



Erasmus+

Innovation in Dressing Techniques Manual

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# INNOVATION IN DRESSING TECHNIQUES MANUAL

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## Škola Za Medicinske Sestre Vrapče

School for nurses Vrapče is a secondary level vocational school for nurses of general care, there are 363 students in 15 classes; the program of education lasts five years, it is a new vocational program in Croatia. First two years they are learning some general subjects (national language, foreign language, Latin language, math, chemistry, physics, biology, history, geography, informatics, gym, religion or ethics and a new subject, civil education) from 18 teachers and last three years all kinds of vocational subjects from 24 nurses and doctors. After finishing that program they could go to work or if they pass state exam they could go to study. We emphasize the educational component which we exercise realizing extracurricular activities in order to enable students development in areas not covered by content subject teaching. These areas are: ecology, sustainable development, multicultural, religious and ethnic diversity respect, common European heritage, culture, tourism, civic education, human rights, volunteering etc. Teachers are educated in those areas formal and informal so they can share that knowledge, or they learn together with their students as partners. In that manner they promote the value of team work and peer tutoring regardless of the age or level of formal education. As a special kind of our extracurricular activities in which we have some international experience there is a GLOBE (Global Learning and Observing to Benefit the Environment) program and we are worldwide known as veterans. Our achievements are highly regarded in and out our country and in and out Europe. In a period 2011-2013. we participated in a Tree Ring Project, led by Norwegian GLOBE coordinator, very successfully and with this project we presented our school, country and Europe and Euro-Asia GLOBE region at 17th Annual GLOBE Meeting in Maryland, USA. 2015-2016. we participated in another similar project, Aerosols in Europe, also led by Norwegian GLOBE coordinator, and this year we represented Croatia GLOBE program on 21 Annual GLOBE Meeting in New Haven, USA. Besides this ecological occupation our students are very active in all sorts of school activities: sport, volunteering, E-medical meetings, school promotion (using IT skills for producing leaflets, brochures, oral and PPT presentations, films...), humanitarian projects, first aid courses, they are also participating in some vocational or other competitions.

We are also regional centers for: GLOBE, vocational teachers in health, teachers of Croatian language in vocational schools, and a center which conduct State Exams for students of Pedagogy. In past 4 years our Team for quality successfully develops strategies in process of managing and organizing school's annual work and submit annual self-evaluation's report. Every year we choose the most important areas in which we can make some significant progress. So far we made a good results in all areas of our special interest: combat with absences, new vocational curricula implementation - in it's technical demands like human resources (new vocational teachers), material conditions (IT devices, instruments and supplies for vocational exercises), space re-purpose, every day schedule that combines theory and practice in optimal load for students; established day attendance of teachers to provide the safe environments. We then organized pedagogical workshops for vocational teachers and trainees to teach them how to make annual plans, daily preparations, how to moderate work in classroom, how to use IT tools in

class etc. We also worked a lot on a team building for a staff because there are lot of new members, most of them unexperienced in schoolwork. Team of Quality successful used all 4 year-work (activities, methods, statistical data, analysis, outcomes etc.) and made project in Erasmus+ program KA1 "International Quest for EU Quality" where we compered our work with Team of Quality Portuguese vocational school from Montijo, Portugal. Also, last year our student went 2 weeks on internship in Portugal, and this year they go in Spain and Germany, in both time these projects are part of Erasmus + program, KA1.

## Seniorenzentrum St. Marien

Seniorenzentrum St. Marien, which serves in North Westfalen, Germany is a private organization. The institution which works with 4 different institutions in the same structure is structured according to the German Social Security Law. Since 2015, it is continuing its activities with a new mission with a new staff that has started to serve. The institution has a built-in physical capacity in accordance with the standards. 85 patients and the elderly are served and 65 people work for them. Employees work in shift mode and 3 shifts are applied in one day. The change of shift, which starts at 7 am without compromising the work discipline, is carried out in 3 sections in 24 hours.

There are 4 separate floors and 4 different colors. Each floor is a separate color, each floor is a sign that a separate group of illnesses is treated there. Also on each floor there are hobby halls, activity centers, dressing rooms, treatment rooms and dining halls.

The management structure of the institution is organized according to the merit method. According to the German health education system, each newly received training (lasting for at least 8-12 months) is an indication of where the person will work next. For example, a staff member with 8 months of dementia-alzheimer training is responsible for the course, and after a certain period of time it is possible to go to the assistant director and then to the director.

The institutional patient care system is also completely patient-centered. There is a structure that can not be rude to the illness and respects all religions, languages, races and views. The patients stay in single or double rooms if desired.

From the point of view of experience: The institution provides elderly care, patient care and chronic care services in one of the most crowded regions of Germany. These services can be done at home with special services or at the institution as well.

The institution proposes itself as a professional in the field of sick care for the elderly:

- Mobility

- Mental, cognitive and communicative skills

- Behavior and psychological problems

- Self-care ability

- The need for the help of someone else's own talent or ability to get rid of the needs of the disease condition and treatment needs

- Planning and social relations of daily life

According to these principles, the maintenance team, which makes an assessment, acts by dividing the service categories into the following categories. It is now decided that only a few degrees of care should be done and a program is prepared to meet the needs.

The most important mission of the institution is to develop an internal education mechanism that will dominate all innovations in the field of elderly patient care and to create a communication environment that will carry out a service with patients' relatives. "Everyone has the right to live until the very last moment, and it is our duty to respect the life that rests." With this sentence, our institution can be introduced with one sentence.



## Gümüşhacıköy Mesleki Ve Teknik Anadolu Lisesi

Our school, Gümüşhacıköy Vocational and Technical Anatolian High School, is located in the Middle Black Sea Region in Gümüşhacıköy which is one of the districts of Amasya. Founded in the Byzantine period, Gümüşhacıköy has a rich history. The main means of living of the people in Gümüşhacıköy is Agriculture. The only way out of our young people who don't want to work in agriculture is to be successful in school life. The population of the district is around 24,120. Our school accepts students according to their TEOG (exam for secondary education) scores. Students from all over Turkey chose our school for their education.

Our school, named Gümüşhacıköy Vocational and Technical Anatolian High School, started functioning in 1993 as Gümüşhacıköy Health Vocational High School. Today, our school educates assistant health personnel in Nursing, midwife and Health Care Technicians. In our school, there are 34 students in 9th grade (basic vocational education), 60 students in 10th grade (health services area), 61 students in 11th grade and 95 students in 12th grade (Nursing assistant, Midwife assistant and Health Care Technician.)

At the end of 2018-2019 academic year, 70 students from our school have been graduated. In the 9th grade, our students take 45 hours of theoretical lectures per week. In 10th and 11th grade students have theoretical and practical lessons in the school. Our students perform their internships in Gümüşhacıköy Community Health Center, Gümüşhacıköy State Hospital and Merzifon State Hospital 24 hours a week in 12th grade. In addition to the practical training, 12th classes are given 18 hours of theoretical vocational training per week. Our students who are studying in the nursing department do all the applications required by the profession in the facilities where they have internship. The applications include dressing, fire-pulse-blood pressure, daily drug follow-up, pre- and post-operation care, outpatient services and psychological support services. The main issue that these applications add to our students is nursing competence.

All these initiatives are strengthened by our institution's supporting. However, the fact that the state hospital does not have sufficient and necessary equipments and the other district hospitals are away from the training institution because of the inadequacy of application area.

In our school, the number of vocational teachers is 8, including the executives. On the internship days of our students, our teachers visit the internship areas and observe the applications of the students. According to the face-to-face education law within the framework of the Vocational Education Law numbered 3308, our teachers are trying to deal with our internship students individually. In the academic year of 2012/2013, our school moved to the new building. 120 of the students stay in the dormitory of our school. 18 students come to school by school services from villages. The rest of them live in the city centre. Within our school, there are 21 classes, 1 IT room, 1 science lab, 1 library, 1 conference hall, 1 dining hall, 1 cafeteria and 1 gym.





## Srednja Zdravstvena Sola Ljubljana

The secondary School of Nursing is the biggest of nine nursing schools in Slovenia, counting 1000 female and male students, 200 adult students and 90 teachers. We offer two programmes to our students, the 4-year programme Practical Nurse and a 3-year programme Nursing Assistant. Both programmes consist of general knowledge subjects, professional theoretical subjects, practical education in specialized classrooms, hospital or nursing home practice and additional activities. We cooperate with majority of health care and with some social care institutions in our region. Our teachers are members of various boards of professional and patients associations. Our school began with European student exchange programmes in year 2005 and we are interested in expanding our international activities in the future.

Recently we were involved in 3 international projects, all of them from the Long Life Learning Programme.

1. COMENIUS- Multilateral School Partnerships: »Sharing is Learning«
2. LEONARDO DA VINCI- IVT: »Beauty and Healthcare Professionals in the Making«
3. LEONARDO DA VINCI- VETPRO: »TENS- Teachers in European nursing schools- let's cooperate for better education«

We are in the process of finishing of opened projects and applying for the new ones.



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The medical advances in wound care were documented in Ancient Greece as well. It was the Greeks that first differentiated acute (□fresh□) and chronic wounds (□nonhealing□) and promoted the importance of wound closure. Greek doctors described 147 wounds. The Greek surgeon, Galen of Pergamum, acknowledged the importance of wound-site moisture to ensure successful closure of the wound, and Hippocrates described the inflammation process caused by wounding. Greeks were using alcohol to clean the wounds: they used wine along with boiled water and vinegar. Romans later adapted this by starting to use dressings drenched in wine.

The Middle Ages and Renaissance had not given any significant advances in wound care, but with the dawn of 19<sup>th</sup> century and with development of microbiology led by Louis Pasteur, the wound management had improved tremendously. Ignaz Philipp Semmelweis, a Hungarian obstetrician, observed that hand washing and good general hygiene in medical procedures significantly reduced, almost eliminated, the occurrence of puerperal sepsis. An English surgeon Joseph Lister accepted and promoted this notion. He used carbolic acid to sterilize the instruments and treat the surgical area before and during surgery, and concluded that good hand-washing practices, sterilization of instruments and scrubs leads to reduction in post-operative infections.

These observations became widely accepted in medicine and enabled major advances in wound care since the advances of Egyptians and Greeks centuries earlier. Innovations in the field led to production of wound dressings sterilized with dry heat, steam and pressure, beginning of the aseptic surgery practices and extensive research into wound management and disinfection methods.

Centuries of gathered knowledge made it possible to revolutionize the wound dressing techniques. Throughout the previous century, advances were made on the wound dressing compounds (invention of polymer synthetics) and the dressing techniques. With the wide variety of dressings, topical drugs and dressing techniques, the burden of chronic wounds has diminished significantly, but still requires attention today.

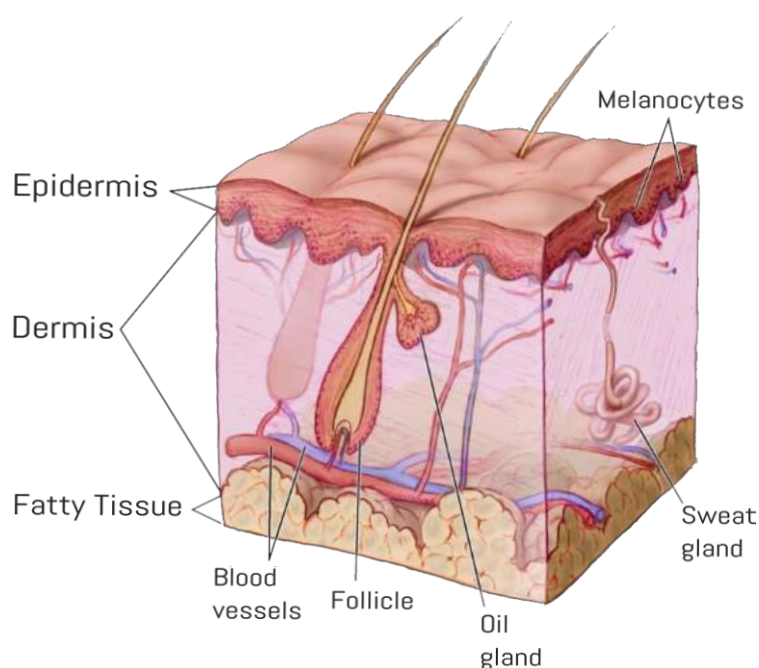
### 3. SKIN ANATOMY

The skin is the largest organ in the body, comprising between 15-20% of the total body weight and second biggest in terms of area (1.2-2.3 m<sup>2</sup>). It is the outer cover of the body responsible for protection of underlying muscles, internal organs, ligaments and bones. Since it interferes with the environment, the skin has a protective role against mechanical, biological and chemical disruptors. It has an important immunological role (protecting against pathogens) and prevents excessive water loss, also functions as an insulator, temperature regulator, sensory organ (touch and heat) and excretory organ, and has a significant role in vitamin D production.

Considering the important roles skin has, skin has a tremendous self-healing ability. Although very complex, wound-healing process is effective and can even manage severe damages to the skin leaving a scar behind. Sometimes this process is interrupted by internal or external factors and it has to be facilitated by medical intervention. Pathological inflammatory reaction of the skin can lead to deterioration of one or more skin layers causing the formation of less or more extensive wounds.

The skin consists of two primary layers and an underlying connective tissue:

1. The upper layer – *epidermis*
2. The middle layer – *dermis*
3. Subcutaneous layer – *hypodermis*



**Figure 1.** Anatomy of the skin (source: National Cancer Institute website)

### 3.1 EPIDERMIS

Epidermis is the outer layer on the skin, forming waterproof, protective wrap, mainly consisting of stratified squamous keratinized epithelium with an underlying basal lamina. The keratinizing epidermal cells called keratinocytes make up around 95% of epidermis. Epidermis also contains three less abundant cell types: melanocytes, Langerhans cells and Merkel's cells. The epidermis contains no blood vessels therefore the deepest layers of epidermis are nourished largely by diffusion from the air, and to a lesser degree by blood transported by capillaries extending to outer layers of dermis.

The epidermis is divided into five layers of keratin-producing cells. Starting from the dermis outward, the layers are: *stratum basale*, *stratum spinosum*, *stratum granulosum*, *stratum lucidum* and *stratum corneum*. Epidermal cells are formed through cell division (mitosis) from stem cells at the basal layer (*stratum basale*). The human epidermis renews every 15-30 days, depending on age, region of the body and other factors. The daughter cells move up all the strata where they go through process of changing shape and composition due to nutritional deprivation. Cells lose their nucleus and organelles, and are filled with protein keratin. This process is called keratinization. The resulting flattened non-nucleated keratin-filled keratinocytes (horny cells) form *stratum corneum*. These cells constantly shed at the surface of *stratum corneum* in process called desquamation.

### 3.2 DERMIS

The dermis is a connective tissue supporting epidermis, bound to it by basement membrane, and represents a connection between epidermis and hypodermis. It is constituted of two layers with indistinct boundaries: the outer thin papillary layer and the deeper reticular layer. The papillary layer is made of fibroblasts and other connective cells, such as mast cells and macrophages, and extravasated leukocytes. The reticular layer consists of connective tissue, consisted mainly of collagen, elastic and reticular fibers, and fewer cells than papillary layer. The proteins give skin its elastic properties.

The dermis contains epidermal derivatives: hair follicles, sweat glands and sebaceous glands; particularly in the reticular layer. Nerves in the dermis form a network with free nerve endings, a hair follicle network, and the innervation of encapsulated sensory organs.

In the dermis, network of blood vessels is found. The arteries that nourish the dermal layer form two plexuses: one between papillary and reticular layers, the other between reticular layer and subcutaneous tissue.

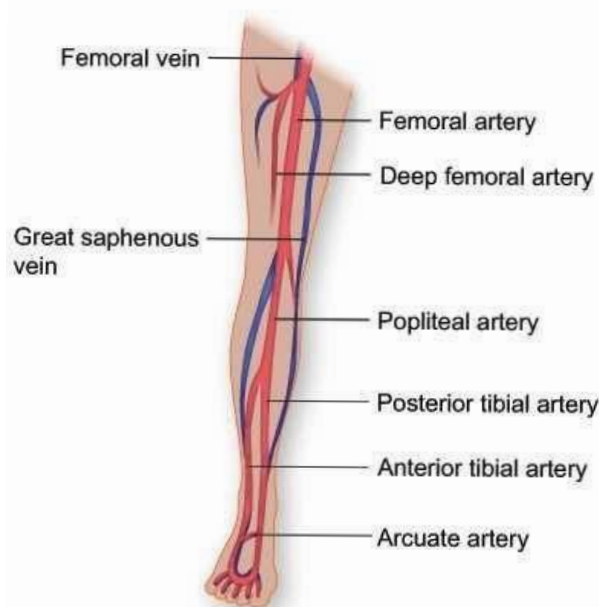
### 3.3 SUBCUTANEOUS TISSUE (HYPODERMIS)

The subcutaneous tissue (hypodermis, subcutis) anatomically is not part of the skin. It lies below the dermis, and consists of loose connective tissue (fibroblasts), fat cells and elastin. Its function is to attach the skin to underlying muscle and bone, as well as supplying them with blood vessels and nerves. Depending on the part of the body, the percentage of fat cells changes. The fat cells serve as padding and insulation for the body. This tissue is also referred to as *superficial fascia* and, where thick enough, *panniculus adiposus*.



## 4. ANATOMY OF THE CIRCULATORY SYSTEM

The circulatory system is an organ system whose role is to permit the blood to circulate through the body. This enables blood to transport nutrients, oxygen, carbon dioxide, hormones and blood cells to and from cells/organs in our body. The essential components of circulatory system are the heart, blood vessels and blood. For the purpose of this Manual, we will focus on blood vessels, particularly on veins and arteries of the lower extremities.



**Figure 2:** Lower extremity veins and arteries

### 4.1 VEINS

The vein system of lower extremities is classified according to the relationship of the veins to the muscular fascia into the superficial veins, the deep veins and the perforating veins. **The superficial veins** are located above the deep fascia and are responsible for the cutaneous microcirculation. **The deep veins** are located beneath the muscular fascia and drain the lower extremity muscles. **The perforating veins** that penetrate the muscular fascia and serve as connection between the superficial and deep veins.

Superficial veins are subcutaneous and only enter deep veins in certain places. The most important are the *vena safena magna* and *vena safena parva*, which are interconnected by communicating veins.

Deep veins are located in the lower extremities between the muscles and are not visible. They carry blood to the heart, from which the venous blood continues to circulate through the pulmonary system, where blood is oxygenated. The main veins of the deep system are *vena femoralis*, *vena poplitea tibialis* and fibular veins.



Both vein systems are joined by perforating veins, which break through the fascia. The blood flow runs against the gravitational force and depends on the complex system of the venous valves, supportive fascial structure and the work of the muscle pump. The veno-muscular pump allows one-way flow to the heart and thus has a peripheral heart pump function.

Understanding the pathophysiological mechanisms is of key importance to enable the timely and correct use of preventative and therapeutic measures.

## 4.2 ARTERIES

Arteries are the blood vessels that deliver oxygenated blood from the heart to the tissues. Each artery is a muscular tube. If the arteries are healthy, their walls are smooth on the inside and elastic enough to adapt to the changes in blood pressure. The main artery in the leg is femoral artery that further down branches into smaller arteries. The main arteries of the lower leg are popliteal artery, posterior tibial artery, anterior tibial artery, peroneal artery, plantar arteries and dorsalis pedis artery.

## 5. CHRONIC WOUNDS

The definition of wounds implies that there is an anatomical and functional disruption of tissue continuity. Depending on the course and duration of healing process, wounds can be acute or chronic. Chronic wounds are defined as wounds that fail to proceed through normal phases of wound healing and in a predictable amount of time – wounds that do not heal within 6 weeks are considered chronic.

About 22% of chronic wounds heal for 3-6 months, 39% for 6-12 months, 16% for 12-24 months, and 23% for 2 or more years. Incidence of recurring wounds within the first year after treatment is 30-58%. (Šitum M., 2006)



## 5.1 CHRONIC WOUND CLASSIFICATION

The chronic wounds are divided into two general groups: typical chronic wounds and atypical chronic wounds as described in the Table 1.

**Table 1.** Classification of chronic wounds

<b>TYPICAL CHRONIC WOUNDS</b>	<b>ISCHEMIC</b>
	Most common causes are atherosclerosis, diabetic angiopathy, tromangitis obliterans, arterial-venous malformations, embolic incident. The appearance of the ulcer is irregular, and localized on distal part of extremity.
	<b>NEUROTROPHIC</b>
	Secondary complication that occurs from a triad of disorders, including peripheral vascular disease, peripheral neuropathy, and infection. Characterized by loss of protective sensation and structural deformities and contractures. Most commonly occur on foot. Include: neurotrophic ulcers, malum perforans.
	<b>HYPOSTATIC</b>
	Formed as a result of vascular insufficiency of superficial and deep veins. The ulcers appear shallow, wider and with irregular borders. The special types are decubitus and diabetic foot.
<b>ATYPICAL CHRONIC WOUNDS</b>	Wounds that cannot be defined under one of the primary non healing wound categories, which can be caused by autoimmune disorders, infectious diseases, vascular diseases and vasculopathies, metabolic and genetic diseases, neoplasm, external factors, psychiatric disorders, drug related reactions etc.

## 5.2 WOUND HEALING

Wound healing is a complex biological process triggered upon disruption of the skin barrier, where predictable progression of physiological events unfolds, needed to replace damaged tissue. This progression is divided into the phases of homeostasis, inflammation, proliferation, and maturation/remodeling as described in Table 2. Each phase is characterized by the sequential elaboration of distinctive cytokines by specific cells.



**Table 2.** Phases of wound healing

PHASE	DESCRIPTION
<b>Hemostasis</b>	Day 1-3: Vasoconstriction, formation of blood clot to reduce bleeding
<b>Inflammation</b>	Day 3-20: Starts soon after the injury causing vasodilation, fluid extravasation and edema. The later phase (debridement) is characterized by influx of white blood cells (macrophages and monocytes). Sets new framework for blood vessel growth.
<b>Proliferation or Granulation</b>	Week 1-6: Granulatory tissue forms and processes of angiogenesis, epithelization and contraction occur to ensure wound closure and revascularization.
<b>Remodeling or Maturation</b>	Week 6 to 2 years: Final wound healing phase where proper tissue forms. Scarring occurs.

Chronic wounds form when the process of wound healing is disrupted. There are several factors that can affect wound-healing process, some of which are listed in Table 3.

