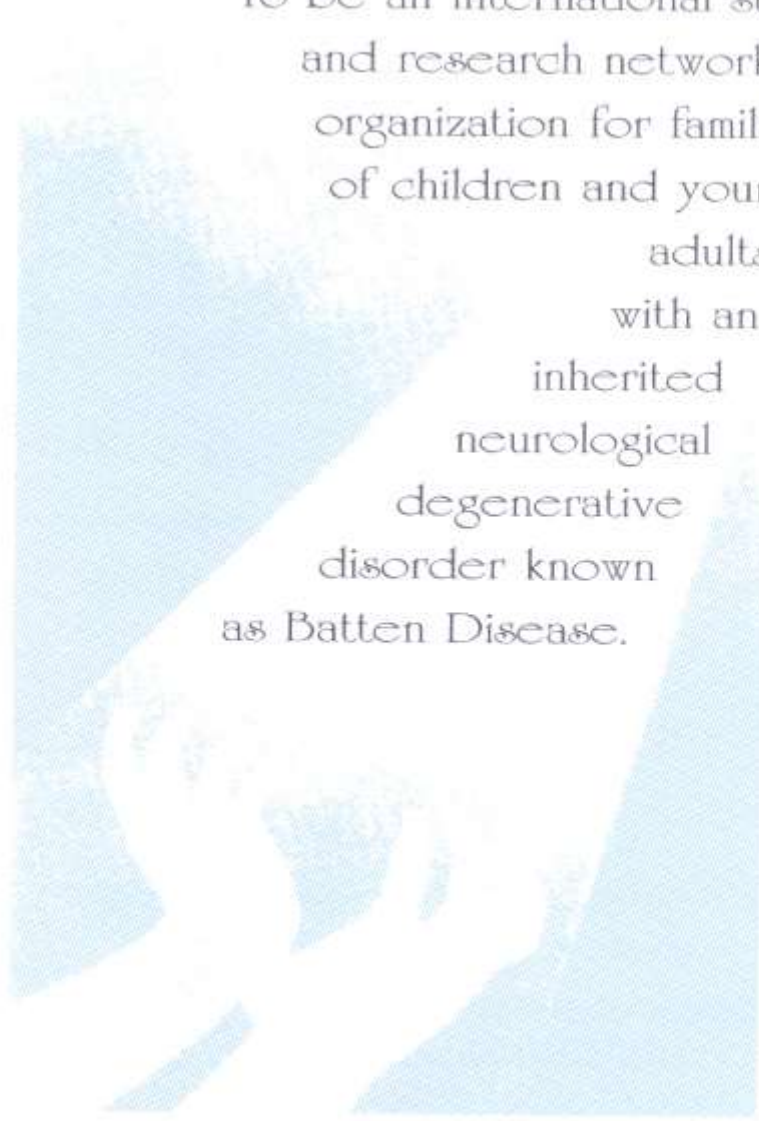


The mission of BDSRA is:

To be an international support
and research networking
organization for families
of children and young
adults
with an
inherited
neurological
degenerative
disorder known
as Batten Disease.



“A light in a world of darkness...”

BDSRA NOVEMBER 2000

PRESSURE SORES

WELCOME

NOTICE TO THE READER

This Batten Disease Handbook is compiled with information from many sources concerning the topics included. Families in the organization have also contributed their specific situations that have been helpful in their own battle with Batten Disease. All material in this book is provided for information purposes only. Although Batten Disease Support and Research Association (BDSRA) has made every reasonable effort to assure the accuracy of the information contained in this book, BDSRA is not engaged in rendering medical or other professional services and advice. BDSRA does not guarantee or warrant that the information in the book is complete, correct, current, or applicable to every situation. BDSRA disclaims all warranties express or implied, concerning this book and the information contained herein. If medical or other expert assistance is required, the services of a competent professional should be attained.

Nancy Carney, RN
Batten Disease Support and Research
Updated December 2011

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Pressure Sores

A pressure sore (also called pressure ulcers or bedsores) is any redness or break in the skin caused by too much pressure on your skin for too long a period of time. Pressure sores are localized areas of cellular necrosis that occur most often in the skin and subcutaneous (SC) tissue over bony prominences. These ulcers may be superficial, caused by localized skin irritation with subsequent surface maceration, or deep, originating in the underlying tissue. Deep lesions often go undetected until they penetrate the skin, but by then they have usually caused subcutaneous damage. Unrelieved pressure on the skin squeezes tiny blood vessels, which supply the skin with nutrients and oxygen. When skin is starved of nutrients and oxygen for too long, the tissue dies and a pressure ulcer forms. Skin reddening that disappears after pressure is removed is normal and not a pressure ulcer. Pressure ulcers are serious problems that can lead to pain, a longer stay in the hospital or nursing home, and slower recovery from health problems. Anyone who must stay in a bed, chair, or wheelchair because of illness or injury can get pressure ulcers. Normally, the nerves send messages of pain or feelings of discomfort to your brain to let you know that you need to change position. Pressure sores can range in severity from minor (minor skin reddening) to severe (deep craters down to muscle and bone).

The importance of preventive measures, such as turning and repositioning, range of motion (ROM) exercises, and proper nutrition and skin care, may be difficult to comply with, but it is so very necessary. Also things like pressure from wrinkles in sheets and clothing, ill-fitting braces and casts, or even crumbs in bed could exacerbate a child's problems of pressure sores.

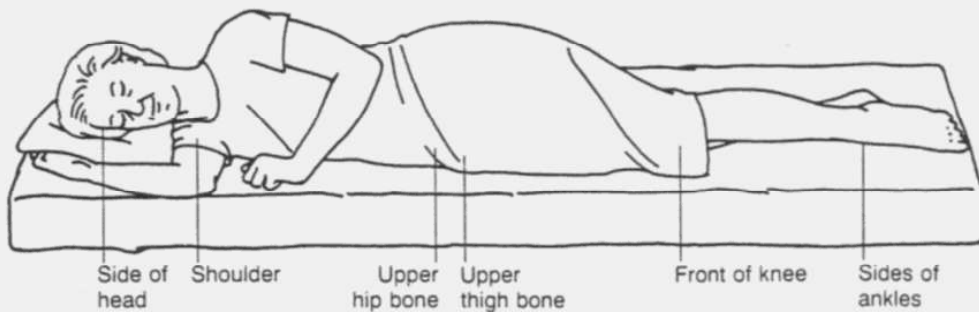
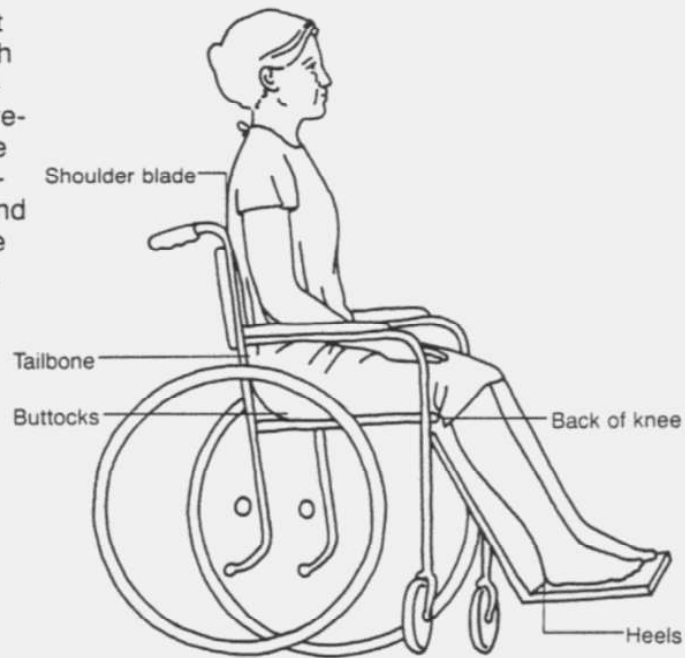
Causes for pressure sores include:

