A STUDENT'S BOOKLET TO MECHANICAL DEBRIDEMENT OF CHRONIC WOUND

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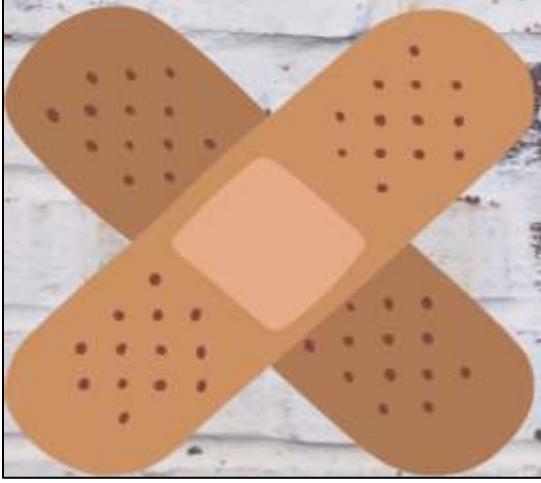

CONTENT

1. INTRODUCTION

Managing chronic or non-healing wounds presents challenges and frustrations for both healthcare professionals and patients (Brown, A. 2019). Wound management can take over 50% of community nurse time according to European studies, with patients often having three or more home health visits per week (Lindholm Christina, R. S. 2016). Wound treatment should be started effectively as soon as the wound appears, as delayed treatment decreases the process of healing. In Finland mechanical cleaning or “revisio” is the primary method for cleaning a thick necrotic wound. However, the treatment should consider the cause and type of the wound. (website of käypähoito, 2020). There have been many different debridement techniques introduced in recent years that promote healing. (EWMA, 2013). Therefore, knowledge in wound debridement is an indispensable skill for students in many fields on nursing.

This booklet discusses the following topics:

- Wound debridement
- Anatomy of the skin
- Chronic wounds
- Stages of wound healing
- Materials for wound debridement
- Wound debridement procedure

2. WOUND DEBRIDEMENT

2.1 What is wound debridement?

The healing process of acute and chronic wounds comprises of either cleansing or debridement. It is a central medical intervention in managing acute and chronic wounds that induces the tissue repair. Debridement, however, is a more complicated process than wound cleansing, which is defined as the removal of dirt. Debridement does not include revision of a wound, resection of functional tissue or amputation. The term debridement came from the French, which means to remove a constraint. It is presently defined as to

deeply remove the attached decaying or contaminated tissues from a wound. As debridement represents a central step in the management of wounds, it can be applied to all kinds of wounds, irrespective of their diagnoses and origin. The question then arises what the indications for debridement and timing of the procedure are. A clear indication can be generated via the diagnosis of different kinds of tissue types and bioburden which cover the wound bed, the state of the wound edges and the peri-wound skin. (EWMA, 2013.)

2.2 Types of wound debridement

There are many new debridement techniques introduced over the years that primarily promote the progress of wound inflammation to wound repair by the application of physical principles and forces. (EWMA, 2013).

Mechanical debridement is performed on the wound daily or every few days at the time of dressing changes. Mechanical cleansing requires skill to identify the tissue in the wound so that the cleansing does not damage healthy tissue. (TYKS, Haavatyöryhmä, 2011.)

Sharp/surgical debridement includes the use of a forceps, scissors, hydro-surgery devices, or lasers to remove dead tissue. Sharp debridement is the gold standard technique of debridement recognized by most clinicians. It can be painful so topical anaesthetic such as lidocaine cream or gels are needed. (Baranoski S. and Ayello, E. 271, 2015.)

Mechanical wound debridement or “revisio” in Finnish is the removal of dead tissue from the wound with small scissors, forceps, a scoop, a ring curette, or a knife. The light hardening barrier at the edges of the wound is removed by scraping with a knife. (Website of käypähoito, 2020.)

In wound irrigation, the wound is cleaned primarily by spraying the wound with potable water, saline solution or ringer’s solution for a short time. As an option for chronic wounds, cleansing solutions can be used. (TYKS, Haavatyöryhmä, 2011.)