**Table 3.** Wound healing processdisrupting factors

FACTOR	DESCRIPTION
<b>Low tissue perfusion and oxygenation</b>	The tissue is inadequately oxygenated. Individuals affected are diabetics, smokers, irradiated patients, qudriplegic and paraplegic persons.
<b>Infection</b>	High bacterial contamination, compromised tissue environment, immunocompromizedpatients etc.
<b>Nutritional status</b>	Diet low in albumins, vitamins and calories. Recommended daily intake of proteins in 0.8-2 g/kg per day, and recommended calorie intake is 35 kcal/kg per day.
<b>Corticosteroid usage</b>	Corticosteroids have antagonistic effect on growth factors and collagen deposition in wound healing.
<b>Inadequately supporting dressing</b>	Medical nurse should know how to dress the wound adequately.





**IMPORTANT TO  
REMEMBER**

*Skin is an organ with structural, protective, secretory, excretory, resorptive, sensory, immunological and nutritive functions. It is comprised of three layers: epidermis, dermis and hypodermis.*

*Wounding leads to disruption of anatomical and functional continuity of the skin.*

*Chronic wound is a type of wound that does not go through all stages of wound healing process, and does not heal in 6-8 weeks.*

*Stages of wound healing process are homeostasis, inflammation, proliferation and remodeling.*



## **MODUL I – LOWER LEG ULCERS**

*Hudin Danica, Matić Nikolina, Ribarić Suzana, Vučen Slavica, Vukelić Ankica*

### **6. LOWER LEG ULCERS**

#### **OUTPUTS**

*Describe the difference between arterial and venous ulcers*

*Explain the physiology of wound healing and the factors that influence the delay in healing*

*Identify the type of lower leg ulcer*

*Document wound monitoring*

*Educate the patient and family members about wound management and treatment*

*Conduct wound dressing according to standard*

*List the nurses' interventions in the care of patients with lower leg ulcers*

*Compare the procedures in the treatment of wound in arterial and venous ulcers*

*Encourage the patient to verbalize their feelings about the wound and the quality of life*

*Use health education methods in dealing with the patient and his family*

*Assess pain in the patient using the pain assessment scale*

Lower leg ulcer is a result of the loss of epidermis and often portions of the dermis caused by the rejection of necrotic tissue. Besides the skin, ulcers can affect the subcutaneous fat, muscle and bone.

The main feature of the lower leg ulcer is insufficient epithelialization in the center of the ulcer and the formation of granulation tissue. As a result, healing of the ulcers is slower, and a scar forms after healing is complete. When examining the ulcers we look at the form and size of the ulcer, the quality of the surrounding tissue and the appearance of the edge of the ulcer itself, wound base and exudates level.

#### **6.1 AETIOLOGY**

The most common causes of lower leg ulcers are chronic venous insufficiency, peripheral occlusive disease of the arteries, neuropathic diseases, diabetes mellitus, traumas (mechanical, chemical and thermal), infections, dermatosis, hematological diseases, malignant diseases, genetic disorders, hypercoagulable states, drugs and therapeutic procedures, snake and spider bites.



## 6.2 PATHOGENESIS

Functionally damaged deep vein valves prevent venous blood to flow in its normal antegrade path and cause a reflux backward down the veins into already congested leg. This causes accumulation of venous blood while walking and standing, as well as elevated pressure in the periphery of the venous basin.

If the perforating vein valves are damaged, the blood is lagging behind in the superficial vein system due to increased pressure in the deep system, causing further deterioration of the perforating vein function and progression of the disease.

## 6.3 LOWER LEG VENOUS ULCERS

The lower leg venous ulcer is a skin disruption, frequently located on the lower (distal) third of the lower legs in the area of the medial malleolus. It is formed as a result of chronic venous disease that weakened venous wall and insufficient blood flow from the leg to the heart. The skin around the ulcer is pigmented and is often swollen due to exudates from the wound, the infection or as the result of improper skin care and wound care.

Venous ulcers constitute 70-80% of all ulcers occurring on the lower extremities, and represent the most common cause of chronic venous insufficiency. Long-lasting venous hypertension begins with symptoms such as heavy legs and leg pain, burning feeling and leg cramps, itching, tingling, restlessness, feet and ankle swelling. If these symptoms are not addressed on time by certain treatment measures, progression of the disease occurs. Symptoms and signs of venous disease are the consequence of inflammatory processes caused by venous hypertension, impaired function and vein structure.

To facilitate the monitoring of advancement of venous disease and documentation, CEAP classification has been developed according to the criteria described in Table 4. The clinical classification of chronic venous insufficiency (C) is divided into six stages according to the clinical manifestation of the venous disease (Table 5).








**Table 4.** CEAP chronic venous insufficiency classification

<b>Clinical classification (C)</b>	
C0	No visible or palpable signs of venous disease
C1	Telangiectasies or reticular veins
C2	Varicose veins
C3	Presence of edema
C4a	Eczema or pigmentation
C4b	Lipodermatosclerosis or atrophie blanche
C5	Evidence of a healed venous leg
C6	Active venous leg ulcer symptoms
<b>Aetiology Classification (E)</b>	
Ec	Congenital
Ep	Primary
Es	Secondary
En	Non-venous aetiology
<b>Anatomic Classification (A)</b>	
As	Superficial veins
Ap	Perforator veins
Ad	Deep veins
An	No identified venous location
<b>Pathophysiologic Classification (P)</b>	
Pr	Reflux
Po	Obstruction
Pro	Reflux and obstruction
Pn	No venous pathophysiology identified



**Table 5.** Clinical classification (C) of chronic venous insufficiency

<b>Clinical classification (C)</b>		
C0	No visible or palpable signs of venous disease	
C1	Telangiectasies or reticular veins	
C2	Varicose veins	
C3	Edema	
C4a	Eczema or pigmentation	
C4b	Lipodermatosclerosis or atrophie blanche	

C5	Skin changes from C4 with healed venous ulcer	
C6	Skin changes from C4 with active venous ulcer	

#### 6.4 LOWER LEG ARTERIAL ULCERS (ISCHEMIC)

Intermittent claudication is a symptomatic peripheral disease characterized by spasmodic muscular pain or discomfort during walking that arises due to increased need for muscle blood supply. It stops after a short 10 minutes rest.

The chronic critical leg ischemia is a result of peripheral artery disease lasting longer than two weeks, and is characterized by ischemic pain during resting or sleeping. During the course of the disease, skin lesions appear on the leg. The pain, also called "rest pain" often occurs in the leg and can be relieved temporarily by hanging the leg over the bed or getting up to walk around.

Characteristic symptoms in the legs include:

- Inability to walk due to the difficulties that occur during strain and movement, manifested as tiredness, pain and tension
- Pain in the hips, thighs, calves or feet
- Slow healing of the ulcer or wound on the extremities
- Coldness in lower leg or foot
- Pain localized in the legs, associated with changing in the position of the body
- Postprandial pain that is induced after taking meals and is associated with loss of body mass
- No pulse or a weak pulse in legs or feet
- Positive family history (abdominal aortal aneurism)

Clinical picture in patients with symptoms depends on the degree of atherosclerotic obstructive disease, the presence of collateral arterial circulation, and the intensity of physical activity. The classification of arterial insufficiency according to Fontaine is summarized in Table 6.

**Table 6.** Fontaine classification of arterial insufficiency

Stage	Symptoms
I	Asymptomatic
IIa	Mild claudication
IIb	Moderate to severe claudication
III	Ischemic rest/nocturnal pain
IV	Ulcerations/gangrene

Arterial ulcerations occur in about 20% of cases and are caused by the diseases affecting lower leg arteries. The most common cause is obliterating atherosclerosis, diabetes, vasculitis, thromboangiitis obliterans or repeated atheroembolic episodes. Arterial ulcerations are often localized over toes (particularly thumb), heels, or bony prominences of the foot. Gangrene may also occur. Patients often experience severe pain. Ulcer is covered with yellow exudate with a lot of necrotic content. When removing deposits, it can be noticed that the process has progressed all the way to the tendon or deep fascia. Granulation is not visible. For the standard procedures in arterial insufficiency according to TASC classification, refer to Table 7.

**Table 7.** Arterial insufficiency classification

<b>TASC Classification (Standard procedures in arterial insufficiency)</b>
Asymptomatic
Intermittent claudication
Chronic ischemia of extremity
Acute ischemia
Gangrene and amputation



## 6.5 LOWER LEG MIXED ARTERIAL AND VENOUS ULCERS

Ulcers of mixed aetiology (ulcus mixtum) are caused by disruption in both venous and arterial circulation. Most of the time they are the result of diabetes mellitus, neuropathy and peripheral vascular disease complications. Mixed aetiology ulcers are very complex and can rapidly change their character, therefore an immediate attention is necessary.

The comparison of arterial and venous ulcers is described in Table 8.



**Table 8.** Characteristics of arterial and venous ulcers

<b>VENOUS ULCERS</b>		<b>ARTERIAL ULCERS</b>
	Characteristics	
Distal third of lower leg, around medial malleolus	<b>Location</b>	Foot, toes, dorsal or lateral side of distal third of lower leg
Fibrinous material, granulations, moderate to heavy exudate, possible venous bleeding	<b>Ulcer bed</b>	Pale, no granulation, dry necrotic base
Shallow and irregular margins that are flat or have a slight steep elevation, ranging from small to nearly encircling the leg	<b>Appearance</b>	Round or punched out with a sharp demarcated border
Pigmented, edema, varicous, warm	<b>Surrounding skin</b>	Pale, thin, shiny and atrophic skin, cold, no edema
Moderate to heavy exudate	<b>Exudates</b>	Minimal secretion
Present only if infection occurs	<b>Pain</b>	Strong pain during resting, walking and sleeping
Peripheral pulse present; ABI > 0.8	<b>ABI</b>	Weak or absent peripheral pulse, delayed capillary refill; ABI < 0.6

## 7. DIAGNOSIS OF LOWER LEG ULCERS

Lower leg ulcer diagnosis is based on:

- Anamnesis
- Clinical examination
- Patient's general condition
- Diagnostic tests such as laboratory tests, Ankle-Brachial (ABI) index, Doppler ultrasound, duplex sonography of arteries and veins, blood flow measurement by laser, LDF (Laser Doppler Flowmetry) and Transcutaneous Oximetry (TcPO<sub>2</sub>)





After thoroughly taking the anamnesis, the clinical examination of the patient is performed in a standing and lying position. Indicators of blood flow are examined by palpation, where the pulse quality at the lower extremities is assessed. The lower legs are also examined for the color and the skin temperature, presence of skin lesions. Cyanotic feet are signs of venous insufficiency and ischemia.

Positioning tests show the status of arterial blood circulation. The patient is laid on his back with legs elevated by 30 cm. The blanching of the skin is a sign of the artery circulation disease.

The ABI index is determined by a blood pressure gauge. By measuring the systolic blood pressure just above the ankle joint and on the upper arm, we calculate the ABI index by the following formula:

$$ABI = \frac{SAP_{ankle}}{SAP_{arm}}$$

Contraindications for measuring the ABI index are cellulitis, painful ulcerations, acute deep vein thrombosis, lower leg edema (findings will not be applicable). The interpretation of ABI index is as follows:

- 1.0-Proper circulation
- 0.5-0.8- Changes in venous and arterial circulation
- <0.5 - Severe damage to arterial circulation; ischemia
- < 0.4 – Critical ischemia, limb threatened

Blood and urine laboratory tests can identify the health general state of the patient crucial for wound healing. Patients with chronic wounds should have basic laboratory tests done before and during treatment course due to long-term existence and secretion of the wound. Laboratory tests should be repeated every 15 to 20 days. An important indicator is the total protein amount -in chronic wound patients protein levels are dropping and should be replenished. Protein value can indicate the liquid balance, normal hormonal and enzymatic production, and is the indicator of tissue recovery. Daily protein intake in chronic early patients should be between 1.25 and 1.5 g/kg. The C reactive protein (CRP) shows changes in value already 10 hours after the onset of inflammation, and reaches the maximum value at 48-72 hours after the onset of inflammation. Other important tests include liver enzymes, kidney tests and blood glucose levels. Hematological tests include complete blood count and differential blood count screens, erythrocyte sedimentation and testing hemoglobin levels. The recommendation is to check and control the blood levels of iron and zinc, and vitamins A, B1, B6 and B12.

Microbiological screening (ulceration smear) is performed when there are clinical signs of infection. Ulceration edge biopsy is performed if there is no tendency of healing even after 3 months of appropriate intensive therapy to exclude malignant alteration or vasculitis.

Color Doppler ultrasound is the most important method in diagnosing chronic venous and arterial insufficiency. Three venous systems (superficial, peripheral and deep veins) are examined. Analysis of arterial tree indicates changes in arterial wall,



calcifications, narrowing of arterial lumen and blood flow through arteries. This diagnostic method enables precise localization identification of pathological changes or extravascular changes that have led to blood flow disturbance through the venous or arterial system.

Transcutaneous Oximetry-TcPO<sub>2</sub> is the partial oxygen pressure measurement in the tissues that warns of the lack of oxygen delivered to the capillaries and tissues. Laser Doppler-LDF measures the total local perfusion of the tissue including capillaries, arterioles, venules and shunts. It shows:

1. Perfusion capacity (maximum blood flow capability)
2. Ischemia
3. Inflammation

LDF can also be supplemented with TCpO<sub>2</sub> when capillary circulation is disrupted, but macro-circulation remains normal. TCpO<sub>2</sub> is supplemented with LDF to determine whether low values are a result of micro- or macro-circulation disruption.

**IMPORTANT TO  
REMEMBER**

*Patient examination is performed while patient is sitting and lying down.*

*Arterial blood flow is examined using positioning tests.*

*ABI index is determined by measuring systolic blood pressure of the ankle and upper arm.*

*Hematological and biochemical control is performed every 15-20 days.*

*Patients with long-term chronic wounds and wounds with exudate have depleted protein levels. Recommended daily intake of proteins for such patients is 1.25-1.5 g/kg of bodyweight.*

*Microbiological analysis of chronic wound is performed when clinical signs of infection are present.*

*Color-Doppler is the most important diagnostic tool in patients with suspected chronic arterial or venous insufficiency.*

*Transcutaneous oxymetry TcPO<sub>2</sub> is used to establish low oxygenation levels in capillaries and tissues.*

*Laser Doppler measures local tissue perfusion.*



## 8. TREATMENTS

Treating lower leg ulcers is complex and depends on the classification of the disease and the clinical manifestation. Disease prevention is of the utter most importance and includes educating high risk patients, as well as patients with early signs of peripheral arterial or vein disease, about the life style changes. Anti-aggregation (anti-platelet) therapy and daily walking programs are recommended for peripheral arterial disease patients.

In the case of deterioration and impaired quality of life, endovascular and surgical treatments are recommended. The choice of therapy is peripheral oxygenation, light therapy, subcutaneous lining (described in more detail later), VAC therapy and compression therapy.

**Vacuum - Assisted Closure (VAC)** is a method that enables faster wound healing by using a device that produces negative pressure on the wound (-125 mm Hg). A special foam or gauze is applied directly on the wound covered by an adhesive semi-permeable film cover to seal the dressing and wound. Since the wound is insulated in a sterile manner, there is no possibility of wound contamination with agents from the environment. A drainage pump system gently removes fluids from the wound into the enclosed container within the appliance. Negative pressure provides optimum amount of liquid content in the wound, tissue tension and capillary flow to improve capillary perfusion. This ensures ideal moisture conditions for wound healing and granulation tissue formation and removes tissue and bacterial debris.

**Compressive therapy** is a gold standard in the treatment of chronic venous insufficiency and lymphedema. Chronic venous insufficiency is caused by the impaired blood flow from the vein to towards the heart, resulting from inherited or acquired structural disorders of the venous walls and/or valves, and commonly occurs as the result of thrombophlebitis or phlebothrombosis. Due to damage to the valves or vascular varicosity of the veins, the blood is pooled in the lower legs and cannot normally flow to the heart. The blood oscillates between the valves, creates increased pressure in venous circulation, causing venous hypertension. The pressure does not decrease with movement, causing further changes in circulation and the onset of edema, varicose veins and tissue changes. These changes can lead to formation of venous ulcers. In the initial phases of chronic venous insufficiency, the venous pressure can be reduced by positioning the patient in a horizontal position with legs raised above the heart level, thus reducing the pain. At the later stages, this approach is ineffective and compression therapy is needed. The role of compression therapy is to increase venous or lymphatic flow, to improve the performance of muscle pumps, reduce tissue edema, and positively act on microcirculation. Compressive therapy is measured in degrees of compression (mmHg), and is carried out in two distinct phases. In the acute phase, the goal is to reduce edema and accelerate venous ulcer healing. The goal of the chronic phase is to prevent recurrence of the disease. The degree of compression depends on the clinical manifestation and the symptoms of chronic venous insufficiency, and is divided into four compression classes from 20 mmHg to 50 mmHg. The products used in compression therapy are summarized in Table 9.

**Table 9.** Types of compression therapy products

<b>Stockings</b>	Most effective on the surface venous system. The pressure they produce imitates physiological pressure distribution.
<b>Inelastic (short-stretch) bandages</b>	Used in the stages of the disease where skin changes and ulcers occur. They are used in the prevention of deep vein thrombosis in lying patients. They have to be changed every 1-7 days.
<b>Elastic (long-stretch) bandages</b>	Used as ongoing maintenance. They do not affect deep veins. Should be changed every day.

### 8.1 PAIN MANAGEMENT AND TREATMENT

The patient should be explained what pain is, what are the causes of pain, what predicted duration of the pain is (i.e. before the examination, prior to the wound dressing). The patient should be familiarized with the procedures and warned about potential discomfort, burning sensation and pain during examination or wound treatment. It is important to teach the patient and family members about the effect of using the methods of distraction during treatment to minimize discomfort, for example breathing or counting. The location of chronic wounds affects the level of discomfort and pain as the location (skin, subcutaneous tissue, muscles) determines the number of nociceptors (pain receptors). To treat such pain, non-opioid analgesics (paracetamol and non-steroidal anti-rheumatic drugs) are primarily used.

Recommended physical therapy method is visible incoherent polarized (VIP) light therapy. The analgesics effect of VIP light is based on converting energy of electromagnetic waves and infrared spectrum into heat that increases blood flow, connective tissue expansion, decreases joint stiffness and muscular spasms. VIP light stimulates the synthesis of natural opiates in the body and improves the conductivity of nerve fibers. VIP light therapy is easy to apply. Before the therapy itself, the treated area should be cleaned. The light flux should fall at right angle to the treated area of the body from a distance of 10 cm, resulting in optimal bio-stimulatory effects. One to two treatments in duration of 4-10 minutes per day are recommended, depending on the indication and recommendation for the treatment. VIP light acts through the cell membrane as trigger for regeneration processes and thus accelerates healing.



### IMPORTANT TO REMEMBER

*Compressive therapy is a gold standard in the treatment of chronic venous insufficiency and lymphedema. It is necessary to exclude peripheral arterial disease with chronic ischemia, decompensation of the heart and trophic skin changes in the diabetic foot.*

*Peripheral arterial insufficiency has a prognostic role in complete cardiovascular health.*

*In patients with ischemic ulcer there is a severe pain that is aggravated by lifting the legs and can be diminished by walking or dangling the legs on the side of the bed.*

*Leukoplast (surgical tape) should not be placed on the skin when the ulcer is swollen due to possible damage.*

## 9. HEALTHCARE OF PATIENTS WITH LOWER LEG ULCERS

While caring for patients with lower leg ulcers, interventions of the medical nurses can be classified in three levels. The first level consists of nursing interventions aimed at preventing the onset of the lower leg ulcers in people with a risk factor; the second level of interventions are aimed at the already occurring lower leg ulcers/wounds; and the third level constitutes interventions of health care education for the patient and the family. The nurse has to act on all levels mentioned.

The nurse participates in the therapy of lower leg ulcers that includes local and/or systemic therapy with the application of certain general measures (eg. weight loss or physical activity). In systemic therapy, vascular protectors and venotonics (flavonoids), anti-aggregating agents (acetylsalicylic acid) and fibrinolytic drugs can be used. To relieve the itching of the surrounding skin and the wounds itself, anti-histamines are used, while analgesics are used to relieve the pain. Local therapy consists of cleansing and disinfection of the wound itself and the surrounding skin, promoting the granulation and epithelialization process and preventing the development of infection by applying wound coverings.

### The first level of nurse intervention

The first level is aimed at preventing the lower leg ulcers. The first step in prevention is the identification of potential risk groups, and then the identification of risk factors. These are patients suffering from arterial or venous insufficiency of lower extremities, diabetes, vasculitis, hematological diseases, malignant diseases and other conditions. Preventive medicine, according to one of the definitions, is a scientific medical discipline aimed at improving and preserving health and preventing disease; these aims are the key activity of a nurse.



The risk factors for onset of lower leg ulcers are divided into two groups: modifiable and non-modifiable risk factors. Modifiable factors are a group of variables that can be changed. A nurse can work on improving several of these factors: inadequate physical activity, excessive body weight, smoking, encouragement to avoid certain static positions, skin care, and proper nutrition. The task of a nurse in individuals with these risk factors is to educate them about their health risks and encourage them to change their life habits. Non-modifiable factors are sex, age, genetics, body height etc.; they cannot be changed but it is important to keep them in mind as they might have an impact on the chronic wound.

Particular attention must be devoted to certain "vulnerable" groups of society, which include elderly people, patients suffering from psychiatric illness, addicts, and malnourished patients. These individuals have a higher risk of lower leg ulcer occurrence.

### **The second level of nurse intervention**

The second level is the nurse intervention in patients with early-onset lower leg ulcer. Before and during the treatment of the wound and sessions with the patient, it is necessary to collect the data properly and evaluate the general condition of the patient and the wound itself. Evaluation of the wound gives the direction of treatment and directs the approach to the proper care of the wound.

#### **9.1 DATA COLLECTION**

Determining the appropriate approach and type of healthcare, and recognizing the underlying problem, begins with taking anamnesis by a medical nurse. The nurse collects patient data from primary, secondary and tertiary sources by interviewing, observing, measuring and analysing available medical documentation. During the data collection, the nurse also uses an observation technique where visual, auditory, tactile and olfactory sensory modalities provide data on different aspects of the patient's condition and environmental influences.

Nurses are required to collect all the necessary information to ensure proper, full and quality care of the patient. All data must be recorded in the nursing documentation.

#### **1. When assessing the general condition of a patient, it is necessary to collect and record the following data:**

- Read the complete history of the disease and observe conditions such as diabetes, vascular disease, impaired immune system, connective tissue disorders and allergies
- Medications
- Nutritional status
- Lifestyle, e.g. smoking or drinking alcohol, or difficulty moving
- Psychological problems
- Life quality

## 2. Assessment of the wound

When assessing and reporting wounds, it is necessary to determine the following:

- Location, size and type of wound
- Wound bed characteristics such as necrotic tissue, granulation tissue and infections
- Unpleasant smell and exudate (no, weak, medium, strong)
- Condition of the surrounding skin (normal, swollen, white, shiny, warm, red, dry, peeling, thin)
- Wound pain (location, duration, pain intensity, nociceptive or neuropathic)
- Clinical signs of early infection (slow healing, unpleasant smell, abnormal granulation tissue, increased wound pain and/or excessive exudate)

During treatment, it is necessary to know the cause of wound development, to monitor wound healing phases, and be able to predict the healing time.