- The intensity and duration of such pressure govern the severity of the ulcer, pressure over an area for a moderate period (1-2 hours), produces tissue ischemia and increased capillary pressure leading to edema and multiple small vessel thrombosis. An inflammatory reaction gives way to ulceration and necrosis of ischemic cells. In turn, necrotic tissue predisposes to bacterial invasion and subsequent infection. The most common sites for pressure points: sores may develop at pressure points over bony prominences that interrupt normal circulatory function leading to ischemia of the underlying structures of skin and fat muscles. Examples are at the shoulder blades, tailbone, buttocks, back of the knee, and the heels while sitting in a wheelchair. In the lying position the pressure points are side of the head or

ear, the shoulders, the upper hip bones, the upper thigh bones, the front of the knees, and the sides of the ankles. To help prevent them, it is very

Pressure points: Common sites for sores

Sores may develop at pressure points, which are shown in these illustrations. To help prevent them, emphasize the importance of frequent repositioning and carefully checking the skin for any changes.



important to change positions every 15 minutes if in a wheelchair and every 2 hours if lying down.

- Shearing force - the force applied when tissue layers move over one another, which is determined by your child's position. Shearing happens when the skin moves one way and the bone underneath it moves another way. An example of this is if you slouch when you sit. This force stretches the skin, compressing local circulation. It can result from raising the head of the bed, as gravity tends to pull your child downward and forward. Friction adds to the problem if your child slides himself up in bed rather than lifts his hips. This causes deep ulcers due to ischemia, changes in the muscles, and subcutaneous tissues and areas most often over the sacrum and ischial tuberosities.
- Moisture is another cause of pressure sores. Whether from perspiration or incontinence, moisture softens skin layers and provides an environment for bacterial growth, leading to skin breakdown.
- Certain conditions can also increase your child's chances for developing pressure sores which include dehydration, poor nutrition or inadequate nutrition (which leads to weight loss and subsequent decrease in subcutaneous tissue and muscle bulk), diabetes, paralysis, cardiovascular disorders, obesity, insufficient weight, edema, anemia, poor hygiene, exposure to chemicals, altered mobility, and a breakdown in skin or subcutaneous tissue (as a result of edema, incontinence, fever, pathologic conditions or obesity).
- Abrasion - can occur when your child pulls himself across a surface instead of lifting himself. This is an example of a friction injury.
- Short exposure to high pressure such as a bump or fall, may cause damage to the skin which may not show up right away.
- Immobility
- Failure of nursing personnel to reposition bedridden children regularly.

Signs and Symptoms of Pressure Sores

Pressure ulcers commonly develop over bony prominences. Early features of superficial lesions are shiny, erythematous changes over the compressed area, caused by localized vasodilatation when pressure is relaxed. Superficial erythema progresses to small blisters or erosions and ultimately to necrosis and ulceration.

An inflamed area on the skin's surface may be the first sign of underlying damage when pressure is exerted between deep tissue and bone. Bacteria in a compressed site causes inflammation and eventually infection, which leads to further necrosis. A foul-smelling, purulent drainage may seep from a lesion that penetrates the skin from beneath. Infected, necrotic tissue prevents healthy granulation of scar tissue; a black eschar may develop around and over the lesion.

Diagnosis is based on observation by a physical examination - early identification may halt progression of sores. Wound culture and sensitivity testing of the exudate in the ulcer needs to be identified and the infection and/or organisms identified so that antibiotics can begin if needed. If severe hyperproteinemia is suspected, total serum protein values and serum albumin studies may be appropriate. A developing sore appears as a pink, red, or even dusky skin discoloration that does not disappear even after pressure is relieved. Other signs include warmth in the area, paleness with possible swelling, cyanosis, and blistering. A deep ulcer may first appear with only slight discoloration or a small opening surrounded by tissue that feels hard. If a sore progresses, one or more breaks in the skin of varying depth and size will occur, with or without drainage. The caregiver needs to measure the sore's width and length. To measure depth, use a cotton applicator and insert it into the deepest point of the sore, remove the applicator, and measure the applicator to the depth reached. Record the findings and its stage. If the pressure sore is open or draining, record the drainage amount and color and the sore's status (infected, healing, or unchanged) at every dressing change. Stress the importance of recording these observations throughout treatment. The four stages of pressure sores are as follows:

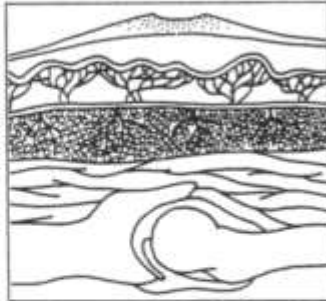
- Stage 1 - in this stage, skin stays red for 5 minutes after removal of pressure and may develop an abrasion of the epidermis (the top layer of skin). The skin also feels warm and firm. The skin may be unbroken. The sore is usually reversible if you remove pressure, and the underlying tissues are still soft. The sore will show redness, edema, induration, epidermal desquamation.
- Stage 2 - Breaks appear in the skin, and discoloration may occur. A blister may be present, either broken or unbroken skin. Penetrating to the subcutaneous fat layer, the sore is painful and may be visibly swollen. If pressure is removed, the sore may heal in 1-2 weeks.
- Stage 3 - A hole develops that oozes foul-smelling yellow or green fluid. The skin becomes necrotic with exposure of fat which extends into the muscle; the sore may develop a black, leathery crust or eschar at its edges and eventually at the center. The sore is not painful. The nerves at the site are deadened. Healing may take months. It is a primary site for a serious infection to occur.
- Stage 4 - Necrosis extends through the fat layers to muscles followed by further fat and muscle deterioration to bone destruction with periostitis and osteitis progressing to osteomyelitis with the possibility of sepsis, arthritis, pathologic fracture and septicemia. The sore destroys tissue from the skin to the bone and becomes necrotic. Findings include foul drainage and deep tunnels that extend from the sore. Months or even a year may elapse before the sore heals.