The wet-to-dry method is where a moist mechanical debridement gauze pad is applied to the wound. As the devitalized tissue dries, it re-hardens and becomes attached to the gauze; when the dressing is removed, the adhered material is pulled free. Wet-to-dry dressings are recommended only as a short-term therapy for infected necrotic wounds. (EWMA, 2013.)

Device-assisted mechanical wound debridement techniques include vacuum treatment which creates a vacuum on the wound surface by means of a polyurethane sponge and a suction hose to cleanse the wound bed. This reduces local swelling, eliminates secretion and stimulates new tissue formation. Another device is an ultrasonic wound cleanser that mechanically cleans dead tissue from a wound. Low frequency ultrasonic wound cleansing does not damage healthy tissue. Ultrasonic cleansing is combined with spaying saline solution to reduce bacterial colonization from the wound and remove fibrin coating as well as dead tissue. (TYKS, Haavatyöryhmä, 2011.)

In surgical debridement or radical revision, any bad and lifeless tissue is removed from the wound with knife, scissors, or forceps and it also removes healthy tissues. The doctor cleans the wound if there is a tendon or bone in it, so that the depth of the revision extends to the border of healthy and dead tissue; that is, bleeding tissue. The removal of necrotic tissue can often be done as a simple “bed-side” procedure without anaesthesia. Surgical cleansing is especially appropriate when the wound has a large amount of dead tissue or a clear clinical bacterial infection. (Baranoski S. and Ayello, E. 256, 2015.)

In biological debridement, sterile cultured maggots are placed on the wound to remove necrotic tissue without damaging healthy tissue. Rapid cleansing of necrosis from the wound also effectively removes bad odour. (TYKS, Haavatyöryhmä, 2011.)

Autolytic debridement takes advantage of the body’s own ability to break down dead tissue and requires a humid environment and good blood circulation in the wound to function. The dressing that maintains and increases moisture promotes autolysis in the wound. However, the autolytic dressing is not suitable for cleaning infected and diabetic peripheral wounds because anaerobic bacteria may multiply under the occlusive dressing. (TYKS, Haavatyöryhmä, 2011.)

In enzymatic wound debridement proteolytic enzymes are applied to the wound to degrade necrotic tissue without damaging living tissue. Enzymes break down collagen fibers between non-circulating and healthy tissue and requires moisture to activate. (TYKS, Haavatyöryhmä, 2011.)

2.3 Indications of Wound Debridement

Wound debridement is included in the individual's management of a wound which is done in order to achieve certain goals such as promoting and accelerating healing. An indication to perform debridement does not relate to the diagnosis of the wound but depends on factors such as tissue types covering the wound, state of humidity and the patient's situation. (EWMA, 2013.)

Choosing the right techniques of debridement can be challenging, given the various and conflicting evidence about the different debridement options available. Remember, your choice may be limited by the availability of the various debridement methods in your facility or healthcare system. (Baranoski S. and Ayello, E. 271, 2015.)

2.4 What are limitations of mechanical wound debridement?

Some techniques may be more painful than other debridement methods and the healthcare provider should always consider patient premedication for pain. All mechanical methods are considered nonselective debridement, meaning there is no discrimination between viable and nonviable tissue. Mechanical methods may be harmful to healthy granulation tissue on the surface of the wound and lead to bleeding, trauma, and disruption of the collagen along with the necrotic tissue. (Baranoski, Sharon, and Elizabeth Ayello, 2015.)

3. ANATOMY OF THE SKIN

3.1 Structure of the Skin

The structure of the skin is basically divided into three separate regions: epidermis, dermis and subcutaneous (Figure 1). (Ian Peate, Muralitharan Nair 2016, 553).

- **The epidermis**

This is the outermost layer of the skin, which is almost entirely visible to the naked eye. The epidermis is made of epithelium which contains four key cell types: Keratinocytes, melanocytes, Langerhans cells, and Merkel cells. The epidermis itself has many different layers called strata. There are five layers of this distinct region: Stratum Corneum, Stratum Lucidum, Stratum Granulosum, Stratum Spinosum, Stratum Basale (Figure 1). (Ian Peate, Muralitharan Nair 2016, 553.)