### 9.2 WOUND DRESSING

Wound dressing and caring for the surrounding skin are the basic steps in treating patients with early onset chronic wounds. It is important to take care of three key things during wound cleaning and dressing:

1. Appropriate dressing technique
2. Suitable washing agent
3. Appropriate cover

Wound care with gauze dressings and physiological saline solution has not been proven to meet the conditions necessary for proper wound healing. Modern wound dressings have a high protective factor in preventing the spread of infections, protecting the wound from microorganisms from the environment and preventing the transmission of microorganisms from the wound to the environment. Factors to consider when choosing the right wound cover are the characteristics of the wound itself and the patient's needs, which include comfort, availability, ease of use, and hypoallergenic properties. Choosing the right cover helps reduce the risk of developing the infection, provides favorable conditions for wound healing in a moist environment, improves autolytic debridement, promotes tissue granulation and reduces pain and odor from the wound.

As there are many covers available on the market, we have many possibilities when it comes to choosing appropriate wound covers: occlusive and semi-permeable covers, simple non-adhesive covers, transparent covers, collagen covers, antimicrobial covers, impregnated gauze, paraffin gauze, hydrogels, hydrocolloids, alginates and various foam coverings. During wound dressing process, it is necessary to monitor the condition of the wound and to recognize in time the appearance of symptoms that indicate a deterioration of the wound status. The first symptom that indicates the development of an infection is an elevated pain sensation in the wound.



Lower leg ulcer dressing must be gentle and slow, without sudden and rough movements, to minimize the pain. The basic principles of asepsis and antisepsis should be followed during wound dressing. Each process of wound dressing begins with hand washing, putting on sterile gloves and personal protective equipment (coats, caps, masks). The dressing is firstly performed on the clean wounds after which the wounds with infection can be dressed.

### 9.3 WOUND DRESSING SOLUTIONS

Usage of antiseptic solutions in the treatment of chronic wounds is effective in prevention of the development of infection, in diminishing the spread of local infection and as a support in targeted treatment. The decision to apply antiseptics is based on a clinical manifestation of infection and presence of microbiological entities.

Antiseptics use as prophylaxis refers to the one-time dose of a particular antiseptic, dosage several times during one day or for one to five days in the form of a compress. Antiseptic therapeutic use is administered for local or systemic infection of the wound as a support for the targeted therapy, applied repeatedly over a long period of time, i.e. for 7, 10 or 14 days or until the beginning of the granulation tissue\* The most commonly used solutions for wound dressing:

**SODIUM CHLORIDE INFUNDIBLE 0.9%** (saline solution) - The most commonly used sterile solution used to rinse all wounds, mucous membranes and body cavities.

**ETHYLALCOHOL 70%** - do not put on the wound! The alcohol denaturates bacterial proteins, but it is not effective for spores. It acts on tuberculosis and hepatitis B causing agents. In combination with other disinfectants, it acts against the HIV virus. It evaporates quickly, but it is most effective 15 to 20 seconds after application. It does not protect the disinfected surface from further contamination.

**BENZIN** - used for removing fat and impurities from the skin and removing leukoplast adhesives. Do not put on the wound!

**PLIVA®sept (chlorhexidine gluconate) 0.05%** - for disinfection of skin and mucous membranes. It has a rapid prolonged bactericidal action, acts as a fungicide (Candida) and acts on a human immunodeficiency virus. It is ineffective for tuberculosis and hepatitis B virus. The bactericidal effect occurs in 15 seconds, resulting in the creation of an antimicrobial film that protects the skin from contamination for 6 hours. It is effective in the presence of blood, pus, serum, feces and other organic substances. It is stored at room temperature.

**HYDROGEN PEROXIDE 3%** (oxidative agent) - most commonly used for purulent wounds. In contact with the organic substance, oxidation process occurs creating foaming that pushes devitalized tissue, pus and other impurities to the surface, thus facilitating their removal from the wound. The downsides of hydrogen peroxide are poor effectiveness on Gram positive and Gram negative bacteria, it is blood inactivated, cytotoxic and can cause





embolism and delayed healing of the wound. Therefore, the use of hydrogen peroxide in the treatment of chronic wounds is contraindicated (+).

**BETADINE (povidonum iodinum) 10%** - brown dye solution for disinfection of skin and surgical infected wounds and for surgical prevention of microbiological contamination. Extended action on bacteria, viruses and fungi.

**MERCURICHROM 2%** - acts as a mild red colored antiseptic. Used for surface and toes wounds to enhance granulation.

**SODIUM CHLORIDE 10%** (hypertonic solution) - a solution that causes water elimination from the wound with enhanced secretion, thus promoting the formation of granulation tissue.

#### 9.4 WOUND LAVAGE

Wound lavage is performed with sterile 0.9% saline solution. The saline solution should be warmed to a room temperature, ideally to body temperature. The use of cold solution during wound lavage leads to vasoconstriction, lowers the temperature of the wound itself thus slowing the wound healing process (1). Before rinsing, all bandages, swabs and dressings should be removed from the wound with sterile forceps.

The saline solution washes away all foreign bodies, such as remnants of coverings, devitalized tissue, exudates, fibrin deposits or necrotic tissue from the wound. To clean the wound, nurse will prepare:

1. Physiological 0.9% NaCl solution at room temperature
2. Sterile syringes (wound is cleaned under mechanical pressure)
3. Sterile pen or tweezers (used to take the material/gauze from the sterile set)
4. Sterile set of gauzes

Description of wound cleaning/lavage process:

The wounds are irrigated to remove all foreign bodies (residue covers, bacteria, detritus and necrotic parts) with sterile saline (0.9% NaCl) solution, which has been warmed to room temperature (about 23°C). Wound is rinsed under pressure using a sterile syringe. After lavage, the wound is cleaned in circular movements, from the center of the wound to the periphery, several times with sterile gauze (Figure 3).



Figure 3. Wound cleaning

The gauze used for wound cleaning cannot be used to clean the wound surroundings and vice versa. This is important to prevent contamination of the wound with microorganisms and impurities found in the surrounding skin, and to prevent the spread of microorganisms from the wound to the surrounding skin. If necessary, necrotomy is performed (Figure



**Figure 4.** Necrotomy

#### **9.5 CLEANING AND PROTECTION OF THE WOUND SURROUNDING**

After cleaning the wound, the procedure of cleaning the surrounding skin follows. The surrounding skin should be washed with antiseptic soap and rinsed with saline solution and dried. After cleansing the surrounding skin and before applying any of the dressings, it is necessary to evaluate the wound and photo-document it (photograph the wound and file it in the documentation for a more adequate assessment of the progress and success of the treatment). The surrounding skin is then treated with creams that protect the skin from maceration and maintain the proper level of moisture and elasticity.



**Figure 5.** Protecting surrounding skin

## 9.6 MODERN WOUND DRESSINGS/PATCHES

The choice of modern dressings in the wound healing process has become crucial in creating optimal conditions for healing. Modern dressings and patches have been developed to such an extent that they meet all the specific requirements for optimal conditions at all stages of healing. Prior to the application of the dressing, protocols containing the etiology of the wound, wound assessment, stage of defect, presence of infection, and general condition of the patient must be followed. It is important to know that there is no ideal dressing for all wounds. Some of the benefits of applying the dressing are: the dressing can stay longer on the wound, high ability to absorb secretions, the frequency of dressing decreases, less trauma to the wound and has an effect on improving the patient's quality of life. Prior to the application of the dressing, it is important to determine the wound status and to apply the appropriate dressing in accordance with the clinical signs and microbiological findings of the wound.

### 9.6.1 HYDROCOLLOIDS

Hydrocolloids are occlusive, self-adhesive dressings that have a combination of carboxymethylcellulose, gelatin and pectin in the structure and are covered with a polyurethane film. They are applied to wounds with medium and low secretion. In contact with the wound secretion, a gel is created that creates optimal conditions for healing and promotes autolytic debridement, creating a moist medium. During application, it is important to properly observe and categorize the condition of the surrounding tissue and the amount of exudation since the hydrocolloids will enlarge the wound through autolytic debridement and will soften the skin around ulcer if it is greatly malnourished. The optimal frequency of dressing is two to three times a week, up to a maximum of seven days.

**Indications:** Granulation and epithelial wounds with intermediate and lesser exudation. Hydrocolloids are extremely suitable for autolytic debridement, retaining wound exudate on necrotic tissue (dry necrosis or fibrin deposits).

**Application:** The wound is washed with saline solution, and the area around the wound is dried to allow the hydrocolloid to stick. The dressing should be 2 centimeters larger than the wound edge. It has to be changed when the gel leaks from the edge (leakage allows the bacteria to enter wound and infection is possible).



## HYDROGEL

The hydrogel consists of an insoluble polymer that is hydrophilic and has the ability to absorb a large amount of liquid. The basic function is to ensure the absorption and debridement of necrotic or fibrin tissue under some active dressing.

**Indications:** Ideal for wounds with minimal secretion or no secretions at all. It provides ideal conditions for wound healing by increasing the moisture under the dressing and, by cleansing and removing necrotic tissue.

**Application:** Applied directly to the wound and covered with a suitable secondary dressing. It is washed out from the wound with saline solution. On very dry necrosis, the dressing should be changed every day. It is very effective for atraumatic and autolytic wound debridement.

### 9.6.2 ALGINATES

The dressing is a soft white woven fiber made from algae. Some alginates polymerize faster, which makes them shorter, therefore frequent changes are required. Their characteristic is that they are hemostatic because they release calcium directly into the wound, so they are an excellent choice after necrotomy or in acute bleeding wounds.

**Indications:** Wounds with medium and extensive secretion. They are a good choice for minor bleeding because their composition actively participates in hemostasis by releasing calcium ions into the wound exudate. Alginate dressings are ineffective on dry wounds.

**Application:** After rinsing the wound with saline solution, the dressing is positioned on the wound ensuring that the edge of the dressing is larger than the edge of the wound for at least half a centimetre. Secondary dressing is positioned over the alginate (Figure 6).



Figure 6. Alginates

### 9.6.3 TRANSPARENT FILMS

Transparent film is an adhesive semi-permeable, transparent film. Semi-permeable characteristic makes the film water resistance while allowing the gases to pass through it. It is made of polyurethane with a layer of adhesive acrylate. The basic purpose of transparent film is to prevent infection and its use as a secondary dressing. It is not absorbable, therefore it cannot be applied to wounds that have extensive secretion.

### 9.6.4 HYDROFIBER DRESSING

It is used for wounds with very strong secretion. Its high absorption capacity reduces the number of wound dressings and controls the microbial flora so that bacteria from the wound remain immobilized in the hydrofibers. Proper application protects the skin from maceration and reduces the possibility of contamination by microorganisms when changing the dressing. Hydrofibers create a cohesive gel during polymerization, which retains moisture at the bottom of the wound and prevents it from drying out. It does not adhere to the bottom of the wound and it partially removes the fibrin fibers.

**Application:** The dressing has to be half a centimeter bigger than the wound edge to compensate for shrinking during absorption. After application to the wound, the dressing is covered with a secondary covering and is changed when the secretion breaks the cover or when the dressing completely turns into a gel.

### 9.6.5 HYDROFIBER DRESSING WITH SILVER IONS

Primary dressing intended for use in medium to severely exuding acute and chronic wounds in which an infection is already present or there is a great potential for the development of a wound infection. The use of silver in various forms provides a more active approach to the treatment of acute and chronic wounds.

**Indications:** If the wound has visible signs of infection, the microbial pathogen must be isolated and an antibiotic administered. In addition to antibiotic therapy, silver dressing is indicated locally. Chronic wounds that are at high risk for infection, such as diabetic foot and burns, should be wrapped with dressings containing silver ions as first choice. Other indications, whether of chronic or acute etiology, require the use of a silver dressing with individual application.

### 9.6.6 ALGinate DRESSING WITH MEDICAL-GRADE HONEY

Honey has two basic properties that exert antibacterial activity: it is an important source of phenolic compounds that contribute to antimicrobial and antioxidant activity. The first property is based on its physicochemical properties (osmolarity, viscosity, pH value - acidity). Another property of honey is based on chemical compounds collectively called inhibins. The main ingredient in honey that provides antibacterial activity is hydrogen peroxide, which has a proven antibacterial effect on the most common strains of Gram-positive and Gram-negative bacteria in wounds, including methicillin-resistant *Staphylococcus aureus* (MRSA) and *Streptococcus pyogenes*.





### 9.6.7 COLLAGENS

Collagen is a natural biomaterial known from Egyptian civilization. It is the most abundant protein in the human body. Collagen is very important in the wound healing process. It is an excellent chemostat.

### 9.6.8 HYDROPOLYMERS - "FOAMS".

Hydrophilic polyurethane foams belong to supportive dressings for wound healing. Their main characteristic is their ability to absorb. By indications, they overlap with hydrocolloids, except that they are not routinely used for diabetic feet (according to clinical studies), they do not promote granulation and epithelialization as hydrocolloids.

## 9.7 DOCUMENTATION

During each wound dressing, and before the application of the appropriate cover for wet wound healing, a wound evaluation is performed. The wound is photographed and data is recorded in the appropriate document(Figure 7). When photographing, the following conditions have to be met: photographing should only be done with the flash, always from the same distance, with a measuring tape next to the wound to see the size of the wound, measure the depth of the wound, or use a range of measuring instruments used during technical measurements (measurement results are more accurate!). After the first documented examination, we also use the accompanying documentation schemes, which should be repeated at least every 7 days, then every 15 days, and then up to one time per month. If in the meantime some important changes occur in the wound, then the documentation has to be updated by a new protocol.

CHRONIC WOUND ASSESSMENT LIST									
Patient Name:		Year of birth:		Identification Number:		Ward:			
Diagnosis:									
Wound assessment:		Wound type							
		Localization							
		Duration of Wound							
		Relapse							
		yes no							
Size: 0 - 5 cm		Depth: Superficial		Wound Edge: Sharp Limited		Wound bed: Necrosis			
5 - 10 cm		Medium Deep		Blunt Limited		Fibrinous Tissue			
10 cm <		Deep				Granulation			
						Epithelialization			
Secretion: Small		Secretion: serous		Surrounding tissue:		macerated		yes no	
(quantity)		(type)							
medium		bloody							
strong		purulent							
Subjective feeling of pain:		Pain		Signs of inflammation:		yes no			
		a little pain		Redness		yes no			
		it doesn't hurt the		Oedema		yes no			
				Temperature		yes no			
Date:		Type of dressing applied :		Material taken for bacteriological analysis:					

**Figure 7.** Chronic wound assessment list example taken from Department of Dermatology at Sestre milosrdnice University Hospital Center



## 9.8 PATIENT HEALTHCARE EDUCATION

Every illness has a negative impact on an individual's life. The chronic wound can significantly affect the quality of life of a patient in several ways: (1) patient can experience discomfort or pain, (2) the mobility of the patient can be diminished depending on the wound localization, (3) performing common everyday activities can be difficult, and (4) if the wound is accompanied by an unpleasant odor the patient can experience social isolation and various frustrations.

Regardless of the level of infirmity of a patient regarding his illness is and its possible outcome, it is necessary to conduct education of both patients and people in direct contact with the patient.

### 9.8.1 Movement

Instruct the patient on the importance of daily leg and foot exercises (multiple times per day), regular walking and movement, to improve circulation in the lower extremities

Show the patient foot exercises: the feet should circle around, first to one side, then to the other, and at the same time to flex and relax the fingers

Instruct patients to spend at least 30 minutes a day walking

Give note to the patient that movements and exercises should not be painful and point out the importance of rest after each exercise

Explain to the patient procedures during rest time that contribute to better draining of the accumulated lower leg fluid: lifting the legs in an elevated position, that is, lifting the lower extremities above the heart level

Warn patients on the importance of adhering to the rule: rather walk and lie down, than to stand and sit

Explain to the patient that they should not carry heavy loads or heavy bags

### 9.8.2 Getting dressed

Explain to the patient the importance of wearing flat shoes

Explain to the patient lack that shoes with narrowing on the particular parts is not appropriate (footwear with shoelaces, high heels or shoes with narrow and tight point)

Instruct the patient on the importance of wearing compressive socks during and even after wound healing to prevent the development of new wounds

### 9.8.3 Care and skin protection

Familiarizing patients with the importance of daily and regular skin care

Explain to a patient wears compressive bandage that the bandages dry out the skin and cause itching of the skin and it is necessary to take care of these places on a daily basis

Explain to the patient the importance of skin care with protective and moisturizing creams and ointments, and the importance of avoiding the use of





detergents and skincare with added perfumes as they may further irritate the skin

Emphasize to the patient the importance of avoiding direct sources of heat that irritate and dry the skin, such as direct exposure to sunlight, use of hot water bottle and blankets, leaning on to the radiators and other sources of thermal energy

Explain the patient the importance of procedures during wiping and drying, explain how to pat the skin gently with soft towels, and avoid skin rubbing to avoid unnecessary additional skin damage

#### 9.8.4 Diet/Nutrition

Patients with chronic wounds often have a need for increased protein and water intake. The proportion of protein and water required depends on the size of the wound: the bigger the wound, the higher the need for nutrients increase.

Patients need to be instructed to increase the intake of fluid into the body in the form of water, unsweetened teas or diluted fruit juices, and to increase protein intake by consuming more dairy products, eggs and lean poultry meat.

Healthy nutrition has a great influence on the speed of wound healing and has a positive effect on the general condition of the patient itself.

Check with the patient:

Daily intake of a healthy and balanced diet that contains fresh fruits and vegetables

Check the patient's current body weight and explain that any reduction in body weight (in obese people) results in a positive effect on the wound healing process itself, but also on the overall general condition of the whole organism

Check the patient's daily fluid intake and if necessary advise an increase (1.5 to 2.5 liters per day)

Explain to the patient the importance of adhering to the individual nutrition plan that has been developed in cooperation with other nutritionists; provide the patient with a supportive attitude

#### 9.9 CASE STUDIES

1. A man, N.N., born 1949, has a change in the lower leg persisting for a month. From the medical history it is evident that the patient has congestive heart disease and has varicose veins on both legs. During physical examination, no visible skin damage apart from a 7cm<sup>2</sup> ulcer on the left lower leg above the right medial malleolus was observed. The ulcer is a shallow, of yellowish bottom with singular islands of red granulation tissue. The surrounding skin is dry, scurfy and brown. Extremities are cold to the touch, with edema present on the left leg making pulse palpation difficult on the dorsalis pedis artery. The patient complains of pain in his left leg that loosens when he puts his foot in an elevated position.



- What is the etiology of the ulcer?
  - What are the potential causes that led to the development of the lower leg ulcer?
2. A woman, N. N., born 1953, complains of extremely painful changes in the lower lateral third of the right lower leg. The change developed two months ago, spontaneously, after minor trauma in the form of a scratch on that part of the leg. The patient states that she had been suffering from diabetes for the past 8 years, smokes a pack of cigarettes daily, but denies alcohol consumption. She controls blood sugar levels regularly and is receiving diabetes therapy. The visible ulcer is 19 millimeters in diameter, with a pale bottom, without granulation. The right leg is free of pigmentation, cold to the touch and has no hair. The patient states that she feels constant pain that does not go away by lifting her leg to an elevated position.
- What is the etiology of the ulcer?
  - What were the potential causes that led to the development of the ulcer?

**IMPORTANT TO  
REMEMBER**

*A medical nurse must act on the prevention of the development of the lower leg ulcer, in the management of the resulting ulcer, and in the health education of the patient and his family.*

*A medical nurse must assess the patient's general condition and evaluate the condition of the wound*

*Dressing a chronic wound is performed in aseptic conditions by first dressing wounds without infection and at the end of wounds with infection.*

*The use of antiseptics in the treatment of chronic wounds effectively acts to prevent the development of infection, reduce the spread of local infection and act as a support for targeted treatment.*

*Chronic wound lavage is performed with 0.9% NaCl saline solution at room temperature.*

*The skin around the wound is cleaned just like the wound and must be protected with protective creams.*

*Advantages of modern wound dressings are: they provide optimal conditions for wound healing, maintain optimal moisture, temperature and pH of the wound, protect against contamination by microorganisms, promote autolytic debridement, are atraumatic for the wound, reduce the frequency of dressings.*

*Wound evaluation is performed during each dressing and the documentation is updated as needed.*

*A nurse educates the patient and his or her family on the treatment, dressing and daily activities.*



## **MODUL II-DECUBITUS**

### **Outputs**

*Discuss the impact of pressure ulcers on individuals, healthcare facilities, and society.*

*Explain the risk factors for developing pressure ulcers.*

*Explain the process of conducting risk assessments and measuring risk associated with pressure ulcers.*

*Identify actions to help prevent pressure ulcers.*

*Describe the staging of pressure ulcers.*

*Discuss effective wound treatment and management of pressure ulcers.*

*Describe the factors affecting pressure ulcer healing.*

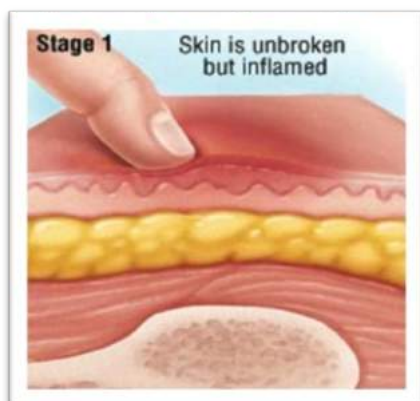
### **1- Definiton of Decubitus**



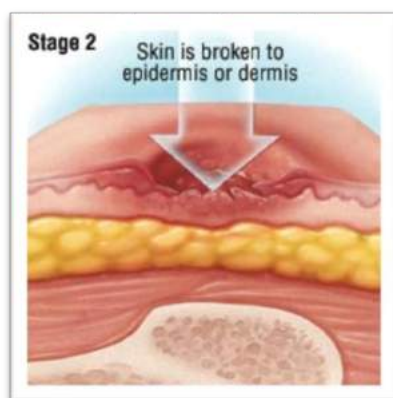
Bedsore — also called pressure ulcer and decubitus ulcer — are injuries to skin and underlying tissue resulting from prolonged pressure on the skin. Bedsore most often develop on skin that covers bony areas of the body, such as the heels, ankles, hips and tailbone. ("Bedsore (pressure ulcer)", 2018) People most at risk of bedsore are those with a medical condition that limits their ability to change positions or those who spend most of their time in a bed or chair. Bedsore can develop quickly. Most sores heal with treatment, but some never heal completely. You can take steps to help prevent bedsore and aid healing.

