale may help those with disabilities or staff at independent living centers identify who is most at risk of developing pressure sores. Here are scores considered high risk as measured by the Braden Scale: A score of 17-18 or lower in nursing homes, and 16-17 or lower in acute care facilities. This scale can help predict high risk. But, caution some medical experts, pressure sores already may have developed in some individuals, such as senior adults, by the time the risk characteristics are obvious.

The article “Pressure Ulcers in Community-Resident Persons With Spinal Cord Injury: Prevalence and Risk Factors” in the 1993 *Archives of Physical Medicine and Rehabilitation* reported at a single point in time, 100 men and 40 women with spinal cord injury living in the community were examined for pressure sores and 33% had a sore. Of those with a sore, 46% had more than one; 27.6% were considered severe. Most sores (69%) were in the pelvic region; 29.9% had one on their legs. People who had the most ulcers were also the ones who had the least motor control. Blacks had more sores than whites, which could be because their darker pigment makes it more difficult to detect initial skin discoloration indicative of a pressure sore.

### **Techniques for preventing sores**

Pressure sores can threaten life or be extremely stubborn in healing. Additionally, pressure sores can interrupt an independent lifestyle, forcing the person to remain in bed and, again, be dependent on others. The best course obviously is to avoid developing pressure sores in the first place. Even though paraplegics and quadriplegics are at increased risk, they shouldn't resign themselves to believing pressure sores are unavoidable. There are a number of proven techniques for prevention.

The undisputed cause of pressure sores is pressure. Avoiding excessive and prolonged pressure probably is the single most important thing you can do in your prevention program. But how long is too long and how much is too much? Studies indicate that a pressure approximating your diastolic blood pressure (the lower rate, which indicates heart relaxation) is necessary to obstruct skin circulation. Normal skin capillary pressure is believed to be 32mm Hg arteriolar.

### **No prolonged pressure**

Other research found that duration of pressure is more important than intensity—if the pressure is high enough to create pressure sores to begin with. For instance, one study found that evenly distributed pressure caused less damage than pressure confined to one small area. Also found was that moderate pressure for longer periods caused more damage than intense pressure for shorter intervals. Finally, another study involving animals found that intermittent pressure resulted in less damage than constant pressure.

What does this mean for you? Low pressure for relatively short times (under four hours) probably won't cause damage. Varying intense pressure (such as lifting yourself up out of the

wheelchair seat at intervals) probably won't cause damage either. But constant, fairly intense pressure will cause damage after only two hours.

Accompanying the findings related to blood pressure is one study that discovered low diastolic blood pressure may be related to risk of pressure sores. Systolic pressure below 100mm Hg and diastolic pressure below 60, in other words, low blood pressure, has been associated with pressure ulcers.

### **How can research help me?**

How does such research translate into daily practice? In a nutshell, the research suggests relieve pressure often and avoid prolonged pressure on one area of your body. Some pressure sore experts recommend performing regular pressure relief such as "push-ups" from your wheelchair or bed, or shifting your weight one minute of each 15. Others recommend push-ups every 30 minutes. You can do a wheelchair push-up this way: place each hand on your armrests (or the wheels if you have no armrests), then push down so that both elbows are extended to allow your body to be lifted off your wheelchair seat.

In many hospitals, staff routinely turn patients who are at risk of developing pressure sores every one to two hours — which is another pressure-relieving technique.

One researcher flatly said: "A person with limited mobility or sensation should not sit in a chair for longer than two hours because of the risk for causing tissue anoxia (no oxygen), thus creating tissue breakdown." He adds, however, that if the person does sit up for longer periods, a gel or air cushion should be used.

Another pressure-fighting technique for wheelchair users is to distribute your weight over a larger area by shifting some weight to your arms via the armrests (or wheels). This relieves the ischial pressure.

### **Be mobile**

Being more mobile is another important factor in avoiding pressure sores. A 1986 study investigated two groups of paraplegics — athletes and non-athletes. Significantly more pressure sores and frequent hospitalizations were reported by non-athletes. The value of mobility has been borne out in other studies.