- **The dermis**

This is the centre of the integumentary system, the deepest part of the skin below the epidermis (Figure 1). It contains blood and lymph vessels, nerves, smooth muscles, sweat glands, hair follicles and sebaceous glands. The dermis is built up of two layers, the papillary aspect and the reticular aspect. The papillary aspect is the top part of dermis, connecting the dermis and epidermis. Human fingerprints are developed from this layer. The papillary layer contains phagocytic, defence cells that help against infections caused by bacteria. It also contains Meissner corpuscle, lymphatic capillaries, nerve fibres, and touch receptors. Thus, it helps people to feel hot, cold, or itchy. The reticular aspect is the deepest part of the dermis and is connected to subcutaneous layers. It is composed of dense irregular connective tissue featuring densely packed collagen fibres and coarse elastic fibre from the reticular aspect. It also has sensory receptors such as Pacinian to help deep sensory pressure. Here, there is an accessory structure, which contains sweat glands, lymph vessels, smooth muscle and hair follicles. (Ian Peate, Muralitharan Nair 2016, 558.)

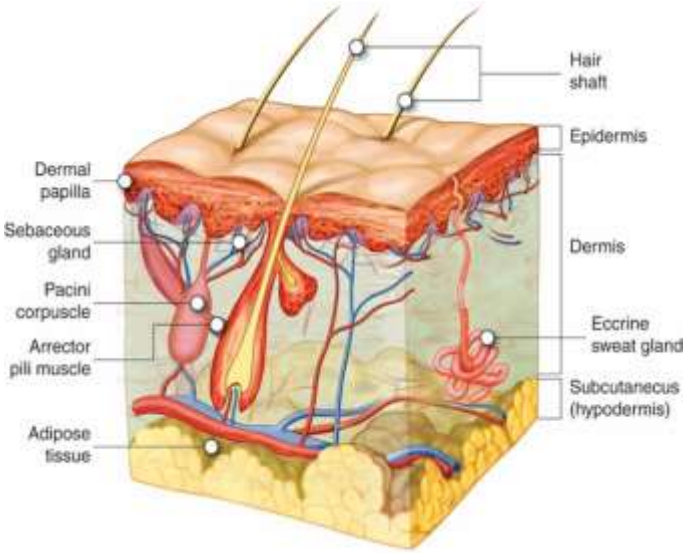

Figure 1. Anatomy of human skin. (Website of lumencandela,2020).

- **The subcutaneous**

This is the deepest layer under the epidermis and dermis, also known as subcutaneous tissue or hypodermis. This is a combination of adipose and connective tissue, blood vessels, nerves,

and lymphatic vessels. Depending on the person or different parts of the body, the thickness of these layers can be different. (Figure 1). (Ian Peate, Muralitharan Nair 2016, 559.)

3.2 Functions of the skin

Included in the anatomy and physiology of the skin is to understand the basic functions and roles of the skin. As follows are the functions of the skin: (Ian Peate, Muralitharan Nair 2016, 563.)

- Protection: The skin is a barrier to help fight bad agents from the outside environment to protect internal organs such as the nervous system, blood vessels, bones, and organs.
- Thermoregulation: Through the sweat glands and blood vessels in the dermis, the skin also plays a role in regulating body temperature. If the outside temperature is high, the skin will increase sweat production to cool the body. On the contrary, when the outside temperature is low, the blood vessels under the skin contract and reduce sweating to retain heat for the body.
- Metabolism: this is the production of vitamin D when the skin reacts with sunlight. It will lead to the metabolism of calcium and phosphate, minerals to help in bone formation.
- Sensation: The skin's sensory receptor function helps us to be aware of heat, cold, pain, pressure, and contact.
- Immune processing: is a property that allows the skin to resist biological, physical and chemical agents from its surroundings, protecting the body.

4. CHRONIC WOUNDS

4.1 Chronic wound definition

The term “chronic wound” was first defined in 1950 to be an irreversible wound in a normal healing process. Other terms were later used such as hard-to-heal wounds, difficult to heal wounds, non-healing wounds and complex wounds, depending in the duration of chronicity. Chronic wound is now defined as wounds that have not proceeded through an orderly and

timely reparation to produce anatomic and functional integrity after 3 months. (Website of Acta Dermato-Venereologica, 2017.)