Four stages of pressure sores

Teach your patient the four stages of pressure sores. Advise him to inspect his body daily and to contact the doctor immediately if he spots a new sore, or enlargement or signs of infection in an existing sore.

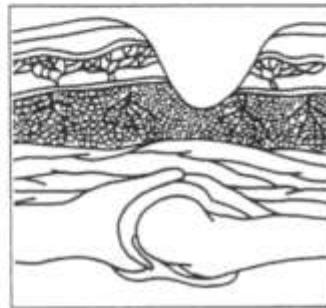
Stage 1

In this stage, skin stays red for 5 minutes after removal of pressure and may develop an abrasion of the epidermis. (A black person's skin may look purple.) The skin also feels warm and firm. The sore is usually reversible if you remove pressure.



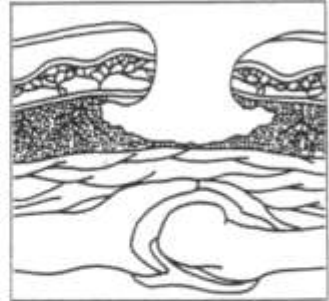
Stage 2

Breaks appear in the skin, and discoloration may occur. Penetrating to the subcutaneous fat layer, the sore is painful and may be visibly swollen. If pressure is removed, the sore may heal in 1 to 2 weeks.



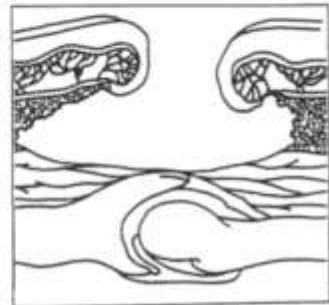
Stage 3

A hole develops that oozes foul-smelling yellow or green fluid. Extending into the muscle, the sore may develop a black, leathery crust or eschar at its edges and eventually at the center. The sore isn't painful. Healing may take months.



Stage 4

The sore destroys tissue from the skin to the bone and becomes necrotic. Findings include foul drainage and deep tunnels that extend from the sore. Months or even a year may elapse before the sore heals.



Prevention - is first and foremost. Movement and exercise improve circulation and prevent sores. A healthy diet keeps skin healthy and better able to resist breakdown. Protective skin care should a pressure sore develop needs proper cleansing, treatment, and dressing procedures.

- Two or three times per day, check the skin of bedridden children for possible changes in color, turgor, temperature and sensation. Examine an existing ulcer for any change in size or degree of damage. When using pressure relief aids or topical agents, explain their function to your child or to the parent if an aide or a nurse is checking the skin.
- Turning and repositioning - every 2 hours, around the clock as much as possible, your child should be turned in bed, or repositioned in a wheelchair. Allow your child to change his own position as long as he can by himself. If your child is being turned, make so he looks comfortable after turning and not in a jackknife position. The use of pillows or rolled up towels or a blanket can help in repositioning, as well as a pull sheet or turn sheet especially if you are the caregiver and will be doing the repositioning yourself.

- Range of motion (ROM) exercises - again allow your child to do as much by himself as he can, but when it becomes evident that he no longer can do it, passively exercise the arms, legs and move the head as well. Record exercise sessions, noting anything unusual - if your child is able to assist in bending a joint or if any exercise causes pain. Get your child out of bed and into a wheelchair as much as possible.
- To minimize the effects of a shearing force, use a footboard and do not raise the head of the bed to an angle exceeding 60 degrees.
- Use a draw or pull sheet to turn or pull up your child.
- Keep your child's knees slightly flexed for short periods.
- Use pressure relief aids on their beds.
- Provide meticulous skin care. Keep the skin clean and dry without the use of harsh soaps. Gently massage the skin around the affected area, not on it, to promote healing and rub moisturizing lotions into the skin thoroughly to prevent maceration of the skin surface.
- Change bed linens frequently for children who are diaphoretic or incontinent
- Clean the lesions with a 3% solution of hydrogen peroxide or normal saline solution. Dressings, if needed, should be porous and lightly taped to healthy skin. Debridement of necrotic tissue may be necessary to allow healing. One method is to apply open wet dressings and allow them to dry on the ulcer. Removal of the dressings mechanically debrides exudate and necrotic tissue. Other methods include surgical debridement with a fine scalpel blade and chemical debridement using proteolytic enzyme agents.
- Encourage adequate intake of food and fluids to maintain body weight and promote healing. Consult the dietary department to provide a diet that promotes granulation of new tissue. Encourage your child to eat frequent small meals that include protein and calorie-rich supplements. Assist your child with meals if needed.

If your child is bedridden, here are some examples of pressure relief devices:

- Gel flotation pads - pads disperse pressure over a wide surface area which is convenient and adaptable for home and wheelchair use.
- Water mattress or pads - wave effect continuously provides even distribution of body weight, but is heavy and awkward, mini water beds or partially rubber domes or plastic bags may be used for small areas like the heels and feet.
- Alternating pressure mattress - contains tubelike sections, running lengthwise that alternate deflation and inflation of mattress, tubes change areas of pressure, use mattress with a single untucked sheet because layers of linen decrease its effectiveness .
- Convoluted foam mattress or pads or also called egg crate mattresses - elevated foam areas cushion skin, minimizing pressure. Depressed areas

relieve pressure. This mattress should be used with a single loosely tucked sheet and is adaptable for home or wheelchair use. If your child is incontinent, cover the mattress with a protective plastic cover.

- Spanco mattress - made of polyester fibers with silicon tubes, decreases pressure without restricting position.
- Sheepskin pad - prevents pressure and absorbs moisture. It must be in direct contact with the skin.
- Foam rubber - cut to just the right size and shape, it cushions individual areas.
- Clinitron bed - contains beads that move under an airflow to support your child, thus eliminating shearing force and friction.
- Low airless beads, such as a Flexcare or Accucare, slow the dryness of any saline soaks. The head of the bed can be elevated so there is less chance of aspiration especially in children who require tube feedings. Children can get out of bed more easily and can be moved more easily on low air-loss surfaces.
- Stryker or Foster frame or Circoelectric bed - relieves pressure by turning your child.
- Lift sheet or mechanical lifting device - lift sheets and other devices prevent sheering by lifting your child rather than dragging him across the bed.
- Padding - pillows, towels, and soft blankets can reduce pressure in body hollows.
- Foot cradle - lifts the bedclothes to relieve pressure over the feet.