## 2- Classification

**Stage 1:** At this stage, the color and texture of the skin changes, but the tissue integrity does not deteriorate. When the pressure on the skin is removed, it takes more than thirty minutes for the skin to return to normal. If the pressure to the skin surface can be removed, healing and normalization of the skin can be easily achieved.

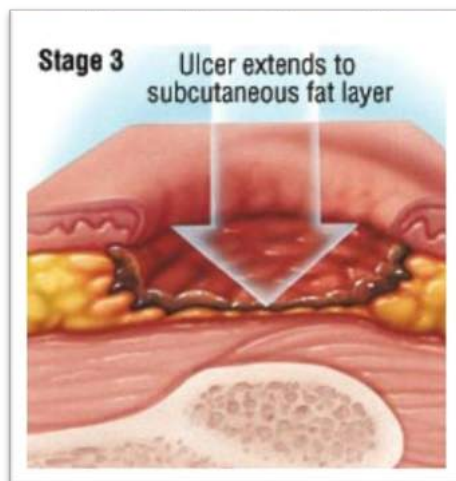


**Stage 2:** In this phase, superficial losses begin on the skin. This may be accompanied by swelling and pain in the skin. If the pressure of this point is reduced, it is possible that the bed sore can heal in a relatively short time.

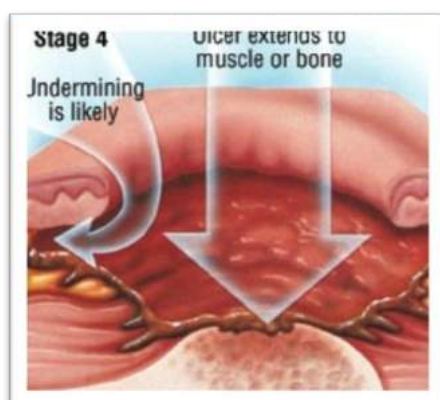




**Stage 3:** A deep pit is formed on the skin. Tissue loss is now at an advanced stage. At this stage, the risk of infection is increased. As the tissue death progresses within the wound, there is no pain. Nerve fibers are dead. If there is a discharge or bad smell, this is usually a symptom of an infection. The recovery lasts for months, even if the pressure is abolished and the treatment is being continued.



**Stage 4:** This is the deepest, most severe stage of decubitus ulcer. To be classified as a Stage 4 pressure sore, a large-scale loss of skin occurred. The stage 4 bed sore burrows so deep into the skin that it damages the muscle, bone, tendons, and/or joints. Stage IV pressure wounds are very dangerous and require extensive wound care. Stage 4 bedsores sometimes require surgery. A stage 4 decubitus ulcer can lead to bone infections (osteomyelitis), blood infections (sepsis), limb amputations and death. A Stage 4 bedsore often creates a visible hole down to the patient's bone. It is very difficult to heal a stage IV decubitus ulcer.



**Unstageable:** An unstageable pressure sore is a bedsore that does not fit the above staging categories. In an unstageable bedsore, the doctor or nurse cannot see the true depth of the decubitus ulcer, and therefore cannot grade it. Signs of an unstageable decubitus ulcer are wounds covered by slough (yellow, tan, gray, green or brown) and/or eschar (tan, brown or black) in the bottom of the decubitus wound. Sometimes, the slough and/or eschar needs to be removed in order to properly stage an unstageable pressure sore. (Karadağ, A., 2003)

### 3- Risk Factors:

- a. The most important factor in the formation of bed sores is **pressure**. The density, duration and pressure resistance of the tissue are important for the development of bed sores. The reason for the absence of bed sores in healthy individuals is related to the duration of pressure. Because people who move their body and do not have sensory perception problems feel uncomfortable if the tissues do not get enough oxygen because of the pressure and they change their positions to shift the pressure to other points. People who have problems such as traffic accidents, pain, and senses of nerve damage may not be able to detect excess pressure in any part of their body and thus not be able to reduce the pressure by changing their hospitalization positions. This may result in the formation of bed sores. (Bryant, Shannon, Pieper et al. 1992, MOH 2001)
- b. **Friction and ruptures** are also important in the formation of bed sores. The friction to occur during movement of the tap on a surface such as a bed or a wheelchair does not lead to the formation of bed sores alone. This only leads to damage to the upper layers of the epidermis and dermis. However, when the friction is combined with the effect of gravity, it increases its effect and causes ruptures in deep tissues. As a result, the blood circulation is impaired and tissue damage develops. In such a case, since the skin cannot move freely, the actual effect of the rupture is seen in the deep tissues above the bone protrusions. (Çınar and Sevgi 2001)
- c. At the extremes of **age**, patients may be at higher risk for the development of pressure ulcers due to inability to move/change position independently. Very young infants are unable to change position by themselves; the elderly may be similarly unable to change position due to other health problems limiting movement. (Bryant, Shannon, Pieper et al. 1992, MOH 2001)



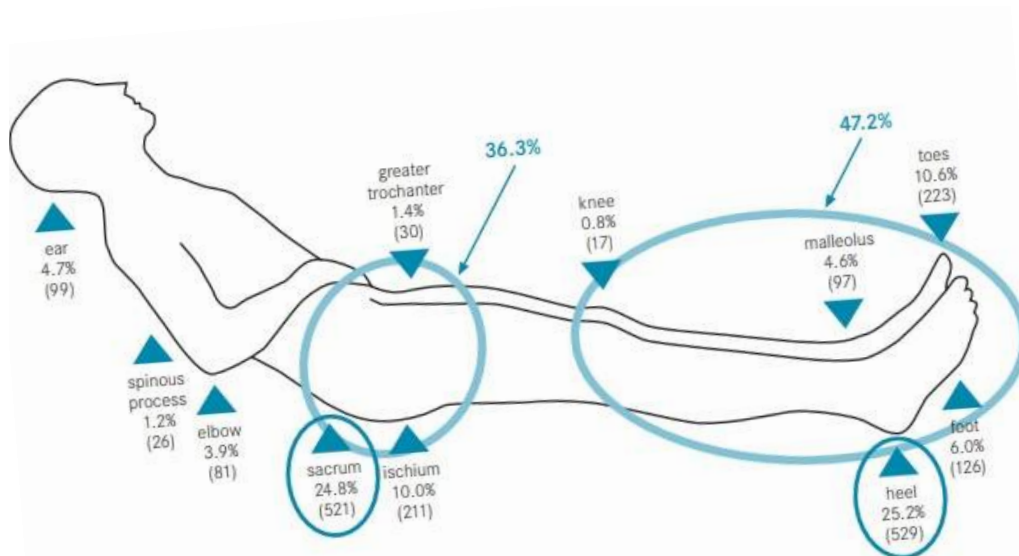
- d. Another element that accelerates the formation of bed sores is **moisture**. Moisture affects the resistance of the epidermis. The skin surface, which is exposed to moisture for a long time, begins to soften first, followed by deterioration in tissue integrity. The incidence of bed sores is higher in those who cannot hold urine and feces and are perspiring. (Karadağ, A., 2003)
- e. **Nutritional deficiency** is also an important risk factor for the development of bed sores and prolongation of healing. Those who have nutritional problems and especially those who have digestive problems with protein and caloric intake have a higher risk of developing pressure ulcers.
- f. **Diseases** that affect blood and oxygen transport to tissues and cause movement limitation are also important in pressure ulcers. For example, in patients with bed- and wheelchair-dependent paralysis bed wounds are more common in patients with hip fractures (NPUAP 2001)
- g. **Psychological factors** are also important in the development of bed sores. In the case of stress, the release of cortisone is increased. This increase in the amount of cortisone reduces collagen synthesis and this has an effect on accelerating the development of pressure ulcers.
- h. In pressure ulcers, factors such as smoking, elevated blood glucose levels, dry skin structure, elevated body temperature, severity of the disease, decreased blood flow, and low blood pressure are also effective. As can be seen from these risk factors, bed sores are not a problem that can only be seen in elderly patients. It is a problem that can be seen at any age, causing difficulties and high costs for patients, relatives and health institutions. To overcome this problem, it would be useful to establish national organizations, conduct research to help produce healthy policies throughout the country, and keep statistics and overcome difficulties with correct measures and treatments.





## 4- Review and Check for skin

### Skin inspection



Check your skin, or have your attendant or caregiver check your skin, a minimum of twice a day (morning and bedtime).

Look for changes in skin color (redness or darkening), blisters, bruises, or cracked, scraped or dry skin.

Feel for hardness, swelling or warmth that may signal skin breakdown.

Closely inspect areas that are at especially high risk for pressure sores because in some areas of the body the bones are close to the surface of the skin; the skin that is directly over bone is at highest risk.

- o sacrum (lower back)
- o coccyx (tailbone)
- o heel of the foot
- o ischium (the base of the buttocks, "seat bones")
- o trochanter (hip, from lying on side, something rubbing, or tight clothes)
- o elbow (from leaning on it)
- o knee (from spasms or side-lying with one knee on top of other)
- o ankle ( from lying on side)
- o toes and bony areas of foot (from tight-fitting shoes)
- o back of the head

Inspect areas of skin that are in contact with casts or braces twice daily.

Use a mirror to inspect skin in hard-to-see areas. Train the person who helps you to carefully and regularly check your skin.

Pay attention to fingernails and toenails: an ingrown toenail or cut along your nail bed may lead to a sore which can easily be infected.

As soon as you notice a discolored area, stay off the area until it returns to normal skin color. (Sarah Woodward , 2013)

## 5- Diagnostic Procedures

The doctor takes a close look at the skin to determine if there is a bed wound and how badly the wound is. He/She tries to classify the wound up to a certain stage. Determining the stage of the wound helps applying the best treatment method. It may also require a blood test to assess the overall health of the patient.

### Possible questions the doctor may ask:

When did bed sores first appear?  
What is the degree of pain?  
Have you ever faced a bed wound?  
What kind of care is currently being applied?  
What is the frequency of changing your position?  
What was diagnosed medically and what is the current treatment?  
What is your daily diet and fluid intake?

Wound care of pressure sores should be given by trained medical personnel and physicians who are specialized in wound care.

### What are the symptoms of pressure sores?

There are variable stages depending on the severity of pressure sores. Patients on wheelchairs have a higher risk of developing pressure sores on back of the head, shoulders, elbows, lower back and hips, buttocks, behind the knee and heels

## 6- Treatment

**Systematical Treatment:** The nutritional status should be evaluated after the initial evaluation of the patient and the measures taken against the pressure. Malnutrition and negative nitrogen balance are usually present in these patients due to both primary disease and ulcer surface loss. High-calorie, high-protein and high-vitamin diet should be started in these patients.

### - Anemia

It is important to keep hemoglobin levels high enough to ensure adequate tissue oxygenation. In addition to this, iron preparations should be added to the diet, as well as adding blood-making substances such as liver. Paralyzed patients usually have a persistent chronic anemia. Repeated blood or erythrocyte transfusions may be required if hemoglobin levels are not achieved.

- **Infection**

Patients with pressure ulcers often have a accompanying urinary tract or respiratory tract infection. If not treated, bacteremia may develop. In the presence of bacteremia, the bacteria are localized in the ischemic tissues under the pressure and cause the development of infection. Systemic infection should be treated with appropriate antibiotics, urinary catheter drainage should be changed frequently, residual urine should be emptied, patients with diaphragm paralysis should have good hydration and respiratory rehabilitation.

- **Elimination of spasm**

Spasm is frequently accompanied by spinal cord injuries, especially from the upper level. Prevention of spasm and correcting the patient's position is necessary for surgery. The possibility of re-opening of the wound is very high after surgery. In such a case, the first thing to do is to consult the neurosurgeons. If neurosurgeons do not consider a surgical intervention, spasm should be prevented by the drug. For this purpose diazem may be used alone or in combination with baclofen.

- **Correction of contractures**

In long-term paralysis, joint contractures develop due to shortening of muscles and joint capsules. In particular, if the flexion contractures encountered in the hip and knee joints are not corrected, the surgical procedure becomes extremely difficult and the likelihood of recurrence of postoperative wounds increases. In order to correct contractures, patients should undergo intensive physical therapy. Capsulotomy or tenotomies may be required in cases where physical therapy is insufficient. However, these procedures should be used in a limited way, as it may make it difficult for the patient to use wheelchair.

- **Elimination of press**

The main principle in both prevention and treatment of pressure sores is to minimize the pressure of the weight bearing regions and to avoid prolonged pressure. The position of the inpatient patients should be changed every 2 hours and the position on the face should be preferred during sleep. Patients using wheelchairs should be instructed to lift their arms every half an hour and to allow tissue perfusion, and to avoid using the chair for more than 2 hours.



## Local Treatment

Local treatment of pressure sores includes conservative wound care and surgical procedures.

### - Conservative treatment

The first step is to evaluate the wound and to evaluate the surgical debridement. It is true that the first debridement is performed in the operating room conditions, in the presence of appropriate light, assistance and cautery. All necrotic tissues are removed, bone fragments are removed, fibrous septae are broken, infected areas are drained and the devitalized fascia and tendons are excised. A biopsy is taken for quantitative tissue culture. Subsequent debridements can be performed on the patient bed during dressings.

### Surgical treatment

Surgical treatment of pressure sores consists of excisional debridement, removal of bone protrusions and covering the wound with a permanent covering. The principles for pressure sore surgery were first described by Conway and Griffith in 1956:

Complete excision of the sore, surrounding scar and underlying bursa is first performed

The underlying bone is removed until healthy bleeding bone remains

The resultant dead space is filled with large pedicled flaps, either fasciocutaneous or myocutaneous

It is better to have a large flap design in order to avoid sutures in the pressure areas

Also avoid violation of adjacent flap territories, which may be needed for future use (Boyko, T. V., Longaker, M. T., & Yang, G. P, 2018)

### 7- Important to Remember

A patient need to be aware of that they should do the following to minimize the risk of having decubitus on their skin.

**Check your skin several times each day.** Check for red skin, or other color changes, over bony areas. Use a mirror if you have trouble seeing certain areas, or ask another person to look.

**Change wet bedding and clothes right away.** The wet material may rub against your skin and cause damage.

**Change your position often.** Change your position every 2 hours if you are in a bed all day. Change your position every hour if you are in a wheelchair all day. Set an alarm to help remind you when it is time to turn. Keep a written



turning schedule to help you remember to turn. If you are helping a person move in bed, lift him or her. Do not slide him or her. Keep the head of the bed as low as possible. This may help prevent damage to the skin from sliding down in bed.

**Protect the skin over bony areas.** Use pillows or foam wedges to keep bony areas from touching, and to relieve pressure. For example, put a pillow or foam wedge between your knees to keep them from pressing on one another. Place a pillow or foam wedge under you to keep your hip raised when you lie on your side. Do not rest directly on your hipbone. Put a foam pad or pillow under your legs from calf to ankle when you lie on your back. The pad or pillow should raise your heels so that they are not touching the bed.

**Use medical equipment and pads.** A draw sheet or large pad under you may help others move you up in bed. An overhead trapeze can help you change positions in bed. Mattresses and overlays made to provide more cushioning may help decrease the risk of pressure injuries. Examples include a foam mattress pad and air or water mattresses. Ask about equipment that may be right for you and how you use it.

**Keep your skin clean, dry, and moisturized.** Use mild soap and warm water to clean your skin. Do not rub or scrub when you wash. Do not use products that contain alcohol, because they can dry out your skin. Gently pat your skin dry. Do not rub your skin with a towel. Apply lotion or a moisturizer on your skin often.

**Eat a variety of healthy foods.** Healthy foods include fruits, vegetables, whole-grain breads, and fish. Foods that are high in protein may help your pressure injury heal. This includes lean meats, beans, milk, yogurt, and cheese. Nutrition shakes may also give you extra calories and protein if you have trouble eating or are underweight. ("How to Prevent Pressure Injuries - What You Need to Know", 2019)

## 8- Preparing the Patients

Introduce yourself to the patient and explain what you are doing and why. If possible, provide privacy. Position the patient comfortably and make sure the surrounding area is clean and tidy before you start. Check the patient's care notes to update yourself on any changes in the patient's condition and to make sure the dressing is due to be changed. Wash your hands and put on sterile gloves (to protect yourself) before removing an old dressing. Dispose of this dressing in a separate dirty clinical waste bag.

Complete a wound assessment. This includes a visual check and comparing and evaluating the smell, amount of blood or ooze (excretions) and their colour, and the size of the wound. If the site has not improved as expected, then the treating physician or senior charge nurse must be informed so they too can evaluate it and consider changing the care plan. ("Yatak Yarası (Basi Yarası) Nedir, Pansuman Nasıl Yapılır?", 2018)

## 9- Preparing the Accessories

**Organize and set up** the equipment you will need before removing your old dressing.

**Line up the equipment in the order you will need it** on a bedside table, bathroom counter or other clean surface. You may want to wipe the surface off with a disinfectant product before you begin or cover it with a sterile towel.

Products you may need for your dressing change include:

- non-sterile gloves
- sterile gloves
- masks
- disinfectant
- alcohol-free hand rinse
- underpads
- gowns
- aprons
- goggles
- red trash bag
- saline or wound cleanser
- primary dressings
- secondary dressings

### Cleansing the Pressure Ulcer

Saline (distilled water and salt) is considered by most wound experts to be the best cleansing solution for most wounds. Saline is natural - which means it is exactly the same percentage of water with salt (0.9%) as are in the body fluids. Saline is not toxic to the body cells that are needed for healing. How much solution you use is dependent on the size of the wound and if it is infected or draining. Some antiseptics and skin cleansers are toxic and should not be used for wound cleansing. Use enough solution (4 oz.) per dressing change is important if you want to thoroughly cleanse the ulcer of foreign material. Be gentle: if cleansing or irrigation is too strong, you can damage healing tissues!! Your healthcare professional may also suggest that you wear protective devices (like gowns, goggles or aprons). (MEGEP, 2012)

### Changing Dressings

It is important to choose the right dressing for a wound. Many factors have to be taken into consideration:

- the amount of moisture in the wound
- the amount of drainage or pus
- the condition of the skin around the wound
- the location of the wound

The healthcare professional will choose a dressing. As the wound changes, the type or size of the dressing may change. **So the wound care plans may change.** Consider ordering approximately enough dressings and supplies for 4 weeks of care. If the person is **incontinent** (have a loss of bladder or bowel control), the healthcare professional may recommend an occlusive or semi-occlusive, protective dressing that adheres tightly to the skin and can prevent the wound from getting contaminated.





Examples include:

- hydrocolloid dressings
- transparent film dressings (MEGEP, 2012)

## 10-Treatment and Evaluation of the Wound– Algorithm

Wound healing should be determined by using validated assessment tools. There are several tools available that evaluate the progress of a wound using objective, rather than subjective, data. Wound healing should never be measured by reverse staging, by a decrease in size alone, or any other solitary parameter.

### Pressure Ulcer Scale for Healing

A useful tool for monitoring the change of a pressure ulcer over time is the Pressure Ulcer Scale for Healing (PUSH) Tool, developed by the National Pressure Ulcer Advisory Panel (NPUAP). Although this is an excellent tool, it should be used in conjunction with good clinical judgment. This tool is intended for use only with pressure ulcers. Other types of wounds should be evaluated using a different tool.

To use the PUSH Tool, the pressure ulcer is assessed and scored on the following three elements:

- Length x Width is measured and scored from 0 to 10.
- Exudate Amount is scored from 0 (none) to 3 (heavy).
- Tissue Type is assessed and scored from 0 (closed) to 4 (necrotic tissue).

In order to ensure consistency in applying the tool to monitor wound healing, definitions for each element are supplied at the bottom of the tool.

**Step 1:** Using the definition for length x width, a centimeter ruler measurement is made of the greatest length (head to toe). A second measurement is made of the greatest width (side to side). Multiply these two numbers to obtain square centimeters and then select the corresponding category for the size on the scale. Record the patient's score.

**Step 2:** Estimate the amount of exudate after removal of the dressing and before applying any topical agents. Select the corresponding category for none, light, moderate or heavy. Record the patient's score.



**Step 3:** Identify the type of tissue present in the wound bed. If there is ANY necrotic tissue, it is scored a 4. For the PUSH Tool, necrotic tissue refers to eschar and not slough. If there is ANY slough, it is scored a 3, even though most of the wound may be covered with granulation tissue. Granulation tissue is represented by a score of 2. If there is evidence of epithelial tissue, the score is 1. Once the wound is closed, the score becomes 0.

**Step 4:** Add up the scores of the three elements to determine a total PUSH Tool score.

**Step 5:** Transfer the total score to the Pressure Ulcer Healing Graph. Changes in the score over time provide an indication of the changing status of the ulcer. If the score decreases, the wound is improving or healing. If the score increases, the wound is deteriorating.

Pressure Ulcer Scale for Healing  
PUSH Tool 3.0

Length X Width (in cm <sup>2</sup> )	0 0	1 < 0.3	2 0.3–0.6	3 0.7–1.0	4 1.1–2.0	5 2.1–3.0	Sub- score
		6 3.1–4.0	7 4.1–8.0	8 8.1–12.0	9 12.1–24.0	10 > 24.0	
Exudate Amount	0 None	1 Light	2 Moderate	3 Heavy			Sub- score
Tissue Type	0 closed	1 Epithelial Tissue	2 Granulation Tissue	3 Slough	4 Necrotic Tissue		Sub- score
							Total Score

Tissue type definitions:

0 – Closed, if wound completely covered with epithelium (new skin).

1 – Epithelial tissue: for superficial ulcers, new pink or shiny tissue growing from edges or as islands on ulcer surface

2 – Granulation tissue: pink or beefy red tissue with a shiny, moist granular appearance

3 – Slough: yellow or white tissue that adheres to ulcer in strings or thick clumps or is mucinous

4 – Necrotic tissue (eschar): black, brown or tan tissue that adheres firmly to wound bed or under edges and may be firmer or softer than surrounding skin

Adapted from [www.npuap.org](http://www.npuap.org), © National Pressure Ulcer Advisory Panel



## Photographic Wound Assessment Tool (PWAT)

Developed as an instrument that could be used to determine ulcer status from a photograph rather than at the bedside

- Originally, the PWAT was based on components of the Pressure Sore Status Tool (PSST) that could be determined from a visual image, including wound size, the composition of the wound base, and the peri-ulcer skin. A revision to the tool was produced and validated in 2012, so that it now contains eight items, each scored on a five-point scale from 0 to 4, yielding a total score out of 32, with zero representing a completely healed wound. Content validity was not assessed with this tool.
- An evaluation of 300 photographs taken of 139 wounds of different etiology showed excellent reliability and 89 percent agreement between total PWAT scores attained when wounds were evaluated at the bedside compared to using a digital image.
- The PWAT was able to detect differences between healing and non-healing wounds, and it has been used to detect differences between treatment groups in three randomized controlled trials.
- This instrument may be useful to clinicians and researchers who wish to photograph wounds and who find that the PWAT contains the items that are relevant to their needs. • Standardized equipment and a consistent technique should be used with serial wound photography. It must be emphasized, however, that photographs should not replace bedside clinical wound assessment (NPUAP, EPUAP, & PPPIA, 2014).