4.2 Classification of Wounds

The most common chronic wounds are the ulcer wounds which can be classified into four different categories: venous, arterial, inflammatory and systemic, and metabolic. The majority of chronic lower limb wounds are caused by venous insufficiency, but peripheral arterial disease also plays a significant role in wound formation. (Website of kaypahoito, 2020). A chronic or prolonged lower limb wound refers to a leg or foot wound that has been open for more than 4 weeks. If there is a deficiency of arterial circulation in the wound, it is already identified as a chronic leg wound when it has been open for 2 weeks. (Rautava-Nurmi et al., 2019, 229-230.)

Most chronic lower limb wounds are caused by circulatory disorders. Venous insufficiency is the cause in 37–76% of cases. Arterial circulatory failure is the cause in 9–22% of cases. The combination of venous insufficiency and arterial circulatory insufficiency causes 7–26% of so-called combined or mixed wounds. 2–25% of wound patients have diabetes. (Website of kaypahoito, 2020.)

4.3 Chronic leg ulcers

A chronic lower limb ulcer is not a distinct disease but a result of some disease or other factors that causes and maintains the wound. Internal factors include insufficiency of the arteries and veins, diabetes, cancer and vasculitis. External factors can put pressure on the skin from prolonged bedrest or immobility. (Rautava-Nurmi et al., 2019, 229.)

- **Venous leg ulcers** occur along the medial or lateral distal leg. They are caused by venous hypertension and clog due to valvular inadequacy. There is backpressure in the vein that promotes absorption, spillage of macromolecules and hemocytes into the perivascular space, ultimately resulting in edema and fibrosis that reduces the distribution of oxygen, vital components and supplements into the injured tissue (Figure2). It will affect around 1-2 percent of adults, especially women and the elderly. (Ruilong. Z, et al., 2016.)

Figure 2. Venous leg ulcer (Website of Wikipedia commons, 2011).

- **Arterial ulcers** are less common than venous ulcers and happen when there is artery deficiency caused by atherosclerosis, thromboembolic, or radiation damage. There is ischemia or reduced blood and oxygen distribution to the affected area. An arterial ulcer is often found over bony prominences and easily identifiable by circular shapes with a defined border (Figure 3). The main risk factors of this condition are diabetes, smoking, high blood pressure, hypercholesterolemia, and old age. (Ruilong. Z, et al., 2016).The most common of the metabolic leg ulcers is the diabetic leg ulcer which means a wound is difficult to heal because of the underlying disease. (Rautava-Nurmi, et al., 2019, 230.)

Figure 3. Arterial ulcer (Website of Wikipedia commons, 2010)

- **Diabetic Foot Ulcer** or diabetic foot ulcers are serious complications of diabetes. Ulcers are formed by many factors such as the loss of sensation in the feet, blood circulation, trauma, foot deformities and pressure (Figure 4). Persistent diabetes often results in neuropathy, where there is partial or complete insensibility to pain and it is easy to neglect minor injuries and symptoms of ulcers. At the same time, diabetes triggers hyperglycemia that disrupt wound healing. Diabetics often face the risk of re-ulceration, amputation and death. (Ruilong. Z, et al., 2016.)

Figure 4. Diabetic ulcer (Website of Wikipedia commons, 2012).

- **Pressure Ulcers** or pressure sores or bedsores is a state that occurs when a patient lacks mobility, sensory perception, is paralyzed or unconscious. Therefore, they could not sense enough to meet the need to reposition. This prolonged condition will lead to partial ischemia of the suppressed skins. As a result, the skin becomes necrotic due to lack of oxygen. Depending on the patient's condition, the vulnerable areas may be tailbone, buttocks, shoulder blades, hips or heel. (Ruilong. Z, et al., 2016.)

  A wound may develop in a very short time of 1-2 hours if the patient is unable to change position. The main principle in the prevention of pressure ulcers is to change the patients positions regularly. (Rautava-Nurmi, et al.,2019,236.)

Patients with pressure ulcers often have an increased need for nutrition. For the prevention and treatment of pressure ulcers, the European pressure wound expert council (EPUAP) recommends a high intake of protein, arginine amino acid, antioxidant vitamins and trace minerals. (Rautava-Nurmi, et al., 2019,237.)