Topical Agents

- Gentle soap
- Dakins solution
- Zinc oxide cream
- Absorbable gelatin sponge
- Granulated sugar (mechanical irritation to enhance granulation)
- Dextranomer (inert, absorbing beads)
- Karaya gum powder
- Topical antibiotics (only when infection is confirmed by culture and sensitivity testing of wound exudate)
- Silver sulfadiazine cream (antimicrobial agent) for necrotic areas
- Water-vapor permeable dressings
- Duoderm, tegaderm dressings

Skin Damaging Agents To Avoid

- Harsh alkali soaps
- Alcohol based products (can cause vasoconstriction)
- Tincture of benzoin (may cause painful erosions)

- Hexachlorophene (may irritate the central nervous system)
- Petroleum gauze
- Oxychlorosene calcium (antiseptic used for irrigations and wet to dry packs, in 0.4% solution)
- Providone-iodine packs (remain in place until dry), also called betadine packs- be sure your child is not allergic to iodine's

Diet

Good nutrition is essential to healing ulcers and preventing new ones. You will want to pay close attention to children whose health history shows a weight loss of 10 pounds or more during the previous six months. With all children, verify that they are eating and monitor their weight every week. Suspect a dietary deficiency if they lose 5% of body weight or if their serum albumin drops below 3.5. A balanced diet, especially one that promotes healthy skin, is critical in preventing and treating pressure sores. Once a pressure sore develops, it will not heal if your child is not getting a healthy diet. If intake is inadequate, your child may need help with oral feedings, dietary supplements, tube feedings, or a daily high-potency vitamin and mineral supplement. Monitor all children to be sure they are able to swallow safely and are tolerating their diet. That includes watching for loose bowel movements related to tube feedings. Those children who are at risk for malnutrition should be scheduled for nutritional screenings at least every three months.

Encourage foods rich in protein and certain vitamins and minerals. Iron helps transport vital nutrients to skin cells - found in meats, cereals, dark green vegetables, enriched breads, zinc helps heal pressure sores and promotes healthy skin - meats, oysters, and whole grain breads and cereals, Vitamin C aids wound healing, promotes iron absorption, and helps skin form collagen for healthy connective tissue - citrus fruits, strawberries, cantaloupe, sweet peppers, tomatoes, cabbage, potatoes, and broccoli. Also important are the B Vitamins which aid in skin cell growth and help the body metabolize protein - meats, poultry, whole grain breads and cereals, dairy foods, and green, leafy vegetables, such as spinach, also adequate fluid intake and maintaining desirable weight are important.

Skin Treatments - successful treatments must relieve pressure on the affected area by keeping the area clean and dry to promote healing. How will you know if the sore is healing? The sore will get smaller, pinkish tissue usually starts forming along the edges of the sore and moves toward the center, some bleeding may be present which shows that there is good blood circulation to the area, which helps healing. Once a pressure sore has developed, the treatment will depend on the sore's stage. Please read the instructions for each stage but in addition to those treatments the following may also be used:

- A heat lamp to dry moist area and increase total circulation - use only a 25 watt bulb at a distance of 18-24" (as the doctor directs) for no longer than 10-20 minutes, three or four times per day. Check your child every 5 minutes for redness or pain in the skin around the ulcer. Your child may inadvertently move too close to the lamp and burn his skin. You need to be aware that increasing the duration, reducing the distance, or increasing the wattage may result in burns; also stay with your child during the treatment, then apply a dressing as directed.
- Make sure you know how to recognize and record signs of healing such as a reduction in the sore's size drainage, and the appearance of healthy-looking granulation tissue (looks grayish red, bleeds easily, and is easily injured).
- Cleanse area with a gentle soap which removes irritants and bacteria - give special attention to drying skin folds - advise gently massaging in lotion or oil on damp skin to retain moisture - rubbing in powder at bony prominences and at skin fold's to absorb moisture and reduce friction (avoids caking and irritation).
- Debridement may be necessary which will be mechanical, chemical, autolytic or surgical removal of necrotic tissue - will go into more depth on the methods of debridement later.
- Use moistened oxygen-slightly pressurized - to avoid dry necrosis along the ulcer's edge. You will need an oxygen source (such as wall oxygen), a pressure system for the oxygen (such as an intermittent positive-pressure breathing machine), a method to localize the oxygen directly over the ulcer, and tubing's for connections. Apply the oxygen directly over the ulcer, usually for 15 minutes three or four times daily.

Guide To Decubitus Ulcer Therapy

- Hexachlorophene (PhisoHex) - may cause vasoconstriction, leading to further decubitus ulceration, tissues may absorb hexachlorophene, may produce neurotoxic effects, always rinse the area thoroughly after use
- Collagenase (Santyl) - do not use with detergents, hexachlorophene, antiseptics, (especially those containing heavy metal ions, such as mercury or silver), iodine, soaks or acidic solutions containing metal ions, such as aluminum acetate (Burow's solution). These may decrease enzymatic activity of the collagenase; apply this debriding ointment in thin layers after cleansing the lesion with normal saline solution, neutral buffer solution, or hydrogen peroxide; use with caution in debilitated children because debriding enzymes may increase risk of bacteremia. Observe for signs and symptoms of systemic infection and protein sensitization (long-term therapy); watch for granulation, which may indicate effectiveness; if enzymatic action must be stopped for any reason, apply Burow's solution.

- Compound Benzoin Tincture (Benzoin Spray) - do not apply to acutely inflamed areas. Benzoin spray is usually applied only to healthy skin surrounding the decubitus ulcer to prevent further skin breakdown; observe for inflammation or infection, because protectants are occlusive layers that retain moisture, exclude air, and trap cutaneous bacteria.
- Dexpanthenol (Panthoderm Cream or Lotion) - do not apply to lesions of children with hemophilia; thoroughly cleanse the ulcer before each application. Works best on dry ulcers rather than on oozing ulcers.
- Dextranomer (Debrisan) - do not use dextranomer beads to cleanse nonsecreting wounds. Discontinue treatment when wound is no longer exuding; cleanse but do not dry the ulcer before applying the dextranomer beads; remove the medication when it turns gray-yellow, indicating saturation; to remove, irrigate with jet lavage using sterile water, a saline solution or other cleansing solution.
- Fibrinolysin and desoxyribonuclease (Elastase) - dense, dry eschar must be removed surgically before enzymatic debridement with Elastase; the ulcer should be cleansed, dried, and coated with a thin layer of the enzyme ointment and then covered with a non-adhering dressing at least once per day.
- Absorbable gelatin sponge (Gelfoam) - sponges control oozing when inserted into the deepest portion of the ulcer. Do not remove or disturb the sponges already in place, but extra pieces may be added, if necessary; do not use with other topical agents.
- Karaya blanket - use only on small, ulcerated areas; do not use on areas that require daily cleansing, protective coating should remain on the wound for several days.
- Scarlet Red (Decubitex Ointment) - keep ointment in contact with newly forming tissue. Use a thin layer of ointment and cover loosely with dry sterile gauze to allow the wound to "breathe"; change the dressing twice daily, especially when seeping and secretions are present.
- Silicone (Silicone and Zinc Oxide Compound, Silon Spray) - be aware that silicone is difficult to remove from skin, it resists soap and water. Although it is a topical protectant, it does not protect against oils or solvents; observe for inflammation or infection, because the protectant is occlusive and retains moisture, excludes air, and traps cutaneous bacteria; it may be used alone, as a vehicle for medications, or with other topical medications; protect eyes against spray.
- Sutilains (Travase) - do not use with detergents, antiinfectives (such as benzalkonium chloride, hexachlorophene, iodine, and nitrofurazone), and compounds containing metallic ions (such as silver nitrate and thimerosal) which adversely affect enzymatic activity of sutilains. Also do not use this debriding agent in wounds involving major body cavities or containing