Water mattresses may be an exception to the rule of frequent weight shifting. Researchers in a study discovered that a person can lie on his or her back for up to eight hours on a water mattress with no sign of damage to the skin. However, it must be emphasized that this was only the findings of one group of researchers.

Face down sleeping is recommended by some. But if you sleep on your side, be aware that the knee, shin or ankles pushing down on the bottom leg can create pressure points. Research has found that extending the upper leg creates much less pressure.

### **Pregnancy creates concerns**

Women who use a wheelchair and who become pregnant should be aware of the additional potential for pressure sores created by the added weight of the baby. This is also true after the baby is born when the baby is held or carried on the lap. The extra weight may raise the chance of abrasions when doing transfers and affect posture. In addition, special nutritional needs must be met. For all of these reasons, it's wise to consult your doctor when you become pregnant.

## **Avoid shearing**

Another recommendation is to avoid shearing. Shearing is the friction caused when two parallel surfaces slide against each other. Shearing can occur when the head of the bed is raised and you slide down, or when you slide into a sitting position.

Shearing can contribute to pressure sore development because the vessels supplying blood to tissue and muscle are stretched and blood flow may be cut off. One researcher found that shearing forces aggravate the effects of pressure by causing circulation blockage in half the usual time.

Hospitals have learned that bedsheets should be washed to create maximum softness and should be fitted on the bed to avoid wrinkles. Hospital staffs keep crumbs and other gritty materials out of bed to avoid undue friction and pressure points. In other words, they make certain bedding is clean.

When transferring, be careful not to scrape the buttocks on any surface such as the wheelchair wheel.

## **Keep dry**

Moisture is another factor associated with pressure sores. It softens and weakens the skin — and the layers of tissue below the skin — which contributes to breakdown. One study showed that moisture together with friction increases tissue destruction by 10%. The acid in urine also contributes to the skin breakdown process.

These findings mean it is important to keep clothing, bedding, and wheelchair cushions dry so that the skin also remains dry. And many doctors advise against plastic-lined incontinence pads because they tend to build up moisture against the skin.

Still other studies blame heat and fever for contributing to the creation of pressure sores.

## **Nutrition**

Poor nutrition has been implicated in the development of pressure sores. Some researchers go so far as to say poor nutrition is second only to pressure as a major cause of sores.

The relationship of nutrition to pressure sores is complex. But, simply stated, not getting certain nutrients can weaken the immune system — and encourage swelling and slow oxygenation of the cells. All this contributes to tissue breakdown and poor healing. Researchers have concluded that dehydration also can contribute to the development of pressure sores and also create fluid and chemical imbalances in the body.

It would be wise to have your doctor or a nutritionist advise you on best eating practices, particularly when you are trying to heal a pressure sore. Researchers have found that certain vitamins and minerals promote healing of sores. Foods high in protein, vitamins and minerals for instance, help skin stay healthy and heal quickly, according to the Spinal Cord Network. In the January 2005 “Spinal Cord Injury: Dealing With More Than Inability to Move” in *Applied Neurology*, the author concurred with the need for protein and also suggested vitamin C, which prevents skin breakdown, and zinc sulfate once pressure sores develop.