## Bates-Jensen Wound Assessment Tool (BWAT)

One of the most widely adopted assessment tools used in wound-care practice in Canada.

The PSST, which was developed by Barbara-Bates-Jensen, is a comprehensive discriminative tool that consists of 13 items, including wound extent (size and depth), the quality and amount of tissue in the wound base, the edges, and peri-ulcer skin. Each item is scored on five-point scale and summed to give a scale range of 13–65, where a score of 13 represents a completely healed wound.

The PSST has previously been shown to have very high content validity, meaning that the tool contains all of the appropriate domains to fully describe the wound

Further validation showed the PSST had excellent concurrent validity when compared with the NPUAP staging system and good intra-rater and inter-rater reliability.

In 2001, the PSST was revised and renamed the BWAT to signify that it could be used to evaluate more than just pressure injuries. The revisions were considered minor, and further validation of the BWAT has been limited.

The BWAT has been used to detect differences in wound status over time and to determine whether new treatment interventions accelerated wound healing over control or standard wound treatments.

Results have been mixed where significant differences between groups and over time have or have not been detected.

Since there are no published reports that demonstrate the responsiveness of either the PSST or BWAT, it is not possible to determine whether conflicting results are due to an ineffective treatment or because the assessment tool is not sensitive to changes.

Given that results derived from the PSST were found to be more accurate and reliable when used by experienced rather than novice clinicians and that it takes an average of 3.4 (experienced) and 15 minutes (novice) to complete the assessment, the PSST/BWAT may be more appropriate for use by experienced wound-care clinicians as a discriminative assessment tool to fully describe the wound during the initial assessment.

Using the tool repeatedly to detect changes in wound status over time is not recommended at this time, since responsiveness of the PSST/BWAT has not yet been demonstrated. (NPUAP, EPUAP, & PPPIA, 2014).



# BATES-JENSEN WOUND ASSESSMENT TOOL

NAME \_\_\_\_\_

Complete the rating sheet to assess wound status. Evaluate each item by picking the response that best describes the wound and entering the score in the item score column for the appropriate date.

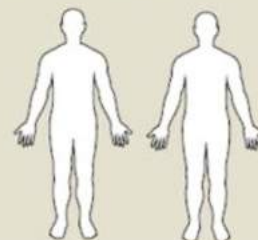
**Location:** Anatomic site. Circle, identify right (R) or left (L), and use "X" to mark site on body diagrams:

- |                          |                     |
|--------------------------|---------------------|
| _____ Sacrum and coccyx  | _____ Lateral ankle |
| _____ Trochanter         | _____ Medial ankle  |
| _____ Ischial tuberosity | _____ Heel          |
|                          | Other Site _____    |

**Shape:** Overall wound pattern; assess by observing perimeter and depth.

Circle and date appropriate description:

- |                        |                           |
|------------------------|---------------------------|
| _____ Irregular        | _____ Linear or elongated |
| _____ Round/oval       | _____ Bowl/boat           |
| _____ Square/rectangle | _____ Butterfly           |
|                        | Other Shape _____         |



Item	Assessment	Date Score	Date Score	Date Score
<b>1. Size</b>	1 = Length x width <4 sq cm 2 = Length x width 4-<16 sq cm 3 = Length x width 16.1-<36 sq cm 4 = Length x width 36.1-<80 sq cm 5 = Length x width >80 sq cm			
<b>2. Depth</b>	1 = Nonblanchable erythema on intact skin 2 = Partial-thickness skin loss involving epidermis and/or dermis 3 = Full-thickness skin loss involving damage or necrosis of subcutaneous tissue; may extend down to but not through underlying fascia; and/or mixed partial- and full-thickness and/or tissue layers obscured by granulation tissue 4 = Obscured by necrosis 5 = Full-thickness skin loss with extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structures			
<b>3. Edges</b>	1 = Indistinct, diffuse, none clearly visible 2 = Distinct, outline clearly visible, attached, even with wound base 3 = Well defined not attached to wound base 4 = Well defined not attached to base, rolled under, thickened 5 = Well defined fibrotic, scarred, or hyperkeratotic			
<b>4. Undermining</b>	1 = None present 2 = Undermining <2 cm in any area 3 = Undermining 2-4 cm involving <50% wound margins 4 = Undermining 2-4 cm involving >50% wound margins 5 = Undermining >4 cm or tunneling in any area			
<b>5. Necrotic Tissue Type</b>	1 = None visible 2 = White/gray nonviable tissue and/or nonadherent yellow slough 3 = Loosely adherent yellow slough 4 = Adherent, soft, black eschar 5 = Firmly adherent, hard, black eschar			
<b>6. Necrotic Tissue Amount</b>	1 = None visible 2 = <25% of wound bed covered 3 = 25% to 50% of wound covered 4 = >50% and <75% of wound covered 5 = 75% to 100% of wound covered			
<b>7. Exudate Type</b>	1 = None			

## 11-Pain Treatment

Pressure sores can be painful and decrease the quality of life of the patients that live with them. Prevention of the sores is always the best solution but once they have appeared, they must be monitored and mediated to promote healing and deter further deterioration of the wound site. In the mean time, the pain associated with the sores must be managed, which can be a difficult process.





## Different Reasons For Pain

With pressure sores, there are many different issues happening that can cause pain. This means each patient may experience pain for different reasons and in different levels. Pressure sores have four stages of progression and depending on how severe the wound is, there may be many treatments needed to heal the wound and prevent pain for the patient.

Some reasons for pain can be:

**Surface pain.** This is pain associated with the wound itself and irritation at the site of the skin and tissue.

**Infection.** If the wound becomes infected and inflamed, this can also cause pain.

**Nerve damage.** Pressure sores can lead to nerve damage that can cause chronic pain.

## Managing The Pain

With each patient, the treatment may be unique depending on the issues they are having with the pressure sore and what kind and degree of pain they are experiencing. These wounds need an individualized approach and should involve the patients input whenever possible.

**Treat the wound.** Obviously, removing the cause of the wound is the first step. Patients will need to have pressure and weight removed from the area as much as possible. The wound may need debridement, or removal of the dead or infected tissue. Reducing friction at the wound site is also important.

**Changing dressings.** The wounds need to be kept dry and clean to promote healing but changing the dressings can be painful for the patient. Using non-stick dressing can help and possibly administering pain medication before hand.

**Treat infection.** For wounds that are healing, an antimicrobial treatment may be used such as silver sulfadiazine or slow-release iodine. More severe wounds may need topical antiseptics. Some patients may require antibiotics.

**Pain medications.** Depending on the level of pain, pain relief medications may be needed. Acetaminophen all the way up to morphine can be used to manage pain while the wound heals. Nerve damage pain can respond to anticonvulsants or tricyclic antidepressants, depending on the type of pain.

Unfortunately, managing the pain of pressure sores is difficult at best. Many sores can take months, even years, to heal once they have progressed to a severe stage. Healing the wounds takes constant care and is the only true way to relieve the pain. (Rosenfeld & Rosenfeld, 2019)





## 12-Nutritional Status

Eating enough food and choosing a variety of foods from each food group at meal times will help stop pressure ulcers from happening. Follow these guidelines to reduce your risk:

Eat a healthy diet

Eat enough calories to maintain your weight

Make sure you are eating enough protein

Drink enough water, 6-8 cups a day

### Eat a Well-Balanced Diet:

Make sure to eat foods that are high in protein at every meal and snack (such as milk, yogurt, beans, eggs, meat, fish)

Drink plenty of fluids like water, unless you have been told by your doctor or dietitian to limit how much you drink.

Food Group	Recommended Foods
<b>Meat and Other Protein Foods</b> (2-3 servings a day) A serving size for meat is about the size of a deck of cards and a 3 oz serving of fish is about the size of a checkbook	3 oz. beef, veal, lamb, poultry 3 oz. fish or seafood 1 egg and ¼ cup egg product ½ cup tofu ½ cup beans like kidney, black, or pinto beans 2 Tbsp peanut butter
<b>Milk and Milk Products</b> (2-3 servings a day)	1 cup whole, 2%, 1%, or skim milk Cheese (1 oz looks like 6 stacked dice) 1 cup yogurt
<b>Grains</b> (6-11 servings a day)	1 slice bread (whole grain, whole wheat) ½ cup pasta (whole grain, whole wheat) Cereal (½ cup hot or 1 cup cold) 4 Crackers or pretzels ½ cup rice
<b>Fruit and Vegetables</b> (5-6 servings a day)	1 small fresh fruit, ½ cup canned fruit, 1 cup raw leafy vegetables, or ½ cup cooked vegetables
<b>Fats and Oils</b> (2 servings a day)	1 tsp oil (Canola, vegetable, olive) 1 tsp soft margarine 1 Tbsp Mayonnaise
<b>Beverages</b> (6-8 servings a day)	1 cup water ½ cup 100% fruit juice 1 cup decaffeinated coffee/tea



**Drink Nutritional Drinks:** Your dietitian may ask you to drink nutritional supplements. These will help to make sure your body is getting enough energy and protein to help heal pressure sores.

**Take a Daily Multivitamin:** Taking a daily multivitamin will make sure that your body is getting all the vitamins and minerals that may be missing in your meals.( K. K., S. P., & T. S. (2015, January))

### 13-Health Care Education

In our country, health personnel training model is applied as 2 types. The first of these is the completion of medical school for 6 years after high school and getting the title of medical doctor. Secondly, it is the training of personnel group which we call as auxiliary health personnel. Here, after high school education, 4 years of health education has to be taken (after 2014-2015 academic year) again in 2014, the auxiliary health personnel of the vocational group of high school education after the health education can begin.

As for the subject of specialization in wound care; in this way there is no special occupational group in other words there is no wound care nurses. However, surgical clinics are the profession of this area. Within the scope of the treatment provided by surgeons, there are staff training in the wound care area and personnel who have been specially trained in every surgical clinic. These personnel develop themselves by learning new practices, new medicines, new dressing tools in wound care that the Ministry of Health has opened for certain periods.

In addition, each surgical clinic has a special dressing room. Chronic wounds are recorded and balanced as dressings are made in these rooms. These dressing rooms have people in charge and are in contact with the hospital management.

### 14-Psychological influence on patient and family

Pressure ulcers are known to impact general physical health, as complications and even death may occur. Additionally, pain almost always accompanies the presence of a pressure ulcer, and studies have shown that 84% of those with pressure ulcers have reported pain even while they are at rest, with some expressing their pain to be at an excruciating level. In addition, many have expressed experiencing fatigue due to sleep disruptions because of the presence of the ulcers. Thus, because of these ongoing factors, patients already experience a diminished quality of life.

Pressure ulcers create physical restrictions for patients which impose lifestyle changes as well. For example, one's living arrangements must be altered to accommodate the presence of a pressure ulcer. As a result of these restrictions, social and psychological implications arise. Research has found that physical limitations may severely restrict an individual's social life, sometimes resulting in social isolation. Some have expressed that their relationships have been impacted. Those with pressure ulcers are often very dependent on others for care, and are affected by the perceived impact these pressure sores impose on others. For example, sufferers develop a fear of becoming a burden upon others, and develop preoccupations regarding the financial impact the pressure ulcer may have on their families. Many have expressed that they have been emotionally or psychologically

embarrassed to due odors which stem from the wound, and this has also led to social isolation as a result. In addition, many have felt embarrassed requiring assistance in changing of dressings, and this has impacted relationships and quality of life as well. Psychological implications also arise when individuals develop a preoccupation with the presence and healing of the sore. This, in turn, may impact an individual's own perception of their body image. When one sustains an injury or wound, particularly one that is visible, it can result in emotional and psychological trauma, including feelings of shame and embarrassment. This is particularly likely in cases of patients suffering from stage IV pressure ulcers, which not only cause pain, but usually also expose muscle and bone.

Because pressure ulcers are highly preventable with proper care, monitoring, and treatment, health care providers must remain vigilant in preventing their development. This is not only to prevent accompanying physical pain and discomfort, but to avoid the distressing social and psychological effects that arise as a result of the development of pressure ulcers as well. (Bhattacharya, S., & Mishra, R. K. (2015)).



## **MODUL III ATYPICAL WOUNDS**

*Matič Lucija*

### **1. Outputs**

#### ***Take-Home Messages***

- *Chronic wounds require a systematic approach, including both patient and wound assessment, no matter what the underlying etiology of the wound.*
- *The care of chronic wounds relies upon basic tenets that aim to remove or ameliorate the etiological causes and to address systemic and metabolic perturbations.*
- *A wound should be evaluated for an atypical etiology if it is present on a location unusual of a common chronic wound, appears different from a common wound, has unusual symptoms, including pain out of proportion to that of a common wound, or does not respond to conventional therapy.*
- *A Malignant Fungating Wound (MFW) presents both physical and emotional challenges to the patient, informal carer, and to health care professionals. The MFW may be associated with the wound-related symptoms like odour, exudate, pain, bleeding and itching.*
- *Because of advances in knowledge chronic wounds should be treated by wound specialists in clinics with fast access to angiology, internist, surgeon, radiologist, infectologist, pathologist, etc.*
- *Approach to care of atypical wound should be interdisciplinary.*

***The aim of this chapter is to support best practice of management malignant fungating wounds, based on current literature and experiences.***

### **2. Definition of atypical wounds**

According to European Wound Management Association-EWMA (2019) atypical wounds are generally understood as wounds that cannot be defined under one of the primary non healing wound categories, such as venous, arterial, mixed or diabetic foot ulcers. They present a broad spectrum of conditions or diseases caused by inflammation, infection, malignancy, chronic illnesses or genetic disorders. Atypical wounds can be suspected if the wound has an abnormal presentation or location and does not heal with a good treatment plan. The prevalence of atypical wounds can be as high as 10 % of all wounds, and it is probable that many of these wounds are underdiagnosed. Typical challenges include considerable diagnostic delay and prolonged healing times. In addition, many atypical wounds have an enormous impact on the life quality of the affected individuals.



### 3. Classification

According to Šitum & Kolarič (2012) the prevalence of atypical wounds is less than 5% of all wounds. Atypical wounds most of the time have rare etiology and are consequence of rare conditions. Classification presented below is etiologic classification of atypical wounds.

***Atypical chronic wounds can be caused by:***

**- *Autoimmune disorders:***

Pemphigoid bullosus, Pemphigus vulgaris, Lupus paniculitis, Sclerodermia, Antifosfolipid syndrom, Morbus Behçet, Dermatomiozitis;

**- *Infectious diseases:***

*Virus* (Herpes simplex, Hand-foot-and mouth disease), *Bacterial* (Ecthyma, Erysipelas, necrotic fasciitis, Chronic piodermia, Tuberculosis cutis, Sifilis, Ulcus mole, Lymphogranuloma venereum, Granuloma inguinale), *Parasit* (Leishmaniasis cutis), *Fungal* (Micosis);

**- *Vascular diseases and vasculopathies:***

Vasculitis allergica, Granulomatosis Wegener, Syndroma Churg-Strauss, Polyarteritis nodosa, Giant cell arteritis, Takayatsu arteritis, Livedo vasculitis, Thrombangitis obliterans;

**- *Metabolic and genetic diseases:***

Necrobiosis lipoidica, Calciphylaxis, Cryoglobulinaemia, Cryofibrinogenaemia, Avitaminosis;

**- *Neoplasm:***

Basal cell carcinoma, Squamous cell carcinoma, Marjolin ulcer, Melanom, Kaposijev sarkom, Morbus Paget, skin metastasis;

**- *External factors:***

Radiodermatitis, insect bites, extravasation;

**- *Psychiatric disorders:***

Dermatitis artefacta;

**- *Drug related reactions:***

Syndroma Stevens-Johnson, Necrolysis epidermalis toxica;

**- *Etc:***

Pyoderma gangrenosum, Syndroma paraneoplasticum, Histiocitoza Langerhans cells, Atrophie blanche, Lichen planus, Morbus Reiter, Morbus Crohn, Sarcoidosis. Patel&Kirsner (2010) are listing traumatic etiology as well.

Numerous systemic diseases can present with atypical wounds. The primary cause of the wound can be either systemic disease itself (Crohn's disease) or aberrant immune response due to systemic disease (pyoderma gangrenosum, paraneoplastic syndrome).





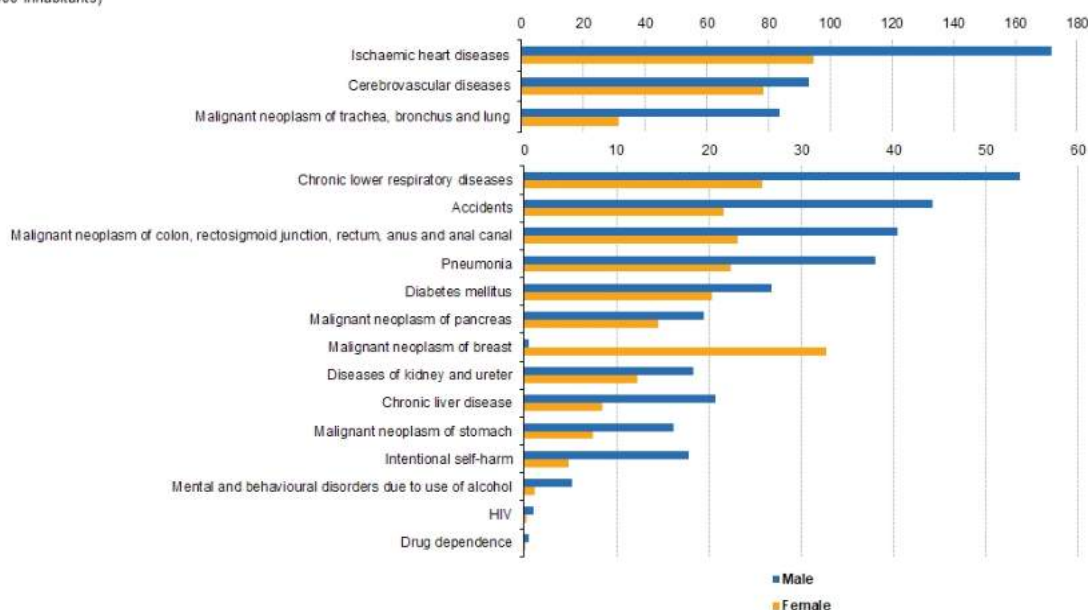
## Objectives

The main objectives of this chapter are to:

- Provide an overview about the diagnostics and medical treatment of patient with Malignant Fungating Wound (MFW)
- Provide an overview about the symptoms of MFW.
- Provide an overview about the care for the patient with MFW.
- Provide basic highlights on nutritional aspect in caring for patient with MFW.
- Provide some aspects about caring for patients in palliative care.
- Provide some aspects of inclusion of relatives in care.

Our society is highly affected with malignancy as Table 1 shows (Eurostat, 2019).

Causes of death — standardised death rate, EU-28, 2015  
(per 100 000 inhabitants)



Note: the figure is ranked on the average of male and female. Note the difference in the scales employed between the two parts of the figure. For the age standardisation, among older people, the age group aged 85 and over was used rather than separate age groups for 85-89, 90-94 and 95 and over.  
Source: Eurostat (online data code: hlth\_cd\_asdr2)

eurostat

Table 1: Causes of death, EU 2015 (Eurostat, 2019)

According to Eurostat (2019) in 2015, 1.3 million people died from cancer in the EU, which equated to more than one quarter (25.4 %) of the total number of deaths. Some studies estimate, that prevalence of malignant wound is 5-10% of oncology patients (EONS, 2015). Many of oncologic patients develop one or more type of malignant wound, which is the reason why the care for patient with malignant wound will be enlightened in this chapter. Malignant wound can emerge as (Brecelj, 2017):

- primary growth of tumor,
- skin metastasis,
- proliferation of tumor on body surface.

In broad meaning oncology wound could be consequence of treatment (radiotherapy, kriotherapy, extravasation of chemotherapeutics) (Brecelj, 2017).





#### 4. Risk factors

Risk factors for atypical wounds are not well known or scientific proved. It is observed that there can be some trigger points (physical/psychological) combined with immunodeficiency and other unknown factors. But it is often not known why atypical wound emerge. There are some larger studies about risk factors of developing cancer. According to National Cancer Institute of United States of America-NCI/USA (2019) the list below includes the most-studied known or suspected risk factors for cancer. Although some of these risk factors can be avoided, others—such as growing older—cannot. Limiting exposure to avoidable risk factors may lower risk of developing certain cancers.

- Age
- Alcohol
- Cancer-Causing Substances
- Chronic Inflammation
- Diet
- Hormones
- Immunosuppression
- Infectious Agents
- Obesity
- Radiation
- Sunlight
- Tobacco

#### 5. Review and check

Chronic wounds require a systematic approach, including both patient and wound assessment, no matter what the underlying etiology of the wound. Atypical wounds can be suspected if the wound has an abnormal presentation or location and does not heal with a good treatment plan. The problem in atypical wounds is very broad etiology and lack of time because of fast development of symptoms and even life threatening conditions in some of the atypical wounds.

According to European Oncology Nursing Society (EONS, 2015) a Malignant Fungating Wound (MFW) presents both physical and emotional challenges to the patient, informal carer, and to health care professionals. The wound may be associated with the wound-related symptoms like odour, exudate, pain, bleeding and itching. Non-healing wounds such as MFWs often result in a considerable financial burden, which is associated with the significant use of dressings and time spent on dressing changes. There is also a high incidence of comorbidities that affect the quality of life of the patient, for example lymphoedema. Table 2 is listing key-points of assessment for clinical practise when caring for patients with MFW (EONS, 2019).



Patient Assessment	<ul style="list-style-type: none"> <li>● Impact of the wound in terms of psychosocial functioning</li> <li>● Co-morbidities</li> <li>● Functional limitations and compromise from wound location and symptoms</li> </ul>
Assessment of MFW	<ul style="list-style-type: none"> <li>● A clinical assessment is always required</li> <li>● It is important to review the symptoms of odour, exudate, pain, bleeding and psychological impact when assessing the wound with reference to a wound assessment tool if appropriate</li> <li>● Swab cultures can sometimes be helpful to determine the need for antimicrobial treatment, if the patient is showing signs of spreading infection.</li> </ul>

Table 2 Key-points of assessment for clinical practise when caring for patients with MFW (EONS, 2019).