exposed nerves or nerve tissue, in fungating neoplastic ulcers, or in wounds in children with limited cardiac and pulmonary reserves; store at 35.2 to 50 degrees F; if used with topical antimicrobials, apply sutilains first; for best response, keep affected area moist; the Doctor may order a mild analgesic to reduce painful reactions, but with Doctor's approval, discontinue sutilains if pain is severe. Also discontinue if bleeding or dermatitis develops; use cautiously near eyes. If accidental contact occurs, flush eyes repeatedly with large amounts of normal saline solution or sterile water.

Treating pressure sores at each stage:

Stage 1 Treatments - to prevent skin breakdown and improve circulation .

- Lubricants (Lubriderm) - lubricants increase tissue pliability and stimulate local circulation. Instruct to massage the lotion gently over the affected area. Vigorous massage can further damage skin.
- Clear plastic dressings (Op-Site) - this dressing adheres to the skin, protecting against friction. Permeable to moisture vapor, it allows oxygen to enter but keeps germs and water out. You may need to dry the area with a hair dryer to have the dressing adhere to the skin.
- Gelatin-type wafers (Duoderm, Johnson & Johnson ulcer dressing) - these wafers promote healing and protect the skin.
- Vasodilator sprays (Proderm) - these sprays act as a lubricant and increase local blood supply.
- Whirlpool baths - besides cleansing the skin, whirlpool baths stimulate circulation, but it may also dry the skin.

Stage 2 Treatment - used with stage 1 to prevent further skin damage.

- Normal saline solution or water - it cleanses the sore and prevents infection, cleanse the sore gently to prevent further skin damage.
- Hydrogen peroxide - a 25% solution cleanses the sore, removes debris, and prevents infection, then follow cleansing the sore with a saline rinse.

Stage 3 and 4 Treatments - to prevent infection and remove neurotic tissue.

- Hydrogen peroxide - a 50% solution cleanses the sore, acts as an antibacterial agent, and lifts debris to the surface, follow cleansing with a normal saline rinse.
- Providone-iodine solution (Betadine) - a 50% solution cleanses the sore and fights infection - do not use if your child is allergic to iodine.
- Granular absorbent dressing (Duoderm granules or Debrisan beads) - this treatment draws drainage from the sore, apply the powder form directly to the sore - if used on a healing sore it may damage new tissue.
- Gel-like absorbent (Bard absorption dressing) - this liquefies on contact with drainage, which helps draw exudate from the sore.
- Enzymatic ointment (Elase, Travase) - this ointment breaks down dead tissue to aid drainage, used after surgical debridement.

- Healing gel or ointment (Carrington Wound Gel, Special Care Gel) - this treatment encourages new cell formation.
- Sodium chloride-impregnated dressing (Mesalt) - this treatment and dressing cleanses deep infected sores by wicking drainage, debris, and bacteria from the sore, while maintaining a moist environment, which promotes healing, anchor this dressing with hypoallergenic tape or Mefix, an adhesive tape that conforms to body contours.
- Gauze dressings - Gauze adheres to dead tissue, allowing its removal along with the old dressing, avoid telfa-like dressings because they will not adhere to dead tissue.
- Wet-to-dry dressings - soak gauze in a normal saline solution or an antiseptic solution, as the dressing dries, it adheres to the sore, when it is removed, debris comes with it.

How to reposition your child in bed and/or in a wheelchair:

- Back positioning - place a flat, firm pillow under head so that your child's neck is straight and in line with his spine, place a thin blanket under the heels, slightly bend his elbows and rest the hands on his hips, straighten his legs and place his feet, toes pointing up on a padded board resting against the foot of the bed.
- Side positioning - place your child's head in line with his spine, support the head and neck with a firm, flat pillow, and have the arms wrapped around another pillow, move his upper leg forward until his knee is bent, to raise it above his lower leg, place a pillow under this leg to keep it at hip level, slightly bend the lower knee and place a folded towel, blanket, or piece of foam rubber under it to keep your child's ankle off the bed.
- Stomach positioning - after turning onto the stomach, turn your child's head to one side and place a pillow or folded towel under his cheek, move your child's arms up so that his bent elbows are in line with his shoulders, place folded towels beneath his chest and stomach, straighten his legs, support the ankles and raise the toes off the bed by using a rolled towel or small rolled blanket.
- Shifting the position - try to shift your child's weight once every hour.
- Doing push-ups - if your child is able to move his arms, try to do wheelchair pushups, grip the arms of the wheelchair and push down hard with your hands and arms to try to raise your upper body off the seat - can also be used to shift your weight.

Performing passive range of motion exercises - active range of motion means that your child can perform exercises by himself, passive range of motion exercises means that he is unable to do exercises on his own, and you will need to do the exercises for him. Mobility or physical therapy early in the course of treatment

can be beneficial for children with pressure sores. Functionally independent children should be encouraged to get out of bed as much as possible. Those confined to bed should receive daily range of motion and stretching exercises to prevent contractures.

- Neck exercises - with your child on his back (no pillow), support his neck and chin - extend the neck backward to look at the ceiling and then forward until the chin comes as close to the chest without causing discomfort, then to the right and then the left.
- Shoulder exercise - extend your child's arm straight out to the side with his palm facing up, support his elbow and wrist, bring arm up until it reaches his ear, and return to the original position.
- Elbow exercise - extend your child's arm out to the side with the palm facing up, support the wrist to keep his hand from drooping, bend the arm at the elbow and bring his hand up forward the shoulder and back to the original position.
- Forearm exercise - place your child's arms along his sides, grasp the wrist and hand, keep the elbow on the bed, raise his hand and gently twist it so his palm is up, then twist it so it is down.
- Wrist exercise - place your child's arms along his sides. Keeping the elbow on the bed, hold the arm slightly below the wrist and raise it, grasp the hand lift it, bend it gently back and forth sideways, twist the hand from side to side.
- Finger exercise - grasp your child's hand keeping his wrist straight, gently straighten fingers, work from his little finger to his thumb, spread each pair of adjoining fingers apart and then bring them back together, pinch the thumb together with each finger, one finger at a time.
- Hip and Knee exercise - straighten the legs of your child flat on the bed, support the ankle and the knee, bend the knee toward the chest, bring his leg down and straighten it and then gently move it out to the side away from his other leg, gently move back to the center, then over and across the other leg, then back to the center again.
- Ankle exercise - support the heel and the ball of the foot of your child, push the ball of his foot gently toward his head as you pull his heel down, pull his toes down toward the bed while you push his heel up, straighten the foot and move it gently from side to side.
- Foot exercise - support the heel and the ball of the foot, gently twist his sole inward toward his sole, straighten his toes and then bend them gently back toward the top of his foot and straighten them again, working from the little toe to the big toe, spread each pair of adjoining toes apart, then bring them back together.