Less common causes of chronic wounds include vasculitis, malignancies, rare infections, and radiation therapy. As the population ages, the number of multifactorial wounds is also increasing. The most common multifactorial wound is a lower limb wound with underlying arterial and venous circulatory failure. (Website of terveyskylä, 2020.)

4.4 Acute Vs. Chronic wounds

A wound refers to damage to the skin and underlying tissues caused by an injury, deficiency or separation of tissues from each other. Wounds vary in shape depending on their causes, tissues involved and whether they are closed or open wounds. The wound may also be caused by a deficiency in the skin or the mucus membrane due to a disease that results in tissue destruction. Wounds are classified into acute or chronic wounds depending on the causes and healing process. Acute wounds however become chronic due to infections and improper treatment. The incidence of chronic wounds increases with age and the presence of vascular disease and diabetes (Rautava-Nurmi et al., 2019, 227-229).

Tumors can also cause wounds. If a wound is suspected to be caused by a malignant tumor, such as squamous or basal cell carcinoma, or if the wound is atypical in appearance, a tissue sample should be taken from the wound or wound edge or both. (Website of kaypahoito, 2020.)

5.WOUND ASSESSMENT

A physical assessment of the skin condition is needed to understand the cause and development of a wound. Basic skin anatomy knowledge is used to assess and classify the wound and define the level of tissue damage. The following parameters from “Clinical Guide to Skin & Wound Care” by Cathy T. Hess.2012 can be included in a detailed assessment of the patient’s wound status:

- **Location**. Details of where the wound is located are needed for accurate documentation and consistent care by each provider working with the patient. Describe the location of the lesion by closest anatomic landmark.

- **Size.** Accuracy in the wound measurements assist in planning appropriate care. Details include length, width, and depth using consistent units of measure. (Figure 5, measure the wound with ruler)

Figure 5. Measure wound with horizontal mattress stitches (Website of Wikipedia commons, 2016)

- **Color and type** of wound tissue. The wound bed description gives a consistent approach in defining the tissue types as granulation tissue, slough, and eschar. Tissue colour is a distinguishes viable from nonviable tissue that assists in the management process.

- **Exudate or drainage** amount and type. The amount of wound exudate or drainage is assessed and described with each dressing change. Including the amount of dressing change needed per week. Excessive exudate can mean infection and a barrier to healing.

- **Odor**. The smell of the wound can identify the presence and type of bacteria and is assessed only after the wound is cleaned.

- **Peri** wound skin condition. Surrounding skin colour and temperature, described as inflammation or redness, may indicate wound infection or dermatitis. Checking for

maceration or denuded tissue is also important for this should prompt an evaluation of the wound dressing for its ability to manage exudate.

- **Wound** margins. The wound's chronicity and healing ability can be shown with the condition of the wound edges. Healing can be indicated by flat and pale pink to lavender wound margins.
- **Pain**. If the patient is experiencing pain, it may indicate infection, underlying tissue destruction, neuropathy, or vascular insufficiency.
- **Patient knowledge** of the disease and wound management. The need for educational activities is important in planning individualized care.

6. WOUND HEALING PROCESS

6.1 Phases of wound healing

This information of the granulation tissues leading to the next phase of healing will help you understand the barriers to healing, taken from the "Clinical Guide to Skin & Wound Care" by Hess, Cathy et.al 2012.

- **Haemostasis** is the first reaction to injury. Platelets works as key cells to create blood clots to prevent further bleeding and release cytokines needed later for healing.
- **Inflammation** is a defensive or reaction phase occurring right after the injury that can last 4-6 days. Inflammatory cells such as leukocytes and macrophages are key cells to destroy bacteria. Pain, heat, redness and swelling characterizes this phase.
- **Proliferation** is the regenerative or connective tissues phase that will normally last for several weeks. Key cells like macrophages, fibroblasts, immature collagen, blood vessels, and ground substance form granulation tissues to close off the wound. Epithelization ends this phase with the presence of viable, vascular tissues to create a scar.
- **Maturation** is remodelling phase, which can last from 21 days to months or even years. Fibroblasts and other key cells reorganize and mature collagen fibres until the scar tissues regain the 80% of the skin's original strength.