## 6. Diagnostic procedures

Chronic wounds due to common causes may not require a biopsy; biopsies are usually reserved to diagnosis wounds that are unusual in appearance, location, or symptomatology or for nonhealing wounds-atypical wounds. In one of the study Tang et al. (2012) found out, that there is little known about the prevalence of atypical ulcers, but that in biopsy they obtained, 30% of them were diagnosed as neoplasm.

Histopathological evaluation with adjunct studies such as special staining, tissue cultures, or immunofluorescence is essential to properly evaluate a wound once it is suspected to be of an atypical nature. In atypical wound it is very important to diagnose ethiology of the wound quickly and correctly, since some of the conditions are life-threatening. It is often that in atypical wounds doctor would search advice from different specialist before making final diagnose.

## 7. Treatment

Shankaran et al (2013) advocate that chronic wounds should be treated by wound specialists in clinics specialised for wounds. Wound care clinics are staffed by specialists and generalists including dermatologists, but also orthopedic surgeons, vascular surgeons, infectious disease specialists, internists, family practitioners, hyperbaric oxygen-trained physicians from a variety of backgrounds, podiatrists, physician assistants, and nurse practitioners. The care of chronic wounds has almost become its own specialty, with so-called advanced therapies now including the use of growth factors, extracellular matrices, engineered skin, and negative pressure wound therapy.

In other words: approach to care of atypical wound should be fast and interdisciplinary. After the diagnose is final, it is upon medical doctrine to follow the treatment. In cases of progressed disease with no known method of healing, palliative care is decided.

Some common features shared by each of chronic wounds include prolonged or excessive inflammation, persistent infections, formation of drug-resistant microbial biofilms, and the inability of dermal and/or epidermal cells to respond to reparative stimuli. In aggregate, these pathophysiologic phenomena result in the failure of these wounds to heal (Frykberg & Banks, 2015). In those cases antimicrobial treatment is important part of treatment plan.

In treatment of MFW (electro)chemotherapy, radiation, surgery, hormonal therapy, biological treatment may be applied. The treatment plan is often combination of two-three or more treatment methods, where combination and order of them is chosen by oncology consilium. Treatment can be applied with curative goals- to cure the patient or with palliative goals-to palliate the symptoms. In oncology treatment is planned and performed carefully, since treatment itself can be a cause for patient developing atypical chronic wound.

### **8. Important to remember**

After making patient and wound assessment, nurses should follow EONS recommendations for the care of patients with malignant fungating wounds according to prevalent symptoms of the wound (EONS, 2015):

#### **Odour control**

- Wound cleaning and use of dressings for exudate control is important to help reduce odour.
- Metronidazole (orally or topically) can be helpful.
- Activated-charcoal and antimicrobial (silver) dressings can help absorb and reduce odour when the dressings completely cover the wounds and contain the volatile substances responsible for the malodour.
- Essential oils (bergamot, or lavender), shaving foam (in a bowl), placed in the room can be helpful. Sometimes they can cause difficulties in breathing for patients or may induce nausea.

*Odour Absorption: Shaving foam, Cat litter, Charcoal coals.*

*Room Deodorisers: Room Deodorisers.*

*Odour masking: Aromatherapy oils (lavender, bergamot, patchouli), Dried sage, Aceto Balsamico.*

- Healthcare providers can become □desensitized□ to the smell and so they must listen to the patient or family if they complain about the smell from the wound, rather than rely on their own observations.

#### **Local bacterial colonization**

- Local bacterial colonization of the wound is expected and should be treated with topical cleansing, debridement as appropriate and antimicrobial agents.
- If there are signs of systemic infection, the use of oral or intravenous antibiotics may be considered.

## Exudate

- Dressings should be selected that can best conceal the wound, absorb exudate and reduce odour.
- Dressings are generally changed 1-2 times per day based on the amount of exudate and odour.
- Large amounts of exudate and/or occlusive dressings may cause maceration of the surrounding skin. Therefore it is recommended that the skin is protected with suitable barrier products in liquid, paste or solid form.
- Menstrual pads can be especially effective because of their good absorption and availability, but discuss with the patient prior to use, to ensure acceptability.

*Low Exudate; maintain moist environment; prevent dressing adherence and bleeding.*

*High Exudate; absorb and contain exudate; prevent dressing adherence in areas of wound with decreased exudate. Use: Alginates, Foams, Gauze, Polymers, Superabsorbent dressings.*

## Pain

It is important to help control pain by using morphine and other medications (some malignant wounds can cause neuropathic pain).

- Topical application of morphine can be helpful to reduce wound pain for some patients.
- Dressing changes can be particularly painful. Giving a breakthrough or rescue dose of morphine prior to the dressing change can often be helpful.
- Non adherent dressings are recommended.
- Ensure that the dressing used is not ☐too dry☐ and therefore causes more pain and bleeding at the time of dressing changes.

## Bleeding

- Prevention is the best method to avoid bleeding. Care must be taken when removing dressings to avoid bleeding. Use warmed normal saline irrigation to moisten the dressing and prevent trauma during dressing changes. Use non-adherent dressings and moist wound products when possible.
- If bleeding does occur, apply direct pressure for 10-15 minutes. Local ice packs can also assist in controlling bleeding.
- Radiotherapy can be considered if appropriate for the patient and the tumour is thought to be radiosensitive. Electrochemotherapy can provide a ☐vascular lock☐ and control bleeding.
- Haemostatic dressings or pressure dressings are sometimes required if the bleeding is severe.
- If a patient is at the end of life and having uncontrolled bleeding from a large wound, using dark towels/ blankets to mask the blood can decrease anxiety for the patient and family. Pain control and sedation with a benzodiazepine would be important considerations in this situation.



## Pruritus

Interventions that can relieve pruritus include:

- TENS (transcutaneous electrical nerve stimulation) machines, which stimulate nerves that carry non-painful messages to the brain (overriding and stopping the pain messages). TENS machines can also initiate the release of endorphins.
- Dressings that keep the skin well hydrated, such as hydrogel sheets.
- Garments and bed linen that relieve pruritus from climatological conditions such as eczema can contribute to relieving pruritus for patients with MFWs.

***For extremely fragile skin non-adhesive dressings and tapes should be selected.***

### ***9. Preparing the patient***

Malignant wound can be treated in variety of location from operating room, to patient home. Pain is one of the symptom characteristic for malignant wound. That is why care for analgesia should be in plan for preparing the patient for wound care. Prior to wound care, patient should be treated by analgetics. Per oral analgetics should be administered 30-45 min prior wound care, paranteral analgetics 15-20 min prior the wound care. If we didn't have information about the pain and we discover it while performing wound care, we can use topical anaesthetic gel, wait couple of minutes to get effect and continue with intervention.

### ***10. Preparing the accessories***

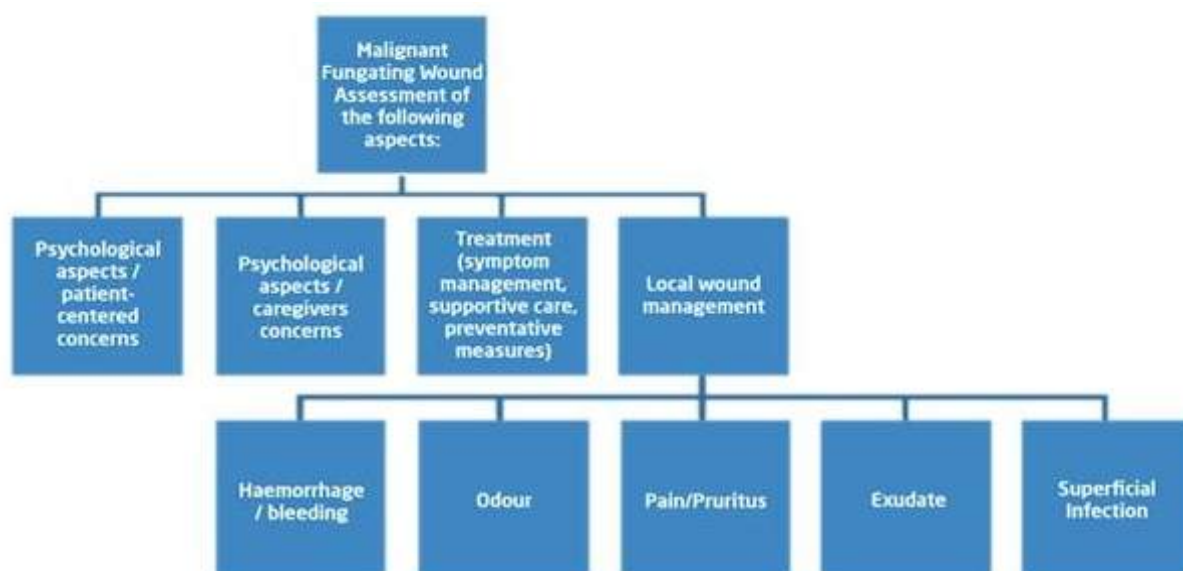
In home environment caregiver prepares selected dressing, cleansing solution according to individual plan. In hospital environment nurses often use wound trolley. Before using it, they make sure, that they have all the accessories and clean working surface. They plan wound care according to hygiene standard, with no mixing of clean and dirty path. Solution selected for cleansing is to be warm (body temperature). Inorder to achieve that we should use heaters/incubators. Unfortunately that is still not part of ordinary equipment. So we can use different techniques of dry/wet warming of cleaning solution.





### 11. Treatment and evaluation of the wound – algorithm

Algorithm of MFW managment-HOPES according to Woo &Shibald (2010):Figure 1.



MFW managment HOPES (Woo& Shibald, 2010)





EONS (2015) describes the management of MFW as:

**General patient assessment:** impact of wound on patient/caregiver, underlying aetiology-cancer, treatment of disease and wound, comorbidities, major symptoms, allergies/sensitivities to dressing products and/or adhesive tape.

**MFW assessment:** wound margins, satellite nodules, skin discolouration, fistula formation, localisation of tumor because the risk of haemorrhage or obstruction (Tumours/wounds close to air-ways, blood vessels, nerves, lymphatics).

The complexity of such wounds can be visible in following pictures:



Picture 2: Fungating lesions related to metastatic cervical cancer ( Shibbald, Woon, 2010)



Picture 3: MFW from breast cancer (<http://www.palliativedoctor.net>, 2019)

## EONS (2015) RECOMMENDATIONS FOR THE CARE OF PATIENTS WITH MALIGNANT FUNGATING WOUNDS

Regarding the assessment of MFW five assessment scales are described in the literature. Five 'core' symptoms are assessed by all these scales, these include: odour, pain, exudate, itching and bleeding. Some scales assess psychosocial aspects and impact on daily life.

### HAEMORRHAGE/BLEEDING

Wound bleeding or haemorrhage may be a common and significant problem in MFWs: tumour cells erode blood vessels and may be compounded by decreased platelet function within the tumour. The tissue within MFWs is very fragile and has a strong tendency to bleed because of the local stimulation of vascular endothelial growth factor. The strength of collagen matrix formation may be affected through reduced fibroblast activity and ongoing thrombosis of larger vessels. Wound bleeding can also be provoked through wound dressing changes. Bleeding can be extensive and/or chronic, so patient might become anemic. But it also can become so acute and excessive, that patient is in life threatening condition.

#### Managing haemorrhage/bleeding

Preventative measures are important to reduce the risk of bleeding. To prevent and control bleeding a variety of topical agents can be applied. Risk of trauma and subsequent bleeding may be reduced by using non-adherent dressings that maintain a moist interface between the dressing and the wound. If bleeding occurs there are a number of haemostatic agents available. Radiotherapy and electro-chemotherapy may sometimes help to control repetitive bleeds.

If haemorrhage is expected, in the form of an arterial bleed, then the haemorrhage can be fatal. In our clinical experience fatal haemorrhage is rare. Head and neck wounds or femoral wounds are the most likely to have risk of haemorrhage. The patient and family should be forewarned and the following items and medications should be on standby to help to sedate the patient and decrease distress: dark (red, brown, black or green) towels and Benzodiazepines- (Midazolam) subcutaneously.

### ODOUR

Malodorous wounds can have a profoundly negative impact on the quality of life of the individual and of their carers causing feelings of guilt, repulsion and leading to social isolation and depression. Malodour is not attributable to any one particular source but is thought to be caused by a combination of bacteria, including aerobic and anaerobic species, necrotic tissue, poorly vascularised tissue and high levels of exudate.

Management of malodour involves both containment of odour and treatment of its cause. To minimise bacterial concentration in the wound, debridement of sloughy tissue may be appropriate. However, the method of debridement is based on clinical presentation, patient treatment goals and knowledge and skills of the clinician and available resources. Due to the increased tendency for bleeding, surgical or sharp debridement is not recommended. Autolytic or enzymatic debridement is the preferred method in MFW. Autolytic debridement is promoted by the use of dressings that maintain a moist wound environment such as hydrofibres, hydrogels, or alginate

dressings. Wound cleansing through irrigation with normal saline 0.9% or drinking or clean tap water should be promoted as this will remove excess exudate and loose debris. Cleaning can also be achieved, by showering the wound. Caution should be exercised with this method and the clinician should check the quality of the water, the pressure of the water and the temperature to ensure it is not too hot or exerts too high of a pressure at the wound site. Other irrigation methods include use of syringes, water packs and repeated paper towel compresses. If cleansing with antiseptic agents the amount of exudate has to be assessed as antiseptic solutions are rapidly inactivated by the exudate. Odour management may be achieved through the selection of primary and secondary dressings that are capable of absorbing both exudate and odour: charcoal cloth combined with other dressing materials, plain activated charcoal cloth or charcoal with silver. To help manage the bacteria responsible for wound-odour the application of specific antibiotics may be useful. Licenced medical grade honey (e.g Manuka honey) has both antibacterial and debriding properties and reports of its use in chronic, radiotherapy induced and malignant wounds claim deodorising properties.

## PAIN

Physical pain is a significant and complex phenomenon in MFW. Pain in MFW is caused through:

- the pressure of the tumour on other body structures,
- damage to the nerves caused by the growing tumour,
- swelling resulting from impaired capillary and lymphatic drainage,
- infections,
- exposure of dermal nerve endings,
- mismanaged change of wound dressing.

To avoid pain when cleansing the wound, irrigation is recommended rather than swabbing. To help prevent pain during dressing changes, low adherent dressings should be used. Maintaining the wound in a moist environment will not only reduce dressing adherence but will also protect exposed nerve endings. Depending of the type of dressing, most low adherent dressings can be left on during the daily radiotherapy sessions.

## Pain management

To prevent pain while changing a dressing it is recommended to administer an analgesic prior to the dressing change: a booster dose of their usual opiate. Remove the dressing gently. When using analgesic drugs the World Health Organisation (WHO) guidelines for the control of cancer pain should be used. A recent published review reported that the application of opioids topically might be useful. Complementary therapies can play an important part in pain management; therapies such as transcutaneous electrical nerve stimulation (TENS), relaxation, distraction or visualisation may help anxious and stressed patients who will have a heightened response to pain.



## PRURITUS

Pruritus or itching is attributed to stretching of the skin, which irritates the nerve endings. Pruritus does not respond to drugs such as antihistamines. However, interventions that can relieve pruritus include:

- TENS machines
- Dressings that keep the skin well hydrated, such as hydrogel sheets.
- Garments and bed linen that relieve pruritus from climatological conditions such as eczema can contribute to relieving pruritus for patients with MFWs.

## EXUDATE

MFW depending on their characteristics, could have a tendency to produce moderate to high levels (up to 1 litre) of exudate per day. Therefore effective clinical management of highly exuding MFW necessitates an accurate wound assessment including the volume and viscosity of exudate as well as an understanding of the exudate aetiology.

To manage exudate a variety of dressings have been designed for non malignant wounds. It can be difficult to find a dressing that conforms to the wound shape, size and the body contours. The aim is achieve a close fitting dressing with a good seal to prevent leakage. Suitable dressings of MFWs with a high exudate level include supra absorbent dressings, alginate and hydrofibre dressings, foam dressings and non-adherent wound contact layers. In Slovenia, we sometimes use ostomy accessories in cases of excessive exudate, because beside achieving other goals it enables removing exudat with no need of direct wound managment.

Where exudate is low, wounds should be managed with dressings that have a low absorbency so as not to dry out the wound bed. These dressings include non-adherent absorbent dressings It should be noted that the use of hydrating dressing products such as hydrogels can in-crease exudate. Hydrogels should only be used when the wound becomes dry. If the patient is losing large amount of fluids, including blood from the wound, the effects of fluid and cellular depletion need to be monitored, e.g. through blood tests, and replacement protocols implemented. Tumour therapies such as radiotherapy, electrochemotherapy and/or chemotherapy may decrease drainage and reduce the tumour bulk.

### Preventing maceration and irritation

Large amounts of exudate and/or occlusive dressings may cause maceration of the surrounding skin. Therefore, it is recommended that the skin is protected with suitable barrier products in liquid, paste or solid form.

## SUPERFICIAL INFECTION

Wound cleansing reduces odour by removing necrotic tissue and decreasing bacterial counts. Gentle irrigation of the wound with warm normal saline or warm tap water is helpful and can be done as often as needed.





## OTHER ASPECTS

EONS (2015) Patients living with a MFW are vulnerable to tissue break down, that may not always be preventable. For extremely fragile skin non-adhesive dressings and tapes should be selected. To prevent trauma from adhesives and exudate thin hydrocolloid strips can be applied around the wound

Consequently, there is little evidence about the palliative management of a MFW; most of the literature has been based on problem solving. Unless the underlying malignancy can be treated effectively, the goal of managing MFW is palliation and not to heal. A care plan that manages the risk of haemorrhage or obstruction prepares the patient and family for such eventualities.

### **12. Pain treatment**

Pain treatment is of high importance in atypical wound. That is why pain treatment is not separated from other wound symptoms, but is a part of wound care in general and it is described above.

### **13. Nutritional status**

According to EONS recommendations (2015) patients with MFWs have a high metabolic demand. If there is high fluid output from the wound, including fistula fluid, general guidelines recommend 25–35 kJ/kg body wt/day. To ensure that the energy needs are met patients with a MFW may require regular meals and snacks throughout the day. The special concerns has to be given to proteins and fluids.

**Protein Requirements:** MFW can produce up to one litre of exudate per day. As a result these heavily exuding wounds have an increased demand for proteins. General guidelines recommend 1.5-2.5 grams of protein/kg body wt/day. Good sources of protein include meat, fish, poultry, eggs, milk, cheese, yogurt, nuts/seeds and vegetables. Due to the high loss of protein through exudate and decreased appetite either through the disease process or nausea sometimes caused by wound odour, the help and advice of a nutritionist or dietician should be sought.

**Fluid Requirements:** Fluid loss through wound exudate is often underrecognised as a cause of dehydration. Carers, patients and nurses should be conscious of this and support patients in encouraging where possible, extra fluid intake. To maintain adequate hydration, 1500-2000 ml/day of fluids is recommended.

In Slovenia nutritional visit is performed once a week in hospital wards of Oncological Institute. Patients detected of high risk of developing/or in the state of cachexia are being checked more often to prevent negative effects of malnutrition.

### **14. Health care education**

Patients with atypical wound often need specialist health care worker to provide wound treatment. However there are some atypical wounds, that are chronic and not so malignant in its progress, which means that the patients will eventually have to learn to take care of the wound as well. Such conditions are: autoimmune diseases (dermatitis bulosa), vascular diseases, metabolic diseases etc. In some of the atypical wound prevention is very important. That is why patients, before treatment with radiotherapy are educated how to take care of the skin to prevent radiodermatitis (gentle care, shower and not bath, using nonaggressive cosmetic line, nutritional creme for the treated skin, dry shaving etc.). Special precaution is being made to

prevent extravasation in chemotherapy treatment and patients are being educated how to prevent and manage side effect (avoiding sun exposure, sideeffects on skin/nails/hair/gastrointestinal tract) to ameliorate suffering.

Health care of patients with atypical wound consist of themes similar to other chronical wound: managment of primary and associate disease, wound managment, nutrition and hydration, avioding of wound injuries, personal hygiene and hygiene of living environment, following health care programme etc.

### **15. Psychological influence on patient and family**

EONS (2015) describes that MFW may adversely affect body image and selfesteem of the individual. An understanding of palliative care goals in the care of patients with a MFW is essential in developing an individualised care and treatment plan to enhance the quality of life of both the patient and their family.

Health care givers should make interviews with patient and caregiver in order to evaluate their ability of coping with complex situation. Caring for patient with malignant wound can be □dreadful experience□ for caregivers. It is not unusual that they experience fear of not doing enough or not doing right for loved one or even experience burnout syndrome. It is very important to develop good national palliative health care network, which can help patients in acute palliative situation (acute symptoms not managed satisfactory) as well as in long-term care (prevention of burnout) for patient and his family. In Slovenia in acute palliative care settings they had cases, when family of the patients were too concerned over the malignant wound and experienced negative feelings due to ther feeling of being unacapable taking care for wound and feared that they were making their loved suffering even more. After family meeting with palliative team, they were empowered and took patient home and were able to perform care for their ill relative.

### **16. Practical examples and tasks**

*Look at the two case scenarios: define problems, wound symptoms and predict what nursing interventions would be suitable.*

#### **1<sup>th</sup> Case: Paliative patient**

***F patient, age 55, Breast cancer T4N3M2 classification, MFW on L breast and torax 20cm x 30cm, limfedem of L arm, VAS 5/7/10 (inactivity, activity, wound care), severe malodore, mild exudate and capillary bleeding. Incapable of self-care. Can only lay on back, with raised position of head because of dyspnea and severe pain.***

#### **2<sup>nd</sup> Case: Patient planed for radiotherapy**

***M patient age 85, Planocelular skin carcinoma T2N0M0 classificationon L mandibula. MFW 8cm x 5cm x 3 cm, VAS 0, no bleeding, minimal exudat that dries on the wound forming scab, no malodor. Curative Radiotherapy 5/25. Capable of selfcare, drives for radiotherapy daily by his car. Likes gardening.***





## **MODULE IV- DIABETIC FOOT**

### **1-Outputs**

***Enable the user to define the onset of diabetic foot.***

***Be able to describe the measures for preventing ulcer formation in diabetic foot.***

***Explain the modes and procedures for foot examination.***

***Discriminate different foot deformities.***

***Be able to list all clinical symptoms of diabetic foot.***

***Describe the risk loci where the most pressure on foot occurs.***

***Proper documentation of the disease progress and treatments.***

***Education of patient and those caring for the patient about diabetic foot.***

### **2- Definition of Diabetic Foot**

Diabetes is a lifelong disease that affects patients' relatives and society as well as patients with difficult and expensive complications that are difficult to treat. In 1991, the World Health Organization adopted diabetes as a health problem. The life-saving additive, which began with the discovery of insulin, changed the way of looking at diabetes and made it to be careful in its treatment (Yılmaz et al, 2002). The importance of informing the patients and their family during the treatment of diabetes was found to be important in the 1920s and is still important. Joslin stressed the importance of education by using the expression education is not a part of diabetes treatment but on the contrary it is the treatment itself. Diabetes mellitus; It is a chronic disease that occurs when the pancreas cannot produce enough insulin or the body cannot use the produced insulin effectively (Altıntaş 2001). Diabetes is a major health problem because of its high morbidity and mortality rate and high burden of treatment and loss of labor.