Applying a dressing: follow this step-by-step guide to cleansing, treating or debriding, and dressing a pressure sore. This is one method. Your Doctor will give you specific orders on how he wants you to do the dressing. If the wound is deep and/or severely painful, you may want to medicate your child 30-45 minutes prior to each dressing change for comfort - talk to your Doctor concerning this issue.

- Assemble the equipment - dressings (gauze pads or transparent adhesive), scissors, hypoallergenic tape, cleaning solution (peroxide, betadine), antibacterial ointment as ordered, two bowls in which to pour the cleansers, sterile gloves, plastic disposable bags, and baby oil, have the new dressing ready before you take off the old one, cut strips of tape, pour boiling water in the bowls to sterilize them, and discard the water, pour sterile water in one and the cleaning solution in the other, position your child so that you can reach the sore easily.
- Remove the old dressing - wash your hands thoroughly, remove the tape carefully from the skin, if this is painful moisten the tape with baby oil before you remove it, change the position of the tape the next time if the skin is reddened, remove the old dressing, but do not touch any part of the dressing that touched the sore, check the amount and color of any drainage, fold its edges together, place in a disposable bag and close the bag. Remove dead tissue and debris from the wound at each dressing change before you assess the wound. Rinse or irrigate the ulcer, typically with normal saline. The amount of force used to deliver the irrigating fluid to the wound bed directly influences its effectiveness. If the pressure is too low, it will not cleanse the ulcer well enough, if the pressure is too high it may traumatize the wound bed and increase the risk for infection. Very-large, debris-filled ulcers can be cleansed in a whirlpool - but discontinue the whirlpool treatment as soon as the wound is clean to avoid potential trauma to newly regenerating tissue that the agitating water can cause.
- Check the sore - inspect for swelling, redness, drainage, or pus - signs of probable infection. Is the sore healing? Write down what you see with each dressing change. Do not touch the sore.
- Put on sterile gloves - wash your hands again before handling the sterile gloves, start with the glove for the hand you use most often, grasp it by the cuff with your thumb and forefinger, and lift it from the wrapper, touch only the inside of the glove to keep it sterile and slip on, then pick up the second glove by slipping your gloved hand under the cuff, pull on the second glove.
- Clean the ulcer - moist necrotic tissue retards wound healing and is a medium for bacterial growth. It must therefore be removed. There are four methods: sharp, mechanical, chemical, and autolytic.
 1. **Sharp** debridement or surgical excision is the fastest way to remove dead tissue and is the method of choice if there is advancing cellulitis or sepsis.

The drawback of this approach is that it is non-selective, it removes both viable and nonviable tissue - and may be painful. It requires specialized skill and in the case of extensive wounds, the use of an operation room. Many children are not candidates for this option.

2. **Mechanical** - there are various forms of this method, but application of wet-to-dry dressings is the one you will see most often. With this method you will moisten gauze with normal saline, place it on the wound bed, and allow it to dry completely, the necrotic tissue adheres to the dressing and as you remove the dressing the tissue peels away as you remove the dressing. Be sure to use wet-to-dry dressings for debridement only and not for routine dressings. Other forms of mechanical debridement include forceful scrubbing with coarse surfaces and pressurized hydrotherapy such as a whirlpool. It also is non-selective and may be painful.

3. **Chemical** debridement uses a topical biologic enzyme such as collagenase to selectively break down necrotic tissue. It promotes debridement and growth of granulation tissue within three to thirty days. Apply the biologic enzyme to dead tissue only, following the instructions. Enzyme treatment can be used alone or in combination with sharp or mechanical debridement. You may see transient redness of the skin surrounding the ulcer following treatment.

4. **Autolytic** debridement is also selective for necrotic tissue. You cover the ulcer with dressing materials that retain moisture in the wound. The body's own enzymes, contained in the wound fluid, are able to break down the necrotic tissue. It takes longer than other methods, however, it is frequently the method of choice for children who cannot tolerate sharp debridement. Autolytic debridement with occlusive dressings is contraindicated for infected wounds saturate a gauze pad with betadine or peroxide, lightly scrub both the sore and the area around it, saturate a second gauze in sterile water, wring it out over the sore, use another gauze to gently blot dry the sore and the skin around it, dispose of all pads in a disposable bag.

Put on the new dressing - if you are using a dressing, be careful not to touch any area that will touch the sore, use any ointment onto the dressing if ordered before applying it, tape securely, if using a transparent dressing. Remove the protective paper, then use your thumb to press that part of the dressing onto the skin near the sore. Peel the remaining paper off the dressing and smooth it over the sore and surrounding skin, press down on all four sides of the dressing to prevent leakage, take off gloves and put in disposable bag, wash your hands thoroughly.

Complications of pressure sores: Once your child develops pressure sores, they require aggressive treatment to stop them from worsening. If treatment is

delayed or inadequate, local infection can result, possibly leading to bacteremia and septicemia, which can be life threatening, infections can spread to the blood, heart, and bone, amputations, prolonged bed rest, and autonomic dysreflexia...

Chronic wounds such as pressure ulcers normally are colonized with bacteria but they are not necessarily infected. Cleansing and debridement help decrease the amount of bacteria in the wound, but may not be enough to ward off infection in susceptible children.

Routinely monitor for signs and symptoms of local infection, including thick green or yellow drainage, foul odor, redness or warmth around the ulcer, tenderness, and swelling. Fever or chills, weakness, altered level of consciousness, and tachycardia may indicate widespread infection.

Local infection may be treated with topical antibiotics. The guideline recommends a two-week trial of a topical antibiotic like silver sulfadiazine to reduce bacteria in ulcers that are not healing.

Do not treat local infections with topical antiseptics such as Dakin's solution, hydrogen peroxide, and acetic acid. These agents are toxic to exposed healing cells. Systemic antibiotics are ordered only in cases of bacteremia, sepsis, advancing cellulitis, or osteomyelitis.

Pay close attention to infection control measures to avoid cross contamination of microorganisms. You will want to wash your hands thoroughly and frequently and change gloves when necessary.

A clean ulcer should begin healing within two weeks. If it does not, reevaluate the entire treatment plan with your Doctor. Consider alternative forms of pressure relief and look for possible nutritional deficiencies. Review wound care and dressing technique, and evaluate the type of dressing used.