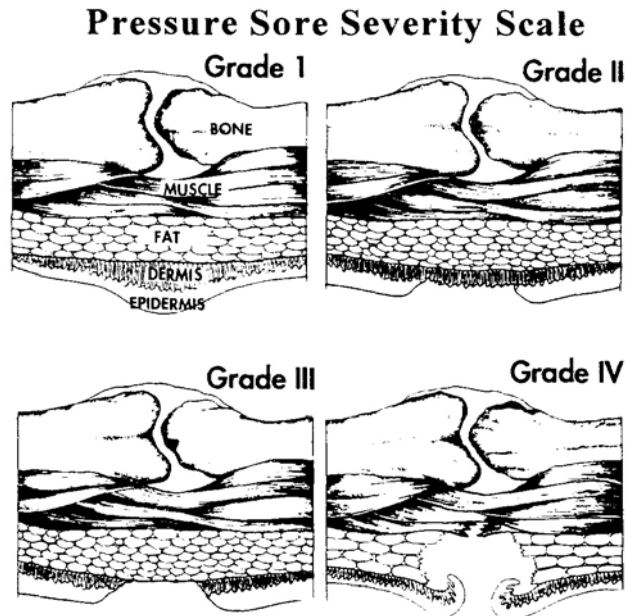
## **Aging**

Unfortunately, several studies show that older age can make a person more susceptible to pressure sores. Part of the cause is the thinning of the top layers of the skin and accompanying stiffening and loss of elasticity. This results in weakening of the skin. At the same time, small

blood vessels degenerate and reduce blood flow. These aging processes mask the development of erythema (redness) which can be an early sign of pressure sores.

### Self inspection

Checking your skin daily for telltale signs of the onset of pressure sores is a good way to avoid more serious problems. In particular, inspect the most susceptible spots such as sitting bones, tailbone, side of hips, and heels. Early signs are redness or a break in the skin.



For example, a grade 1 sore has redness that does not fade for longer than 24 hours. Although the skin is not broken, there may be heat, welling and hardness. A grade 2 sore has a break in the surface layer of the skin or blistering in the addition to redness, heat, and swelling. When the area of tissue destruction extends into the under layer of the skin this is Grade 3. By grade 4, the area of tissue destruction extends into the deep layer of connective tissue and may involve muscle.

Use a mirror to help you look at difficult-to-see locations. Special long-handled mirrors are available for quadriplegics or paraplegics. If you are unable to do self-inspection, you should instruct your personal assistant which signs to look for. Be sure the most vulnerable

spots (where bones protrude) are checked regularly.

For dark-skinned persons, however, redness may be difficult to detect. This means the range of other prevention techniques must be used even more diligently.

### Other contributing factors

Smoking, which impairs blood circulation, also has been linked to pressure sores. People with spinal cord injuries who are considered heavy smokers get pressure sores more often and have more severe sores. They also heal slower, have more frequent and more serious pressure sores, and when they do get sores, the healing process is slower. Diabetes, high blood pressure, high cholesterol, and other conditions that impair circulation should be considered as possible contributing factors.

### Equipment

Many types of assistive products have been developed in the search for prevention of pressure sores. Pressure-reducing surfaces are generally divided into two types: dynamic and static. Dynamic surfaces use a moving substance to reduce pressures while static surfaces change the shape of the surface when weight is applied. Examples of a dynamic surface are the alternating pressure or pulsating pad and air-fluidized bed which contains fine siliconized ceramic beads moved by a gentle air flow. Egg-crate and gel ("artificial fat") overlays are examples of the static surface.

## **Bed environment**

The Spinal Cord Injury: Skin & Pressure Sores publication (2005) produced by The Northwest Regional Spinal Cord Injury System advises that while in bed people with spinal cord injury should use pads or pillows to position the body to relieve pressure, keep a pad (not donut-shaped) or pillow under the midcalf to ankle area to reduce blood flow to the lower legs, keep knees and ankles from touching, avoid lying directly on the hip bone, and keep the head position at 30 degrees or less.

Some type of cushioning to ease the pinch of pressure is widely recommended. For beds, egg-crate cushions and mattress overlays of different materials such as sheepskin or air help reduce pressure. Not all mattresses on the market can achieve these low-pressure levels, so take care when selecting mattresses.

## **Wheelchair environment**

Wheelchair cushions can be made of various materials such as air, flotation, gel, or polyurethane foam. In a wheelchair, the body's weight is concentrated on a few primary points—the sitting bones, the rear hipbones and the thighs. In fact, 50% of the body weight is supported on just 8% of the sitting area. For this reason, several researchers have concluded that few cushions achieve needed pressure reduction.