6.2 What delays wound healing?

The following are processes that becomes barriers to healing wounds from the "Clinical Guide to Skin & Wound Care" by Hess, Cathy et.al 2012.

- **Desiccation** is caused by a dry wound environment which result in cells dying from dehydration and will ultimately cause a scab or crust. A moisture-retentive dressing allows wounds to heal faster and less painfully.
- **Infection or abnormal bacterial presence**. A systemic or local infection impedes wound healing as there will be drainage or exudate, induration, erythema, or fever. Appropriate antibiotic treatment should be ordered by a physician after a culture identifying the causing bacteria.
- **Maceration.** Urinary and faecal incontinence interrupts the skin's integrity. Proper skin care is essential for successful skin and wound management.
- **Necrosis.** Slough and eschar are the two types of necrotic tissue that may appear in a wound and slows down healing. Slough is normally yellow, moist, loose, and stringy. Eschar often appears as black, dry, thick, leathery tissue. Both tissues often need to be removed before healing starts.
- **Pressure**. Blood circulation is disrupted when there is too much pressure in the surrounding tissue and delays healing.
- **Trauma and oedema** interrupt the oxygenation and cellular nutrition to the wound.

7. MATERIALS AND PRODUCT FOR WOUND DEBRIDEMENT

No single skin or wound care product provides an optimum environment for skin health or healing of all wounds. It's your responsibility to understand the characteristics, function, and appropriateness for each patient of the skin care products, dressings, drugs, and devices. (Hess, Cathy et.al 2012.)

- **Syringe and needles** are used to deliver cleaning agents must provide enough pressure to remove debris without presenting trauma to the ulcer bed. (Baranoski, Sharon, and Elizabeth A. Ayello. 2011).

- **Personal protective equipment.** As recommended by Lapin sairaanhoitopiirin kuntayhtymä 2010, we can choose the appropriate products based on purpose of care. These are gloves, gowns and aprons, footwear. and protective face wear such as full-face shields, visors, goggles, masks, headwear.
- **Irrigation solutions** for cleansing and moisturizing wound included sterile water or tap water, saline solution (0,9%), Hydrogen peroxide liquid (1-3%). (Baranoski, Sharon, and Elizabeth A. Ayello. 2011).
- **Sharp and cutting instruments** to remove necrotic tissues can be surgical knife, scissors, scoop currete, ring Currete (Figure 6). (TYKS, Haavatyöryhmä,2011).

Figure 6. Disposable dermal curette (Photo by Vo & Pinas, 2020)

- **Forceps and tweezers** are used to grab and hold on to wound tissues. (TYKS, Haavatyöryhmä,2011).
- **Local anaesthesia (xylocaine**): we can numb the wound area with Xylocaine 2% at least in 5 minutes for reducing the pain during procedure. (Pohjois-Savon sairaanhoitopiiri).
- **Dressing and gauze** can be chosen as seen appropriate to size and location of the wound (figure 7). Check manufactures instructions in choosing the right dressing, a list of has been updated by Etelä-Pohjanmaan sairaanhoitopiiri and can be found at:

https://www.epshp.fi/files/9213/Haavanhoitotuotteet_PDF_(ei_hintoja)_2018-2022.pdf

Figure 7. Different types of wound dressing (Photo by Vo&Graile, 2020)

8. MECHANICAL WOUND DEBRIDEMENT PROCEDURES

An optimal wound care will include combination of debridement techniques such as irrigation, wet-to-dry dressing and sharp debridement depending on the state and condition of wound (Vesa Juutilainen, 2011).

8.1 Wound assessment and wound care planning

When conducting a wound assessment, we do not only evaluate the wound itself, but it is necessary to combine comprehensively all the factors that can promote the healing process. Plan the wound care holistically, as wound healing is affected by different factors like immune status, blood glucose level, hydration, nutrition, blood albumin and prealbumin levels, oxygen and vascular supply, pain, cause of wound, age of patient, smoking. (Lippincott Williams & Wilkins, 2015, 56.)