If the pressure ulcer appears like it is not healing or getting worse, please notify your health care agency or Physician and report your findings - the treatment plan may need to be altered.

Documentation - Record the time and date of initial and subsequent treatments. Initially document the ulcer's location, size (length, width, depth), and color, amount, odor and color of drainage, and condition of the surrounding skin. Note the treatment being used and update daily or as required. Note any change in the condition or size of the ulcer and any elevation of skin temperature. Record your child's temperature daily. Documenting is very important.

Glossary

Pressure Sores

A

Abrasion - a scraping away of a portion of skin or of a mucous membrane as a result of injury or mechanical means

Absorbable - to take in, a substance, which absorbs

Acute - sharp, severe, having rapid onset, severe symptoms and a short course, not chronic

Adhering dressing - the quality of clinging or being closely attached

Alkali soaps - a metallic hydroxide that has the property of combining with an acid to form a salt, or with an oil to form a soap. Any substance, which can neutralize acids and affect indicators in certain ways

Analgesic - a medicine which relieves pain

Anemia - a condition in which there is a reduction in the number of circulating red blood cells or in the hemoglobin or in the volume of packed red blood cells. If the anemia is slow, the body may adjust so well that there will be no functional impairment noted until the hemoglobin level becomes extremely low. Anemia may be due to blood loss or low production of blood cell formation

Antimicrobial agent - preventing the development or pathogenic action of microbes, helps decrease an infection and allows healing of a wound

Aspiration - to draw in or out as by suction. Foreign bodies may be aspirated into the nose, throat or lungs on inspiration, the withdrawing of a fluid from a cavity by means of suction with an instrument called an aspirator

B

Bacteremia - bacteria in the blood

Bacterial - unicellular microorganisms, lacking chlorophyll, many different kinds of bacteria, germs, creating an infection

Bony prominence - the protrusion of a bone that you can feel like an elbow, hip or ankle bone

C

Capillary pressure - minute blood vessels carrying blood and forming the capillary system. Capillaries contain the smallest arteries (arterioles) with the smallest veins (venules)

Cardiac reserves - when the heart is strong, but the rest of the body is weakening, the heart will be able to carry the body for a while longer due to the strength of the heart muscles

Cardiovascular disorders - pertaining to the heart and blood vessels

Cellular - pertaining to or derived from cells

Cellulitis - inflammation of cellular or connective tissue. A deep abscess, in pushing its way to the surface, may result in the formation of a sinus tract leading to an exit on the surface of the skin. If the inflammatory fluids are forced into the tissues, rather than being discharged on the surface, and inflammation of the tissues results, the condition is known as cellulitis

Central nervous system - the brain and spinal cord, including their nerves and end organs, controlling voluntary acts

Chronic - long, drawn out, applied to a disease that is not acute

Cutaneous - pertaining to the skin

Cyanosis - slightly bluish, gray, slate-like, or dark purple discoloration of the skin to the presence of abnormal amounts of reduced hemoglobin in the blood, when the whole body is affected, it is said to be dusky in color.

Cyanosis is due to the deficiency of oxygen and the excess of carbon dioxide in the blood caused by gas or any condition interfering with entrance of air in the respiratory tract

D

Debridement - to remove dirt, foreign objects, damaged tissue, and cellular debris from a wound or a burn in order to prevent infections and to promote healing. In treating a wound, debridement is the first step in cleansing the wound; debridement also allows thorough examination of the extent of the injury. In treating a burn, debridement of the eschar may be performed in a hydrotherapy bath

Debris - the actual material that has been debrided

Dermatitis - inflammatory condition of the skin, characterized by erythema and pain or pruritus. Various cutaneous eruptions occur and may be unique to a particular allergen, disease or infection. The condition may be acute or chronic, treatment is specific to the cause, usually reddened skin

Desquamation - a normal process in which the cornified layer (thickening of the skin by a buildup of dead tissue) of the epidermis is sloughed in fine scales. Certain, conditions, injuries, and medications accelerate desquamation and may cause peeling and the loss of deeper layers of the skin

Diabetes - a clinical condition characterized by the excessive excretion of urine, may be caused by a deficiency of the antidiuretic hormone or it may be the result of the hyperglycemia (high blood sugar) where usually the pancreas is not producing enough insulin to carry the body

Diaphoretic - perspiring, the secretion of sweat

Duoderm - a dressing that looks like a wafer that can be cut to fit the exact area of a pressure sore, or to prevent a bony prominence from rubbing on the sheets, or can be to place tape on the wafer to protect the skin from constantly tearing tape off

Dysreflexia - an abnormal neuromuscular condition characterized by abnormal motor response to stimuli that normally produce a specific response

E

Edema - a condition in which the body tissues contain an excessive amount of tissue fluid. It may be local or general swelling

Enzymatic activity - an organic catalyst produced by living cells (as in digestive juices), but capable of acting independently of the cells producing them. They are capable of inducing chemical changes in other substances without themselves being changed in the process

Epidermis - the outer layer of skin

Erosions - an eating away of tissue, destruction of a surface layer, either external or internal, by physical or inflammatory processes

Erythematous - a form of a rash showing diffused redness over the skin - caused by capillary congestion, due to the dilatation of the superficial capillaries as a result of some nervous mechanism within the body, inflammation, or as an external influence as in a sunburn or heat

Eschar - a slough, especially one following a cauterization or burn - any agent used to destroy dead tissue and to cause sloughing which produces an eschar (a blackened area) in the treatment of skin diseases

Exacerbate - aggravation of symptoms or increase in the severity of a disease

Exudate - accumulation of a fluid in a cavity, or matter that penetrates through vessel walls into adjoining tissue, or the passing out of pus or serum, or the matter so passed

F

Footboard - a board which goes on the bottom of a bed to prevent foot drop, to where the bottom of the foot can be flat against a hard surface

Fungating - growing rapidly like a fungus, applied to certain tumors

G

Granulation - any soft, pink, fleshy projections that form during the healing process in a wound not healing by first intention, consisting of many capillaries surrounded by fibrous collagen. Overgrowth of granulation tissue results in proud flesh growing to protrude above the skin

H

Hemophilia - a hereditary blood disease characterized by greatly prolonged coagulation time, which means, the blood does not clot like in "normal" people, and abnormal bleeding occurs

Hydrotherapy - scientific application of water in treatment of disease, can be hot or cold applications

Hyperproteinemia - excess of protein in the blood plasma (the clear part that separates from the red blood cells)

I

Incontinence - the inability to control urination. It may be caused by cerebral clouding in the aged, infections, lesions, in the brain or spinal cord, or damage to the peripheral nerves of the bladder.