The prevalence of sedentary life and obesity due to developing technology has increased the frequency of the disease worldwide and this increase is continuing rapidly. The number of diabetics in the world, which was 151 million in 2000, is expected to double by 2025 and to reach around 300 million. Patients with diabetes are candidates for various complications due to neuropathy, microvascular and macrovascular changes, as well as their disease. As a result of these changes, the patient may develop cardiovascular diseases, renal failure, blindness and diabetic gangrene. Complications of diabetes are seen as acute, subacute and chronic complications (Table 1) . Nerve damage as a complication of diabetes and the most affected organ by occlusive vascular disease is the lower extremity of the patient. Neuropathy is the leading cause of diabetic foot lesion. In most of the hospitalized patients, it was understood that a physical factor that could not be noticed by the patients such as impact, hitting, stinging, burning etc. started the wound. Patients usually do not notice the injury early due to loss of sensation and continue to stand and walk. This leads to progressive tissue damage.

Approximately 50% of diabetic patients are at risk of developing diabetic foot all their lives, and diabetic foot is the most likely to affect quality of life among chronic complications of diabetes (Franch 2002). Approximately 15% of diabetic patients have at least stage 2 diabetic foot complications and approximately 6% of them go to



amputation. 85% of non-traumatic foot amputations are performed depending on the diabetic foot. When one foot is amputated, the probability of the other foot being amputated in 5 years is 50% \*. Diabetic foot lesions are one of the most important causes of morbidity and mortality of the diabetic patient (Wertheimer 2002). Diabetic foot ulcers are the most important reason for hospitalization of diabetes patients. Approximately 1.4% of Type II diabetic patients in the UK have one active foot problem (Elliott 2002). These lesions, which increase the duration of hospitalization, also bring with it a great economic burden. In addition, the quality of life in patients with amputation decreases significantly and there are serious problems with the loss of labor. More than 0.9% of patients exposed to diabetic amputations die in hospital. Therefore, the treatment of the diabetic foot begins with the identification of risk groups before the wound formation and taking measures accordingly. After the formation of diabetic foot lesions, the aim is to improve the patient's wounds as soon as possible and to protect the patient from amputation whenever possible. Diabetic foot ulcers can be prevented. Even if the foot ulcers are advanced, the amputation can almost always be prevented. Training of the patient with diabetic foot lesion, treatment, protection of the foot is a team - work.

The foot of each diabetic patient is a candidate to become a diabetic foot (Yılmaz et al. 2003). Diabetic foot ulcers may be neuropathic, ischemic or both ischemic and neuropathic. Repetitive traumas in normal gait cause callus formation especially in neuropathic foot. Calluses are perceived as precursors of diabetic foot ulcers (Yılmaz et al., 2003). High risk patient groups in terms of diabetic foot are given in Table 1 (Tüzün et al. 1999, [http://www.hipokrat.org/hnet/menu/tip/diabet / dmlkons.html-101k](http://www.hipokrat.org/hnet/menu/tip/diabet/dmlkons.html-101k) 2004, Yılmaz et al. 2003, Leong and Weston 2001)

- |   |
|---|
| <ul style="list-style-type: none"> <li>• Patients with a history of diabetic foot or a diabetic ulcer in the opposite extremity</li> <li>• Patients with reduced joint mobility</li> <li>• Patients with symptoms and signs of neuropathy and / or ischemic vascular disease</li> <li>• Patients with foot deformities and unsuitable shoes</li> <li>• Patients with severe visual impairment</li> <li>Patients with poor metabolic control / poor hygiene / poor diabetes education</li> <li>• Patients with poor foot care</li> <li>• Patients with other long-term complications</li> <li>• Patients with alcohol and smoking</li> <li>• Elderly diabetic patients</li> <li>• Patients without diabetes education</li> <li>• Patients with advanced age, male gender, low socio-economic status</li> </ul> |
|---|

Table 1. High-risk patient groups for diabetic foot



The task of the diabetic foot team is to prevent the development of diabetic foot wounds by patient training and the use of special shoes, and to determine the treatment methods in patients with diabetic foot wounds. Amputation must be given with the consensus of this team.

- Good adjustment of blood glucose
- Press removal
- Wound care
- Antibiotic
- Angioplasty
- Surgery (debridement, amputation, vascular)
- Rehabilitation
- Special footwear
- Education
- Close follow-up

Table 2. Approaches used in the treatment of diabetic foot

### 3- Classification

In view of the many factors contributing to foot ulceration, it is important to establish a classification system, which will help health care providers to predict the outcome, healing, or amputation. A number of wound care centers have established their own classification. The classification system that has been used most often and the one with the longest track record is Wagners system. However, this classification system is basically anatomical with gradations of superficial ulcer, deep ulcer, abscess osteitis, gangrene of the forefoot, and gangrene of the entire foot. Only grade 3 addresses the problem of infection

#### ***Classification Objectives***

Etiology variable

- Pathological changes are different
- Metabolic properties different
- Ulcers are not homogenous

#### **Evaluation-1**

##### **A) Skin / ulcer**

- Definition
- Size
- Localization
- Classification

##### **B) Deformity**

- Joint mobility
- Contractures



## **Evaluation-2**

### **A) Infection**

- Gram painting
- Culture
- Radiological
- Scintigraphy

### **B) Etiology**

- Mechanical
- Thermal
- Chemical

## **Evaluation -3**

- vascular
- Pulse
- Skin color
- Skin temperature
- Doppler

## **Evaluation -4**

- neuropathy
- Sensory disorders
- mono-filament
- DTR

## **IDSA Classification**

American Society of Infectious Diseases, diagnosis and treatment guide of diabetic foot infections

- Infection: Local swelling or induration is defined as the presence of at least two of erythema, local tenderness or pain, heat increase and purulent discharge.

Clinical signs of infection	IDSA
No signs and symptoms of infection	Not infected
Local infection with only skin and subcutaneous tissue erythema around ulcer 0.5-2 cm Other causes of skin inflammation (trauma, thrombosis, broken etc.) should be excluded	Lightly
Local infection with $\geq 2$ cm erythema without involvement of systemic inflammation or involvement of structures deeper than skin-subcutaneous tissues (abscess, osteomyelitis, septic arthritis, fasciitis)	Moderate
Local infection with at least two of the SIRS symptoms: $T > 38^{\circ} \text{C}$ or 90 beats / min. Respiratory count $> 20$ / min or $\text{PaCO}_2 > 50$	Heavy



## PEDIS- International Diabetic Foot Concensus

Perfusion

Extent/size

Depth/tissue loss

Infection

Sensation

Clinical Findings	Infection Intensity	PEDIS
No purulent discharge, no inflammation	Not infected	1
<ul style="list-style-type: none"> <li>• <math>\geq 2</math> signs of inflammation (erythema, purulent discharge, heat increase, induration)</li> <li>• <math>/2 \text{ cm}^2</math> cellulitis / erythema</li> <li>• Infections in skin and skin deep tissue</li> <li>• No systemic findings</li> </ul>	Lightly	2
<ul style="list-style-type: none"> <li>• Metabolically stable patient and has <math>\geq 1 &gt; 2 \text{ cm}^2</math> cellulitis</li> <li>• Lymphangitis, fasciitis, deep tissue abscess</li> <li>• Muscle, tendon, bone involvement</li> </ul>	Moderately	3
<ul style="list-style-type: none"> <li>• Not metabolically stable (high blood sugar, nitroemia)</li> <li>• Fever, tachycardia, hypotension, confusion, vomiting</li> <li>• leukocytosis</li> </ul>	Heavy	4





PEDIS 3



PEDIS 4

### PEDIS

- For the purpose of research, cheap and diabetes related foot complications are predictive.
- Sub-headings are very detailed and time-consuming
- IDSA- PEDIS may be included in common table



## Knighton Wound Score

- In 1986
- Thrombocyte wound care product study
- 15 variable scoring
- 0 to 97 points
- General Wound Parameters
- Erythema - edema - purulence - fibrin - leg edema - color change of leg - granulation
- Evaluation of circulation
- Dorsalis pedis- Tibialis posterior pulsus
- Wound diameter (cm<sup>2</sup>) - Duration
- Tendon propagation
- Bone propagation
- Depth (mm) - tunnel (mm)
- Detailed, 15 variants
- Circulation, Wound time, width, depth
- neuropathy
- Used in a single study
- All chronic wounds
- Pecoraro and Reiber
- In 1990
- Morphological and anatomical criteria
- Over 10 points
- Subjective
- Infection and ischemia
- Clinical study
- University of Texas (UT) Classification
- Lavery 1996
- Infection, ischemia
- Depth of ulcer
- 16 separate levels

PHASE DEGREE	A	B	C	D
0 Preulcer / postulcer	CLEAN	INFECTED	ISCHEMIC	INFECTED + ISCHEMIC
1 skin deep ulcer	CLEAN	INFECTED	ISCHEMIC	INFECTED + ISCHEMIC
2 Deep ulcer (tendon and capsule involvement)	CLEAN	INFECTED	ISCHEMIC	INFECTED + ISCHEMIC
3 Bone-joint involvement	CLEAN	INFECTED	ISCHEMIC	INFECTED + ISCHEMIC

**Table 3.** University of Texas (UT) Classification



#### 4- Risk Factors

Diabetic foot infection is defined as infection in the inframalleolar region of a diabetic patient. Paronychia, cellulitis, myositis, abscess, necrotizing fasciitis, septic arthritis, tendinitis and osteomyelitis may occur; however, the most common lesion is infection of diabetic foot ulcers. Diabetic patients are prone to infections due to neuropathy, vascular insufficiency, and neutrophil dysfunction. Risk factors for the development of diabetic foot infection are presented below. The most important risk factor is the presence of peripheral neuropathy and is present in 30-50% of diabetic patients. As a result of sensory, motor and autonomic dysfunction in the nerves, the foot becomes vulnerable to traumas and excessive pressure occurs in the deformed foot. As a result, ulcers develop, and microorganisms enter this disrupted skin first, creating superficial infection, and then spread to deep tissues and even bone.

In particular, the presence of circulatory disorders and inadequate neutrophil functions facilitate the spread of the infection.

- Past foot ulcers, history of amputation
- Peripheral vascular disease history
- Neuropathy
- Dyslipidemia
- Infection (Fungal or bacterial)
- Uncontrolled diabetes / irregular glycemic control
- Smoking and alcohol use
- Bone deformities (osteoarthropathy)
- Not having diabetes education
- Heavy nail pathology
- Limited joint movement
- Accompanying health problems (vision loss, obesity)
- Advanced age (65 years and older)
- Adverse hygiene conditions
- trauma
- Wrong shoes selection
- Foreign body in shoes
- Walking barefoot
- Accidental accidents
- Low socioeconomic status
- Inadequate health care service
- Neglect

#### 5-Rewiew and Check

An annual foot examination should be performed to determine the risk status of the foot in all people with diabetes. This examination includes dermatological, vascular, neurological evaluations of the lower extremities(Çelik, 2013). Also, the presence of color change, dryness, edema, calluses and ulceration should be checked in the lower extremity.

Foot examination starts with learning about patient complaints. The presence of one or more of the following findings should be recorded in the patient's file together with the time of occurrence.



- Pain
- Tingling
- Combustion
- Sensitivity
- Sensation loss
- Foot ulcer

### **Dermatological Evaluation:**

a) Color Control: The color of the ankle up to the fingertips is evaluated. It is classified as pale, cyanotic or reddened. The presence of purpura and cyanosis indicates peripheral circulatory disorders and redness indicates infection.

b) Temperature Control: Both feet of the patient are examined by palpation.

### **Vascular Rating:**

Vascular evaluation gives us some evidence of the ability of peripheral circulatory capability. Dorsalis Pedis and Tibialis posteriorly check for the pulse and evaluate the result as "strong", "weak" and "not".

The palpation of the pedal pulses should be performed at room temperature. However, palpation of pulses does not exclude ischemia, whereas, on the contrary, inability to obtain ankle pulses does not mean serious ischemia. Raising of the foot above the level of the heart, the reduction of redness, that is, redness of the sputum rubor is a sign of severe ischemia is observed. However, the absence of this should not suggest the absence of ischemia.

### **Neurological Evaluation:**

With neurological evaluation, sensory evaluation can be performed and peripheral nerve damage can be detected. The sensory loss due to peripheral nerve damage is evaluated with Semmes Weinstein monofilaments. If there is loss of sensation in the evaluation with this filament which gives 10 g pressure to the foot, the patient's foot is in danger, the protective sensation is lost. Since it is difficult to find a monofilament in the work areas, the pen tip can also be used, provided that it is always the same. (Diabetic Foot Reconciliation Report)

In addition to the baseline sensation evaluation, achilles tendon reflex examination, pain test, vibration test (with 128 Hz diapozon), vibration threshold detection (with biotesiometer) will be helpful methods for diagnosis. Implementation of at least two of these tests is important because it increases reliability.



# Basic Foot Assessment Checklist

<b>1. Ask the patient</b>	neuropathic symptoms	Y	N
	rest pain	Y	N
	intermittent claudication	Y	N
	previous foot ulcer	Y	N
	amputation	Y	N
specify SITE _____		DATE ____ / ____ / ____	

<b>2. Look at both feet</b>	infection	Y	N
	ulceration	Y	N
	calluses or corns	Y	N
	skin breaks	Y	N
	nail disorders	Y	N

		LEFT		RIGHT	
<b>3. Check foot pulses</b>	Dorsalis pedis	Y	N	Y	N
	Posterior tibial	Y	N	Y	N

		LEFT		RIGHT	
<b>4. Test for neuropathy</b>	Monofilament *	Y	N	Y	N

\* detected at sites marked



<b>5. Assess footwear</b>	style	Good	Poor
	condition	Good	Poor
	fit	Good	Poor

<b>6. Assess education need</b>	Does the patient understand the effects of diabetes on foot health ?	Y	N
	Can the patient identify appropriate foot care practices ?	Y	N
	Are the patient's feet adequately cared for ?	Y	N

<b>7. Assess self care capacity</b>	Does the patient have impaired vision ?	Y	N
	Can the patient reach own feet for safe self care ?	Y	N
	Are there other factors influencing ability to safely care for own feet ?	Y	N

**All people with diabetes need to have their feet assessed with these 7 simple steps every 6 months or more often if problems are identified**

## 6- Diagnostic Procedures

### Diabetes Diagnostic Criteria:

- Fasting plasma glucose of at least 8 hours after fasting at 126 mg / dl or more
- Reducated plasma glucose level of 200 mg / dl and over + presence of diabetes symptoms (polyuria, polydipsia, polyphagia)
- On the glucose tolerance test (OGTT) at the end of the 2nd hour plasma glucose of 200 mg / dl and above
- HbA1c of 6.5% and above

The presence of at least one of these criteria leads the physician to diagnose Diabetes Mellitus. Since HbA1c is not standardized in our country, its use alone can be misleading for diagnosis. (National Diabetes Consensus Group / 2017)

### Diabetic Foot Infection Diagnostic Criteria:

#### 1) Wound Culture

Deep tissue sample from the wound base with biopsy or curettage (at the risk of soft tissue infection)

- Spring area aspiration

#### 2) Blood Culture

- Leukocyte count
- ESH (> 70 suggest osteomyelitis.)
- Procalcitonin

#### 3) Radiography (in the monitoring of bone deformities)

#### 4) MRI (in detecting the presence of osteomyelitis)

## 7- Treatment

CLINICAL SEVERITY	ASPECTS	TREATMENT
LIGHT	<ul style="list-style-type: none"> <li>- Dry skin</li> <li>- Skin deep ulceration</li> </ul>	<ul style="list-style-type: none"> <li>- Moisturizing creams</li> <li>- Local wound care</li> <li>- Antibiotic therapy if necessary</li> </ul>
MID-SEVERE(Threatening the extremity)	<ul style="list-style-type: none"> <li>- Deep tissue ulceration</li> <li>- Cellulite</li> <li>- Mild / moderate necrosis</li> <li>- Osteomyelitis</li> </ul>	<ul style="list-style-type: none"> <li>- Antibiotic therapy</li> <li>- Evaluation and treatment of revascularization</li> <li>- Long-term appropriate antibiotic therapy, if necessary bone resection</li> </ul>
SEVERE(threatening the life)	<ul style="list-style-type: none"> <li>- Deep tissue ulceration</li> <li>- Purulent drainage</li> <li>- Heavy necrosis / gangrene</li> <li>- Septic shock</li> </ul>	<ul style="list-style-type: none"> <li>- Surgical debridement, drainage and antibiotic therapy</li> <li>- Surgical drainage, appropriate broad-spectrum antibiotic therapy</li> <li>- Local amputation if revascularization is required</li> </ul>





## 8- Important to Remember

- The wound site should be constantly monitored for signs of infection. (heat increase, redness)
- Color changes should be observed to evaluate the circulatory status of the affected limb. (Cyanosis is one of the most important conditions in circulatory disorders).
- In patients who are discharged from the health care institution and whose care continues at home, care should be given to wound dressing.

## 9- Preparing the Patient

- Prior to starting the procedure, the physical needs of the patient for feeding, dumping, etc. should be met before cleaning the wound and during the dressing application.
- The patient should be informed about the procedure and the application steps should be explained in a short and understandable way.
- Patient consent must be obtained for the procedure.
- In order to strengthen the patient's autonomy, the patient should also be asked for help, and if the physical qualifications are appropriate, he / she should be asked to help and participate in the practice.
- It is important to communicate with the patient during the procedure.

## 10-Preparing the Accessories

Wound Care begins with the control of risk factors. There should be no burden on the foot where the wound is located. Elevation should be applied to prevent edema. Blood glucose levels of patients should be regulated. In the local treatment of ulcers, the basic principles of wound healing must be adhered to. Drying of the wound should be avoided.

The use of potentially toxic preparations such as chlorhexidine, alcohol should be avoided.

The use of topicals should be limited to the use of saline or antibacterial ointments.

## Dressings

Wet dressing with saline should be performed once or twice a day. In addition to being reliable, saline dressings keep the wound surface moist, reduce the number of bacteria on the surface and debride the ulcer surface.

Wet-dry dressings should not be used because they remove the newly formed epithelium. For superficial ulcers, non-sticky, dry, sterile thin dressings can be used. They allow drainage and protect the newly formed epithelium. Dressings play an important role in the maintenance of wound care. A good dressing material should prevent drying out, be absorbent enough to absorb exudate, allow gas condensation, and serve as a mechanical barrier that separates the wound environment from microorganisms.

In home conditions, only Wagner 0 and 1 diabetic foot wound can be dressed. The necessary materials for this;



- Gloves
- Water in a clean bowl
- Soapy water
- A clean cloth (to dry the wash area)
- Local antiseptics
- Sterile sponge to cover the wound

## 11- Treatment and Evaluation of The Wound

The evaluation of diabetic foot wounds according to Wagner classification will be beneficial in terms of treatment approaches.

Stage 0: It is a high risk group without diabetic wound. In these patients, diabetic foot training should be given intensively and intermittently. Insulin should be switched to a good glycemic control. Neurological and peripheral arterial examinations should be performed. Foot pressures should be evaluated with podography; simple insoles should be made accordingly.

Stage 1: Superficial wounds that do not descend below the dermal layer. Generally, the infection does not accompany the picture. The wound is often located proximal to the foot and has a thick callus layer on the floor. By removing the callus layer, the actual dimensions and depth of the wound should be determined. First, wound care and dressing should be done, the foot should be freed from the load and taken to rest. For this purpose, special shoes, walkers, crutches and under the knee plaster can be used. If infection is accompanied by appropriate antibiotics are initiated.

Stage 2: Diabetic foot wound tendons progressed to the fascia, including the ligaments. However, there is no osteomyelitis. It is often accompanied by infection. Debridment should be obtained by taking tissue culture from the wound and antibiotherapy should be started immediately. The foot should be taken to rest. The infection should be controlled and hospitalized until wound healing begins. For metabolic control, insulin therapy should be applied aggressively.

Stage 3: The diabetic wound includes the bone as well as the tissues. Since osteomyelitis is accompanied by foot immobilization, foot radiographs should determine the extent of infection in the bone. Osteomyelitis is detected in deep penetrating wounds, usually 1 cm in diameter. With intensive insulin therapy, tissue cultures should be taken and broad-spectrum antibiotherapy should be initiated and continued for a long time. After the infection is controlled, bone can be curettaged.

Stage 4 and 5: The foot has become gangrene. In the 4th degree, there was a gangrene located proximal to the foot, whereas in the 5th degree the gangrene was spread to the whole foot. Antibiotherapy should be started immediately. If possible, heel protection should be performed in amputations, but advanced knee amputation should be performed in advanced cases.

## 12-Pain Treatment

Diabetic neuropathy is caused by damage to the peripheral nervous system in individuals with diabetes. Pain, such as burning, tingling, stinging, electric shock, and symptoms of frostbite are called neuropathic pain. Neuropathic pain can be seen as a simple type affecting the single extremity or peripheral areas (such as the finger tips) and in the more complicated types of the whole neural network that distort the message, differentiations of the patient in the form of feeling the pain can be seen.



For example: Phantom Pain, also referred to as ghost pain, describes the severe pain of the amputated limb.

The treatment of pain should also be shaped according to the cause. Relieving the patient under stress and providing a peaceful treatment environment is the first step of pain management. However, although it depends on the severity of the pain, pharmacological agents / drug treatment is frequently preferred because of the high potency.

Pharmacological agents used in the treatment of neuropathic pain:

- Anticonvulsants
- Tricyclic Antidepressants
- Opioid Analgesics
- Antiarrhythmics
- Local Anesthetics

### 13- Nutritional Status

The food consumption is distributed to the main meals and snacks by taking into account the individual's eating habits (2-3 main meals (breakfast, lunch, dinner), 2-4 snacks

- Carbohydrate (CH) intake; 45-65% of the daily energy requirement (GEG) is calculated as 14 g / 1000 kcal (25-35 g / day).
  - Fat intake; It is calculated as 30% of daily energy, saturated fat is planned as 7% of GEG.
  - Cholesterol; <200 mg
  - Sodium intake <2300 mg / day (approx 5 g salt)
  - Vitamin or mineral supplementation is not recommended unless there are clinical or laboratory signs of insufficiency.
- Points to be Considered in Diabetic Patient Nutrition;
- Long periods of starvation should be avoided as blood can cause sudden drop in glucose level.
  - At least 3 meals must be eaten.
  - Meals should usually consist of fruits and vegetables that are easy to digest and have a low sugar content.
  - Fruits should not be consumed alone, milk, yogurt, wholewheat, etc. should be consumed. (Because fruits consumed alone will cause undesirable elevations in blood glucose levels)
  - Ready-made fruit juices and sugar-rich products should not be used.