Yet wheelchair cushions still are widely prescribed and used. When sitting in a wheelchair, the best advice is to follow a strict program of regular pressure relief—push-ups or weight shifting and to make sure that your cushion is clean and in good condition. Another option is specialized cushions such as the ones that have battery-powered pistons in the cushions inflate and deflate the cushions causing a person's weight to shift.

## **Treatment techniques**

There are some previously accepted treatments that now have fallen into disrepute. Pouring of sugar or honey into pressure sore wounds is no longer recommended even though there is some evidence of previous success. Heat lamp treatments are discouraged due to the possibility of burns. The once-popular alcohol rub and talcum powder treatment is out. At least one study found that povidone-iodine treatments of the wound might encourage infection. Massaging of reddened areas is now taboo—and even turning on a two or three-hour schedule is giving way to more individualized schedules in hospitals.

Technology also is influencing the treatment of pressure sores. Wheelchair pushup monitors have been developed to remind users to raise up and relieve pressure, although some researchers complain that dependency on the monitors can result. During surgical treatment in some hospitals, lasers rather than scalpels are being used to vaporize dead tissue.

Other treatments include debridement of severe sores by high-pressure irrigation or whirlpool therapy, and moist wound healing techniques. The advancement of medical treatment of pressure sores is demonstrated by the fact that now there are thousands of wound care products to choose from.

Yet the fact remains that pressure sores interfere with personal independence and mobility, are not easily cured, and even can be life-threatening. Prevention still is the best cure.

## **Pressure Sore Terminology**



Here are definitions of medical terms you may encounter when discussing pressure sores with doctors or when reading the articles cited at the end of this booklet:

**Ablation** (ab-lay'-shun) Removal of a part, for example by surgical cutting.

**Anoxia** (an-ox'-ee-uh) Deficiency of oxygen.

**Cellulitis** (sell-u-lie'-tus) Inflammation of cellular or connective tissue. If fluids are forced deeper into tissue rather than to the surface, the condition is cellulitis.

**Colostomy** (ko-los'-tomi) Incision of the colon to form an artificial anus and divert path of feces.

**Cyanosis** (si-an-o'-sis) Slightly blueish, grayish, slate-like or dark purple discoloration of the skin resulting from lack of oxygen and excess carbon dioxide in the blood.

**Decubitus ulcer** (di-cub'-it-us ul-sir) An excavation or pocket in the skin or surface of an organ caused by the sloughing off of dead tissue.

**Debridement** (da-bred-mon') Enlargement of a wound during surgery to remove dead tissue. Chemical debridement also is used.

**Erythema** (er-ith-e'-ma) Diffused redness of the skin caused by capillary congestion.

**Eschar** (es'-kar) Hard, black, crusted tissue.

**Flap** (flap) A mass of tissue or skin used in grafting so that when repositioned, it retains its own blood supply.

**Granular** (gran'-u-lar) A wound having the texture of grain or seeds, looking grainy, red and moist.

**Hyperemia** (hi-per-e'-mee-uh) Congestion; unusual amount of blood.

**Ischemia** (is-key'-mi-a) Temporary anemia due to the obstruction of blood circulation to an area of the body.

**Ischium** (is'-key-um) (plural: ischia) The lower portion of the hipbone; the two pointed bones you sit on.

**Malleolus** (ma-le'-o-lus) The protruding bone on both sides of the ankle.

**Necrosis** (nek-ro'-sis) Death of tissue or bone areas surrounded by healthy parts.

**Sacrum** (say'-krum) The base of the spinal column, the tailbone.

**Sepsis** (sep'-sus) Infection; sometimes used when referring to blood poisoning.

**Slough** (sluff) Loose, stringy, dead tissue.

**Suppurative** (sup'-u-ray-tiv) Producing or associated with formation of pus

**Trochanter** (tro-kan'-ter) Protruding bones at upper ends of the femur; the hipbones you lie on when resting on your side.