Induration - hardening of a tissue, particularly the skin, owing to edema, inflammation, or infiltration by a tumor

Inert - not moving or acting

Invasion - characterized by a tendency to spread, infiltrating, and intrude

Ischemia - decreased blood supply to a body organ or part. Some causes of ischemia are arterial embolism, atherosclerosis, thrombosis or vasoconstriction

Ischial tuberosities - the bony prominence on the lower portion of the hip, which is how some of the muscles are attached to the pelvis

J

Jet lavage - by taking a 60cc syringe and pushing with some force to expel the water/cleansing solution to the wound to debride it with the agents being used to help in the debridement process

K

Karaya gum powder - a dry white powder that becomes sticky in a wound and can debride a wound. It can also protect good skin around the wound

L

Lesion - any visible, local abnormality of the tissues of the body, as a wound, sore, rash, or a boil. A lesion may be described as benign, cancerous, gross, occult, or primary

Localized - of or pertaining to a small circumscribed area of the body

M

Maceration - to soften something by soaking

Meticulous - being very thorough as in a dressing change relating to cleansing a wound

N

Necrosis - localized tissue death that occurs in groups of cells in response to disease or injury, as an example - blood clots may block the flow of blood causing tissue ischemia below the blood clot, or ischemia combined with bacterial action can cause gangrene to set in

Neoplastic ulcer - an ulcer with an abnormal growth of tissue or bone

Neurotoxic effects - having a poisonous effect on the nerves or nerve cells

Non-Occlusive - as in a dressing that is not completely occlusive or taped around all four sides

O

Osteitis - an inflammation of bone, caused by infection, degeneration, or trauma. Swelling, tenderness, dull aching pain, and redness in the skin over the affected bone are characteristic of the condition

Osteomyelitis - local or generalized infection of bone and bone marrow, usually caused by bacteria introduced by trauma or surgery, by direct extension from a nearby infection, or via the bloodstream. Staphylococci are the most common causative agents. The long bones in children are the

commonest sites of infection as a result of hematogenous spread. Persistent, severe, and increasing bone pain, tenderness, guarding on movement, regional muscle spasm and fever suggest this diagnosis. Draining sinus tracts may accompany posttraumatic osteomyelitis or osteomyelitis from a nearby infection. Specific diagnosis and selection of therapy depend on the bacterial examination of bone, tissue or pus. Treatment includes bed rest and IV antibiotics for several weeks. Surgery may be necessary to remove necrotic bone and tissue, to obliterate cavities, to remove infected prosthetic appliances, and to apply prostheses to stabilize affected parts. Nursing consideration: any drainage is disposed of with the usual precautions against contamination. Absolute rest of the affected part may be necessary, with careful positioning, using pillows and sandbags for good alignment. During the early phase of infection, pain is extremely severe, and extraordinary gentleness in moving and manipulating the infected part is essential.

P

Pathologic fracture - a fracture resulting from weakened bone tissue, which can be caused by many different reasons

Periosteitis - inflammation of the membrane around the bone

Permeable - capable of or allowing the passage of fluids or substances in solution

Petroleum gauze - absorbent gauze permeated with white petrolatum

Pliability - capacity of being bent or twisted easily

Porous - full of pores (a minute opening especially one on an epithelial surface) example is like a dressing where air is able to permeate the dressing to the wound

Protein sensitization - where the protein in the blood is very sensitive for what ever reason, in this case to the broken down tissue of the ulcer

Proteolytic enzyme - a process in which water added to the peptide bonds of proteins breaks the protein molecule. Numerous enzymes may catalyze (a increase in the rate of chemical reaction by the enzyme) this process. The action of mineral acids and heat may also include the proteolytic effect

Pulmonary reserves - the pulmonary system (respirations) is strong and has reserves to where it will keep the body going for a while

Purulent - producing or containing pus

S

Sacrum - the large triangular bone at the front part of the pelvis, inserted like a wedge between the two hipbones. The base of the sacrum touches with the last lumbar vertebrae. It is shorter and wider in women than in men.

Saturation - unable to absorb any more of a given substance

Scalpel - a little knife, a straight, small surgical knife with a convex edge and thin blade

Sepsis - infection, contamination, pathological state usually with a fever, resulting from the presence of microorganisms or their poisonous products in the blood stream

Septicemia - invasion of the blood by pathogenic bacteria or their toxins

Serum albumin - a major protein in the blood plasma that help's maintain the blood's pressure

Serum protein - any protein found in the serum of the blood

Subcutaneous - beneath or to be introduced beneath the skin

Subsequent infection - an infection that will be following due to the symptoms presented

Superficial - confined to the surface

Systemic infection - pertaining to the whole body rather than to just one of its parts

T

Tachycardia - a circulatory condition in which the myocardium (heart muscle) contracts regularly but at an accelerated rate of 100-150 beats per minute

Tegaderm - a form of a transparent dressing, one that you can see through

Topical agents - creams, ointments, or lotions put on the skin, not for internal use, pertaining to the surface of the body

Transient - usually is referenced to an area where blood supply is diminished or is cut off for a period of time due to many different reasons, as in pressure sores, by which then the tissues surrounding the ulcer would die from inadequate blood supply

Transparent dressing - a dressing that you can see through and visualize the ulcer, but can be occlusive (taped on all four sides)

Turgor - the normal resiliency of the skin caused by the outward pressure of the cells and interstitial fluid. Dehydration results in decreased skin

turgor, manifested by lax skin, which when grasped and raised between two fingers, slowly returns to a position level with the adjacent tissue. Marked edema or ascites (extreme amount of fluid within the abdominal cavity, usually due to liver failure) results in increased turgor manifested by smooth, taut, shiny skin that cannot be grasped and raised. An evaluation of the turgor of the skin is an essential part of a physical assessment

U

Ulcer - a circumscribed, craterlike lesion of the skin or mucous membrane resulting from necrosis that accompanies some inflammatory, infectious, or malignant processes. An ulcer may be shallow, involving only the epidermis, or a deep crater going down to the bone

V

Vasoconstriction - of or pertaining to a process, condition, or substance that causes the constriction of the blood vessels. Cold, fear, stress, and nicotine are common vasoconstrictors. Internally secreted epinephrine and norepinephrine cause blood vessels to contract by stimulating adrenergic receptors of the peripheral nerves

Vasodilatation - widening or distension of the blood vessels, particularly arterioles, usually owing to nerve impulses or to certain drugs that cause relaxation of smooth muscle in the walls of the blood vessels

W

Wafers - a thin sheet of adhesive on one side to prevent tearing tape from the skin usually each time a dressing is changed. The tape is attached to the wafer on the smooth side and can be left on for a week or so.

Wicking - by taking a gauze pad and put down into a wound and the liquid or exudate will be absorbed by the gauze pad

Wound culture & sensitivity - a specimen from the wound is sent to the lab and examined to determine what species of bacteria is growing so the correct antibiotic can be prescribed to treat the infection in the wound

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