The main purpose of nutrition of the patient with diabetic foot injury is to maintain tissue integrity / tissue integrity in the patient whose tissue integrity deteriorates and to prevent infection. In this direction,

- Protein can be added to the diet considering the degree of kidney damage.
- Vitamin A and vitamin C supplementation should be made to ensure tissue elasticity and support for collagen.
- Vitamin C intake should be encouraged to protect against infections and increase body resistance.
- Liquid intake should be supported in line with fluid-electrolyte balance monitoring.



## 15-Health Care Education

It is possible to prevent the formation of diabetic foot wounds with an effective training provided by the health personnel to the patient and his family, to prevent complications in the patient who has diabetic foot injury, and to plan a treatment process in which the patient will easily adapt.

Basic topics to be included in health education: self-examination, skin and foot care and also the choice of suitable shoes.

Self Inspection:

- The feet should be checked daily for cuts, abrasions, redness, fungi and calluses. If necessary, the mirror should be used to see the sole of the foot.

Daily inspection;

- Are socks wet? Is his color darkened? Is there a different color? Normal color and dry is expected. Socks should not be torn and wrinkled, they should be fit to the feet.

- The scalp is visually examined with the help of a mirror and it is observed whether there are calluses, redness, bullae or open wounds. If there is, it must be rested immediately.

- Nail Inspection: Thickening, nesting and length are evaluated in nails.

- Finger Interval: It is evaluated whether there is maceration between the fingers, tinea pedis and paws on the fingers.

- Temperature Control: The patient should check the temperature of the feet with his / her back and should rest if there is a temperature.

- Deep Sensitivity Control: Resting is necessary if there is pain or tenderness in the application of pressure with the thumb on different points of the foot base.

- There is a suspicion of deep infection or neuropathic fracture if there is a sudden increase in foot temperature, redness, edema and tenderness. Possible charcot deformity should be avoided by pulling a foot x-ray.

- Shoe control: The patient should inspect the shoe he should wear daily.

- There should be no metal nails in shoes

- There should be no foreign bodies such as dust and stone inside the shoe.

- Inner insoles should not be worn,

- It should not lose its protective feature,

- Wipe the inside of the shoe once a week with a wet soapy cloth.

Skin Care:

Feet should be washed daily.

Finger breaks must be thoroughly dried.

Hardened, cornered parts should be massaged.

If there is dryness heels can be moistened.

No moisturizer, petroleum jelly etc. applied to the fingers!

The nails should be cut straight, not round. (To prevent ingrowth)

Shoe Selection:

Shoes should be fit and comfortable to stand up. Pointed toe, open toe and high-heeled shoes should not be preferred, the base should be wide and thick shoes should be preferred.

Narrow shoes should never be used.

Shoe purchase should be preferred in the afternoon.

No flip-flops should be worn.



## 15- Psychological Influence on Patient and Family

Patients with diabetes mellitus are also informed that there will be no physiological and endocrinological differentiations in their bodies, as well as a process that will require many regulations in the life of a person and will be followed by lifestyle changes. Although the patients seem to accept the situation, this situation, which they know will affect their lives and the lives of the family members and caregivers, both puts them and their families under stress and pressure. The feelings of anger, fear and anxiety that they may experience in this process are inevitable for most patients.

Emotion sharing, trust in the family, compliance and cooperation with the treatment team are important factors that will reduce the concerns of patients and facilitate their adaptation to the process of treatment.

In patients undergoing amputation due to diabetic foot wounds, it may be difficult for the patient and his family to accept the loss of an organ that has been actively used and has been healthy for a long time at the end of the disease process. In particular, if this bodily loss affects the business life of the patient, both the absence of the source of financial support and being away from the social environment may leave the patient facing an introverted and angry individual. In some patients, depressive behaviors can be observed, and the individual refuses to make efforts even for their daily physical needs.

The support of the care staff and the family of patients will be relaxing for the patient and will play an active role in facilitating compliance throughout the treatment and care period. Taking psychological help from a specialist in patient groups where progress cannot be recorded despite all this support can be a good option for the patient, and can be relaxing in the family members who experience inadequate feelings of caregiver role.

## 16- Practical Examples and Tasks

DY, 63y, F,

Complaint: Open wound on foot

History: Diabetic scar in the foot of the left foot for 10 years, reconstruction with free flap 10 years ago, fracture of the left foot 5 years ago, partial excision of calcaneus

Resume: Type 2 DM (for 22 years) Hypertension (10 years) Hyperlipidemia (5 years) TAH / BSO 17 years ago

Drugs Used: Glucophage 2x1, Hummuline R (3x8 ü), Lantus (1x20 u) Micardis plus 1x1, Tarden 1x1

Risk factors: old age, long-term diabetes, hyperglycemia, hypertension, hyperlipidemia

Physical Examination:

Obese

A: 36.7 C Nb: 96 / min TA: 120/80 mmHg SS: 15 / min

Necrotic open wound ulcers with a depth of 5x4 cm and a depth of 2 cm.

System examinations are natural.

Wagner Classification: Stage 3: Deep ulcer containing abscess and / or osteomyelitis

PEDIS classification: Tissue feeding (Perfusion): Stage 2: There are signs of PAH, but no severe ischemia.

Extent / size: 5x4 cm





Depth / tissue loss (Depth): Stage 3: Probing to bone method or direct view and determination of all layers of the foot including bone and joint

Infection: Stage 3: There is an erythema greater than two cm and at least one of the above-mentioned symptoms or there are no signs of infection, abscess, osteomyelitis, septic arthritis, fasciitis, systemic inflammatory response syndrome (SIRS).

Sensation: Stage 2: Loss of sensation in the affected foot (absence of a sense of pressure with 10 g monofilaments in at least two of the 3 regions on the plantar surface of the foot)

She was admitted to Plastic-Reconstructive Surgery Clinic for operation on 31.3.2011. SAA Bone structures under the flap were debrided by orthopedics and deep tissue culture was taken.

Day 7: With PRC and Orthopedics she was operated.

Surgery Note: The skin with necrotic tissue defect on the left heel was excised under spinal anesthesia. The necrosis of the exposed talus and cuboid bones were debrided by orthopedics. Deep tissue culture was obtained. An example was sent to pathology. The defect was closed by spreading the skin at the edges of the defect.

On the 12th day she was admitted to the Infectious Diseases and Clinical Microbiology Clinic.

Internal Diseases and Nutritionist consultation

Eye Consultation: Common laser chorioretinitis foci due to signs of proliferative diabetic retinopathy at bilateral fundus examination

Wound - Burn Care Center consultation

Hyperbaric oxygen therapy

Day 14: Fireless. Minimal detachment in the suture line. Deep tissue culture was obtained.

Elevation + dressing

MONITORING: Ciprofloxacin 2x750 mg tb. She was discharged. (6 weeks in total)

Hyperbaric Oxygen therapy in wound care center (60 sessions)

Internal Medicine outpatient follow-up (BG regulation)

Eye polyclinic follow-up (Diabetic retinopathy)

Patient status: 1x1 cm diameter ulcerated lesion, no discharge, no infected appearance.

The patient can walk with special production shoes.

## 10. GLOSSARY

**ACUTE** - Short-term occurrence of a disease

**AMPUTATION** - Surgical cutting of all or part of an extremity

**ANGIOGENESIS** - Creation of new blood vessels

**ANGIOPLASTY** - Surgical intervention to repair or shape a vessel

**ANTIARRHYTHMICS** –Substances for eliminating rhythm irregularity in the heart

**ANTIBIOTICS** – A group of chemical substances having the capacity to inhibit the growth and destroy bacteria and other microorganisms; used mainly in the treatment of infectious diseases

**ANTICONVULSANT** - Eliminates the contraction of striated muscles



**ANTISEPSIS** - Process of destroying microorganisms on living tissue to prevent their growth and development and limit existing infections

**ANTISEPTIC AGENTS** – Agents that destroy or inhibit the growth and development of micro-organisms in or on living tissue

**ARTERIES** - Blood vessels that drain blood from the heart into other parts of the body

**ARTHRITIS** - Joint inflammation

**ASEPSIS** - A working condition in some medical disciplines achieved by sterilization

**ASPIRATION** - Discharging of fluids accumulated in body cavities

**AUTOLITIC DEBRIDEMENT** - Physiological process that is an integral part of the healing of each wound, it allows phagocytes to dissolve necrotizing tissue and promotes the granulation process

**AZOTEMIA** - Nitrogen deposition substances (urea, etc.) in the blood

**BIOFILM** - A thin but robust layer of mucilage adhering to a solid surface and containing a community of bacteria and other microorganism

**BIOPSY** - Medical technique by which cell or tissue samples are collected for testing

**BWAT** – The Bates-Jensen Wound Assessment Tool is used to measure the changes in wounds over time

**CACHEXIA** - Cancer cachexia is a wasting syndrome characterized by weight loss, anorexia, asthenia and anemia

**CALORIES** – A quantity of food capable of producing a given amount of energy

**CARDIOVASCULAR** - Circulatory

**CELLULITIS** - Extensive inflammation in subcutaneous tissues

**CLEANSING** –The process of using fluids to remove surface contaminants, bacteria and remnants of previous dressings from the wound surface and surrounding skin

**COCCYX** – This is the small triangular bone forming the lower extremity of the spinal column in humans, consisting of four ankylosed rudimentary vertebrae

**COLLAGEN** – A class of extracellular proteins abundant in higher animals, forming strong insoluble fibers and serving as connective tissue between cells

**COMORBIDITY** - Existing simultaneously with and usually independently of another medical condition

**COMPLICATIONS** - The pathological condition that occurs during the disease, is not specific to the disease and complicates the treatment

**CONSILIUM** - A convocation of three or more experts to confer and give advice

**CONSULTATION** - Examination and evaluation of the patient by two or more doctors for the diagnosis and treatment of a disease

**CORTICOSTEROIDS** - Drugs used in the treatment of diseases for which there is no etiologically effective drug

**C-REACTIVE PROTEIN (CRP)** - An acute phase protein that is formed in the liver in response to the release of inflammatory cytokines such as interleukin-



6; one of the most sensitive acute phase proteins, determination is suitable for monitoring the inflammatory process

**CURETTAGE** - Removal of unwanted material from body cavities by scraping

**CYANOSIS** - Blue appearance of the skin due to insufficient oxygen in the blood

**DEBRIDEMENT** – The removal of foreign matter and damaged/ dead tissue from a wound

**DECUBITUS ULCER** – Pressure ulcer

**DEHYDRATION** – Dehydration occurs when water intake is insufficient to replace free water lost due to normal physiologic processes (e.g. breathing or urination) and other causes (e.g. diarrhea or vomiting)

**DENATURATION** - Process in which native protein structure is disrupted, leaving protein inactive

**DERMATOSIS** - Name for skin diseases

**DERMIS** - Middle layer of skin, it consists of connective tissue: follicles, sweat glands, loins, and blood and lymph vessels

**DEVITALIZED TISSUE** - Dead tissue

**DIABETIC KETOACIDOSIS** - Metabolic imbalance with excessive increase in ketone bodies as a result of severe insulin deficiency

**DORSALIS PEDIS** - The region in front of the lower bone of the ankle joint

**DRAINAGE** - Slow drainage of a liquid from the body cavities

**DYSLIPIDEMIA** - Changes in triglyceride level in blood

**ELECTROCHEMOTHERAPY** - A local treatment that, through the application of cell-membrane-permeabilizing electric pulses, potentiates at the application site the high intrinsic cytotoxicity of non-permeant or poorly permeant anticancer drugs

**ENDURATION** – Hardening

**EPIDERMIS** - Upper skin layer consisting of a platelet-like epithelium called keratinocytes

**EPITHELIAL** – Any biological tissue that covers a surface, or lines a cavity and performs various secretory, transporting or regulatory functions

**EPUAP** – European Pressure Ulcer Advisory Panel

**ERYTHEMA** – An abnormal redness of the skin due to local congestion such as in inflammation

**ESCHAR** – Usually dry, tough, leathery, black tissue that is tightly adhered to the wound bed; when softened, eschar may turn brown or gray

**ETIOLOGIC** - Related to the cause of occurrence of the disease

**ETIOLOGY** - The study of cause or origin

**EXTRAVASATION OF CHEMOTHERAPEUTICS** - Inadvertent infiltration of chemotherapy into the subcutaneous or subdermal tissues

**FASCIITIS** - Inflammation of the membrane on the muscle layer

**FIBRINOLYSIS** - The process that prevents blood clotting

**FOAM DRESSING** – Are absorbent, sponge-like polymer dressings providing thermal insulation and a moist wound environment

**FRICITION** – Occurs when the skin is rubbed against an external surface; often happens when turning, moving or boosting patients

**GANGRENE** - Tissue death

**GASTROPARESIS** - Stomach muscles paralysis.

**GAUZE** – Gauze is usually in the form of woven or non-woven cloth, and it is typically placed over the top of an open wound. Another type of bandage or medical tape may be used to hold the dressing in place until the wound heals

**GRANULATION** – Proces of making granulation tissue, the pink / red moist tissue comprising new blood vessels that fill an open wound when it starts to heal

**HEMOSTASIS** - Vasoconstriction and blood clot formation.

**HYDRATION** – Taking in water to provide the body with adequate fluids for normal physiological functions

**HYDROCOLLOID** – Made of carbohydrate-based material, these dressings are adhesive, moldable wafers that are impermeable to oxygen, water and water vapor;they help keep the wound moist and promote autolytic debridement

**HYDROGEL** – Made with a water or glycerin base, these dressings hydrate wounds and soften necrotic tissue;however, they provide limited absorption

**HYPERCOAGUBILITY** - Prone to clotting

**HYPERGLYCEMIA** - Blood glucose levels higher than normal

**HYPERLIPIDEMIA** - Blood lipid levels higher than normal

**HYPOGLYCEMIA** - Blood glucose level is lower than normal

**INCONTINENCE** – Unable to restrain natural discharges or evacuations of urine or feces

**INDURATED** – Hardened – as a soft tissue that becomes extremely firm.

**INFECTION** – Invasion by and multiplication of pathogenic microorganisms in a bodily part or tissue, which may produce subsequent tissue injury and progress to overt disease through a variety of cellular or toxic mechanisms

**INFLAMMATION** – A condition of redness, swelling, pain, tenderness, heat and disturbed function of an area of the body, especially as a reaction of tissues to injurious agents

**ISCHEMIA** - deterioration of blood flow to a tissue or organ

**LEUKOCYTOSIS** - Increase in red blood cell count

**MACERATING** - Tissue decompensation due to long-lasting wetting

**MACERATION** - The process in which the skin is softened and broken down by extended exposure to wetness or moisture

**MALNUTRITION** – Poor nutrition because of an insufficient or poorly balanced diet or faulty digestion or utilization of foods

**METASTASIS** - A pathogenic spread from an initial or primary site to a different or secondary site within the host's body

**MORBIDITY** - Disease status

**MORTALITY** - Rate of deaths due to an illness

**NECROSIS** - Tissue destruction, death

**NECROTIC TISSUE** – Dead cells resulting in wound tissue that is gray, brown, black and moist

**NECROTOMY** - Process of removing dead, devitalized or contaminated tissue and foreign material from the wound

**NEPHROPATHY** - General name of various functional disorders of kidney

**NEUROPATHY** - Nerve cell damage

**NORTON SCALE** – This pressure ulcer risk assessment tool was developed for the elderly population in the United Kingdom.

**NPUAP** – National Pressure Ulcer Advisory Panel (American)

**NUTRITION** – The taking in and metabolism of nutrients (food and other nourishing material) by an organism so that life is maintained and growth can take place

**OSTEOMYELITIS** – An inflammation of the bone and bone marrow, usually caused by a bacterial infection

**OXYGENATION** – The addition of oxygen to any system, including the human body; Oxygenation may also refer to the process of treating a patient with oxygen, or of combining a medication or other substance with oxygen

**PALLIATIVE CARE** - An approach that improves the quality of life of patients and their families facing the problem associated with life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual

**PALPATION** - Touching an area by hand

**PEDICLE** – A stalk through which a skin flap receives its blood supply until the skin flap is transferred to its intended site of attachment

**PERFORANT VEIN** - A communicational vein that connects deep and surface veins

**PERFUSION** - Provides oxygen supply

**PERIPHERAL** - Outside the center, located at the tip

**PERSPIRATION** – A salty, watery fluid secreted by the sweat glands of the skin, especially when very warm or as a result of strenuous exertion; also known as sweat

**POLYDIPSIA** - The desire to drink a lot of water, excessive thirst

**POLYPHAGIA** - Appetite increase, over-eating desire

**POLYURIA** - Increase in urine

**POSTPRANDIAL PAIN** - Pain after meals

**PRESSURE ULCER** – A localized injury to the skin and underlying tissue usually over a bony prominence, as a result of pressure or shear; other terms used are bedsore, pressure sore and decubitus ulcer.

**PROLIFERATION** -Growth

**PROTEIN** – Proteins are fundamental components of all living cells and include many substances, such as enzymes, hormones, and antibodies that are necessary for the proper functioning of an organism, they are essential in the diet for the growth and repair of tissue.





**PURULENT** - Inflammatory, irritant

**PUSH** – The Pressure Ulcer Scale for Healing is a tool to monitor pressure ulcer healing over time

**RADIOSENSITIVE** - Sensitivity/responsive to treatment with radiotherapy

**REMODELING** - Wound healing

**REPOSITIONING** – The act of changing an individual's body position to relieve pressure and enhance comfort.

**RETINOPATHY** - Visual impairment of vision

**SACRUM** – A triangular bone made up of five fused vertebrae and forming the posterior section of the pelvis

**SEPSIS** – Local or generalized invasion of the body by pathogenic micro-organisms or their toxins

**SILICONE DRESSING** – A contact layer dressing designed to lie directly on the wound's surface; often made of silicone because of its non-allergic and non-stick properties.

**SILVER-IMPREGNATED** – An antimicrobial dressing containing silver that has powerful antimicrobial and bactericidal properties

**SLOUGH** – Yellow, tan, or gray-white tissue that may be loose and stringy, or well adhered to the wound bed. It may be moist or dry

**SURGICAL DEBRIDEMENT** – The removal of foreign material and devitalized tissue using a scalpel or other sharp instrument

**TIBIALIS POSTERIOR** - The region behind the flat bone extending from below the knee-cap to the foot

**TISSUE PERFUSION** – The passage of blood and tissue fluid through the capillary bed

**TOPICAL** – A term used to describe a medication that has effects only in a specific area, not throughout the body; usually is administered directly onto the skin

**TRANSPARENT FILM** – Made of polyurethane, these dressings adhere to the skin and help maintain a moist wound environment; they promote autolytic debridement and stimulate formation of granulation tissue

**TRICYCLIC ANTIDEPRESSANTS** – substances used to treat depression, bipolar disorder, anxiety, obsessive-compulsive disorder and other mood disorders, also effective as analgesics so are used to treat chronic pain

**TROCHANTER** – The two knobs at the top of the femur serving for the attachment of muscles between the thigh and pelvis

**ULCER** - Defect on the skin or subcutaneous tissue resulting from various pathological processes

**VASCULITIS** - Pathological process of inflammation of the blood vessels that involves changes in the blood vessel walls, thickening, scarring and narrowing

**VEINS** - Blood vessels that carry blood from the periphery to the heart

**WOUND HEALING** – A process to restore to a state of soundness any injury that results in an interruption in the continuity of external surfaces of the body

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**Pictures:Mini incubator, 2019**

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Links:

<http://ewma.org/index.php?id=8170> (novosti v oskrbi kroničnih ran)

<http://ewma.org/index.php?id=8172> (videogradivo živet s kronično rano)

<https://international-pressure-ulcer-guidelines.myshopify.com/> (gradiva-plačljiva)

<https://www.npuap.org/wp-content/uploads/2017/03/Baranoski-Sharon-Unstageable-lecture-March-2017-1.pdf> (RZP)

[https://www.northeasthealthline.ca/healthlibrary\\_docs/Atypical%20Wounds.pdf](https://www.northeasthealthline.ca/healthlibrary_docs/Atypical%20Wounds.pdf)  
(atypical wound PP presentation from conference)

<https://www.youtube.com/watch?v=vKOr0jn8BuY> (YT video lectures, *Atypical wound recognition*)

<https://vimeo.com/309933266> (vimeo video lectures *Atypical wound*)

[https://www.dors.si/wp-content/uploads/2017/02/prehranska\\_podpora\\_2010.pdf](https://www.dors.si/wp-content/uploads/2017/02/prehranska_podpora_2010.pdf)  
(DORS)

<https://edu.hkms.hr/course/info.php?id=57> (e tečaj o ranah)

<https://repozitorij.vub.hr/islandora/object/vtsbj:42/preview> (kronične rane z raziskavo o kakovosti življenja)

<https://repozitorij.unidu.hr/islandora/object/unidu:219/preview>

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<http://www.bccancer.bc.ca/nursing-site/documents/10.%20malignant%20wounds.pdf> (guidelines)





## Photos Of Our Project Meetings

03-04.12.2018 from Croatia



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15-16.04.2019 from Slovenia







23-24.09.2019 from Germany



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05-10.01.2020 from Türkiye

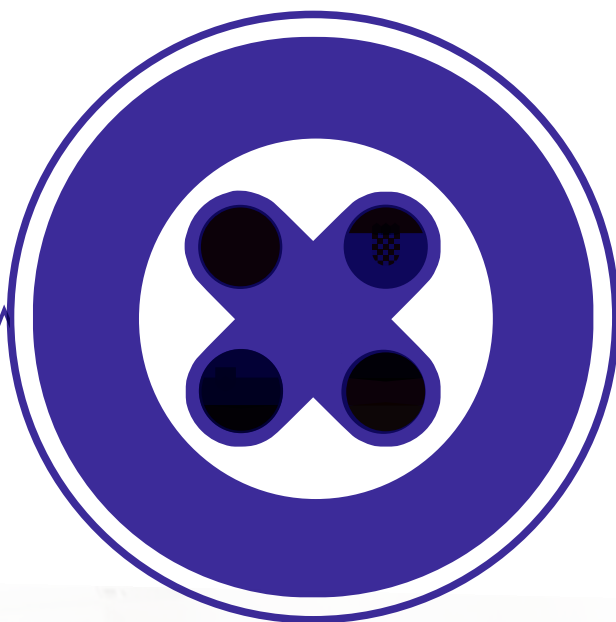


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