- Assess the patient about their feelings and pain using a pain scale. Monitor and observe patient for altered body position, moaning, and sighing. Plan wound care with a doctor's diagnosis and a prescription of dressing and cleansing materials including frequency of wound care. (Lippincott Williams & Wilkins, 2015, 57.)

- Initiate wound care by examining the wound bed, edges, and environment. Examine the wound after a thorough cleanse. Document by wound extent (length x width cm), depth (dermal, subcutaneous, intramuscular, tendon, bone), cavities and fistulas (direction, length cm), wound surface phenomena (necrosis, fibrin, granulation, epithelialization), the amount, quality and odor of the secretion. (Website of Edis, 2017).

8.2 Wound care goals

Eric vanBok, 2014 had stated on website of wound care education partners 2020 includes these goals for wound care:

- To remove debris and necrotic tissues such as slough and eschar from the wound bed. This will decrease bioburden, improve epithelialization, and decrease inflammation.
- To maintain a moist environment to help the wound heal effectively and reduce pain. This prevents desiccation that causes scabbing and crusting.
- To control exudate that causes peri-wound maceration and contributes to an increased bioburden in the wound.
- To remove or decrease the bacterial load from the wound. A systemic or local infection impedes wound healing as there will be drainage or exudate, induration, erythema, or fever.
- To prevent the wound recurrence and further tissue damage.

8.3 Wound debridement implementation

8.3.1 Before debridement

These are recommended steps for preparing wound debridement by Lippincott Williams & Wilkins, 2015 from “Wound Care Made Incredibly Easy”.

- Explain the procedure to the patient or guardian and obtain their consent.
- Prepare and collect wound care equipment and materials indicated on the wound care plan.
- Design a clean, bright and environment for the procedure. Make sure to provide privacy and be able to have good posture while working.

- Allow pain medication or local anesthesia to work.
- Observe hand hygiene and asepsis during the procedure. Wear personal protective equipment as indicated by the wound care plan. In addition, use surgical face mask, goggles and apron, if there is a risk of secretions splashing.

8.3.2 Irrigation

Lippincott Williams & Wilkins, 2015 from "Wound Care Made Incredibly Easy". outlines irrigation procedure as follows:

- Prepare the materials and the irrigation solution. Allow the solution to reach room temperature.
- Carefully place the protective linen and emesis basin under patient wound to collect the solution during irrigation. Position the patient to allow the drainage to flow into the basin.
- Remove the dressing and discard the used gloves and dressings to the trash.
- Put on new gloves and prepare irrigating solution in sterile container.
- Fill the syringe with prepared solution and connect the catheter.
- Gently and slowly pump the solution into a steady, uninterrupted flow into the wound until the syringe empties.
- Cover all surface of the wound with the solution moving from clean to dirty wound area to prevent contaminated.
- Repeat the procedure until the dead tissues and debris are removed from the wound and the solution returns clear.
- Cover or pack the wound with prescribed dressing as ordered or indicated in the wound care plan.
- Remove gloves and discard the used equipment into appropriate container
- The next irrigation should be done with lower pressure.

- Document the procedure and notify physicians and other health care provider of any unusual changes.

8.3.3 Sharp mechanical debridement

- Choose and prepare appropriate instruments for the type of necrotic tissues to be removed. The basic instruments used for mechanical wound cleansing are the wheel curette, scoop curette, needles, scissors and a surgeon's knife. (TYKS, Haavatyöryhmä,2011.)

- Identify the type of tissues in and around the wound. Remove necrotic tissues carefully avoiding damage to healthy new tissues working from the clean areas to the dirty areas. (Website of käypähoito, 2020).

- Use identifying characteristics of wound tissues to decide whether to remove or protect the tissue. These are described as follows by käypähoito, 2020:

    - Epithelial tissue that is the out layer of the skin appears pink. The new layers of tissues are thin and must be protected.

    - Granular tissue appears red. The new granular tissues must be protected and kept in moist environment. However, excess moisture damages the tissues.

    - Hyper-granulation tissue light or dark red in color and grows above the level of the skin. It is an overgrowth of granulation tissue, which prevents wound epithelialization, is often due to excessive moisture in the wound. It musts be remove mechanically with a curette or a spatula.

    - Fibrin coat or Slough tissue is yellow and can be soft or tough depending on wound moisture. It must be softened and mechanically removed.

    - Eschar is black necrotic tissue. Depending on the wound moisture, it can be tough or soft. Eschar should not be removed or softened with prior to a vascular surgeon’s examination or intervention.

- Bone and tendon tissues. Bone feels hard against sharp instrument while healthy tendon is white and fibrous. Keep bone and tendon tissue moist during the procedure.
- Infected wound tissue is reddish, hot, and swollen around the wound. Wound secretion is odorous there is increased pain. Remove or decrease bacterial load.

- Do not attempt to clean all dead tissues at once. Use a combination of debridement methods such as irrigation, wet-to-dry and hydrotherapy biological, enzymatic and autolytic for the best results. Stop the procedure If excessive pain or bleeding occurs, especially if it is not possible to determine the tissue type or is suspected to be malignant. Press the wound with a dry gauze or moistened hydrogen peroxide solution gauze if the wound bleeds. Document the procedure and notify physician and other health care provider of any unusual changes. (Vesa Juutilainen, 2011).

8.3.4 Wet-to-dry dressing

Susan C. deWit and Patricia A. Williams, 2013 from “Fundamental Concepts and Skills for Nursing” had described these steps for wet to dry dressing:

- Prepare the dressing tray with instruments.
- Gently and slowly remove the dressing from the wound. Observe how the necrotic tissue will be tear away with the gauze.
- Place the used dressing to the rubbish bag. Remove gloves and perform hand hygiene.
- Fill the sterile, wetting solution into the basin.
- Put on clean gloves. Place the dressing to the solution or pour the solution on the dressing. Skip this procedure if you have ready packed moisture dressing.
- Squeeze the dressing and gently apply on the wound, covering all the exposed surfaces. The dressing needs to be moist but not dripping. This moisture will help the healthy tissue growth. A second moist dressing can be applied depending on the status of the wound.

- Place a dry and sterile dressing on the top of wet dressing. Add dry dressing if there is leakage to keep the outside area dry. (Figure 8, the dressing is applied on the top of wound)
- Remove gloves and perform hand hygiene.
- Document the procedure and notify physicians and other health care provider of any unusual changes.

Figure 8. Chronic wound with dressing after wound care (Photo by Vo&Pinas, 2020)

8.4 Pain Management

Kari Becherta & Steve E.Abrahamb, 2009 had recommended Pain Management in Wound Care as following:

- Identify the reasons for pain background pain, breakthrough pain, procedure pain or operative pain.
- Assess the pain type, duration, impact, palliative factor, qualities of pain, region, severity, temporal aspects.

- Provide non-pharmacological treatment by communicating with the patient to help minimize anxiety. Other methods can be music therapy, relaxation strategies, meditation, imagery, physical activities, rest, repositioning and physical modalities.
- Provide pharmacological treatment such as analgesics increasing from mild to strong as prescribed (NSAID, opioid, narcotic).
- Choose the appropriate dressing type to reduce the pain.
- Decrease the pressure during irrigation.

8.5 Documentation

Documentation is an essential component of wound care should thorough and accurately do. The following are recommended for the documentation of wound care: (Baranoski S. and Ayello, E. 294, 2015.)

- Wounds should be documented as soon as the wound is observed, weekly, with each dressing change, upon any significant change in the wound, and upon healing or discharge.
- Use the initial assessment and documentation as baseline comparison for all future assessments.
- It is recommended that each agency have a consistent style and format for wound documentation. All facilities should follow the wound assessment policy as determined by their setting-specific regulations. Ulcers or wounds identified first patient contact should be assessed and documented at least within the first 24 hours.

8.6 Evaluation

Etelä-Pohjanmaan sairaanhoitopiiri, 2020 had issued the guideline for evaluation:

- Evaluate the procedures outcome using aspects such as the wound bed, edges, secretion, depth, dimensions, pockets, cavities, fistulas, odor, pain and wound environment.
- Assess for necessary change to the treatment plan by comparing the current state of the wound from the previous records.

- Identify indicators of healing such as pink granulation tissues appearing.
- Monitor the patient's level of comfort during the different procedures.
- Assess the patient's ability to self-manage the wound and include counselling to the wound care plan for the patient if possible.

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