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**PRESSURE ULCERS (BEDSORES, DECUBITUS ULCERS): COMPLICATION
AND CLINICAL STRATEGY OF COMPLEX TREATMENT IN A PALLIATIVE CARE
DEPARTMENT FROM THE POSITION OF CLINICAL EXPERIENCE**

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Bedsore (syn. pressure ulcers – Decubitus ulcers) are caused by chronic compression, soft tissues ischemia and neurotrophic changes, inadequate nutrition and care, urinary and fecal incontinence, metabolic disorders due to the underlying disease; localized microcirculatory disorders; metabolic disorders. Modern scientific research is mainly aimed at developing strategies and methods for the treatment of pressure ulcers that have already formed, which is a local purulent-necrotic process. There is no clear consensus on the criteria for readiness of bedsore (which affects the outcome of surgery) for surgical treatment, which ultimately determines the length of the hospital care of palliative patient's. The aim of the work was to optimize the strategy of complex surgical treatment of stage III-IV bedsore and purulent complications in some palliative care clinic.

A case of bedsore (pressure ulcers, decubitus ulcers) especially stage III-IV from palliative care department is being investigated. The total sample of the retro- and prospective analysis included the results of the complex treatment of 412 patients aged 40–93 years: 174 males and 238 females with soft tissue pressure ulcers. Stage I and II pressure

ulcers were treated conservatively. In the presence of purulent complications, complex surgical sanitation was performed. Clinical plans and treatment included adequate nutritional support, decompression of the area, sanitation of pressure ulcers with antiseptics, including surgical intervention if necessary, adequate local and systemic infection control, and correction of background comorbidities.

Based on author's clinical classification and the DOMINATE strategy, we created a simplified strategy, pathogenetically based and adapted for the treatment of pressure ulcers in a palliative care department with an adequate sequence of care and complex therapy. If it was impossible to simultaneously remove necrotic masses from the standpoint of monitoring the patient's general condition or additional/repeated necrosis formation, we used strategies of complex treatment according to standard clinical protocols, tactics of programmed resanitations/resectomies, and antibacterial therapy. Our proposed clinical classification criteria and adapted NODITE clinical strategy are simple and easy to use. Significant reduction of pain, signs of purulent necrotic inflammation and effective secondary prevention of complications constitute a set of criteria for effectiveness and economic feasibility, which, in our opinion, determines the possibility of introducing into clinical practice. Using the NODITE strategy, we found complete healing of complicated pressure ulcers within 45–60 days in half of the patients in the main group, while in the control group, this figure was only 35.7%. It has been shown that adequate local restriction and sanitation of the problem area and the use of special anti-decubitus mattresses in palliative care departments contribute to the regression of the pathological process, granulation and marginal wound epithelialization.

The strategy for the prevention, care and treatment of complicated bedsores includes N (Nutrition) – adequate nutritional support; O (Offloading) – offloading, decompression – external pressure reduction on the bedsores area by the use of special care products and orthopedic devices, which contributes to the proliferative phase of the wound process; D (Debridement) – opening, removal of pus and necrosis from the wound with precise step-by-step necro- and (if necessary) sequestrectomy, with drainage of purulent cavity; I (infection) – the most appropriate combination of general antibiotic therapy and topical application of antiseptics and antibiotics; T (tissue management) – creating an appropriate environment in the wound, care, and stimulation of marginal epithelialization; E (education) – providing appropriate care, monitoring the dynamics of the pressure ulcer wound process and correcting local venous and/or lymphatic stasis.

Key words: local purulent-necrotic process, pressure ulcers (bedsores, decubitus ulcers), classification criteria, features of prevention, strategies of complex treatment.

Андрій Вергун, Михайло Красний, Оксана Вергун, Юрій Мацях, Ігор Макагонов, Тарас Іванікович, Рустам Жураєв. Компресійні виразки (пролежні, декубітальні виразки): ускладнення та стратегія комплексного лікування в умовах паліативного відділення з позицій клінічного досвіду

Пролежні (син. належки, декубітальні виразки) виникають унаслідок хронічного здавлення, ішемії м'яких тканин і нейротрофічних змін, недостатнього харчування та догляду, нетримання сечі та калу, порушення обміну речовин унаслідок основного захворювання; їх виникненню сприяють локальні розлади мікроциркуляції, метаболічні порушення. Сучасні наукові дослідження переважно спрямовані на розроблення стратегії та методів лікування вже сформованих пролежнів, які є місцевим гнійно-некротичним процесом. Немає чіткого консенсусу щодо критеріїв готовності компресійних виразок (що впливає на результат операції) до хірургічного лікування, що в кінцевому підсумку визначає тривалість стаціонарного лікування паліативного хворого. Метою роботи було оптимізувати у клініці паліативної допомоги стратегію комплексного хірургічного лікування пролежнів III–IV стадій та гнійних ускладнень.

Проаналізовано та досліджено випадки компресійних виразок (пролежнів, декубітальних виразок), особливо III–IV стадій, у відділенні паліативної допомоги. Загальна вибірка ретро- та проспективного аналізу включала результати комплексного лікування 412 пацієнтів віком 40–93 років: 174 чоловіків та 238 жінок із пролежнями м'яких тканин. Пролежні I і II стадій лікували консервативно. За наявності гнійних ускладнень проведена комплексна хірургічна санація. Клінічні плани та лікування включали адекватну нутритивну підтримку, декомпресію області, санацію пролежнів антисептиками, хірургічне втручання (за необхідності), адекватний місцевий та системний контроль інфекції та корекцію фонових супутніх захворювань.

На основі авторської клінічної класифікації та стратегії DOMINATE ми створили спрощену стратегію, патогенетично обґрунтовану та адаптовану для лікування пролежнів у відділенні паліативної допомоги з адекватною послідовністю надання допомоги та комплексної терапії. У разі неможливості одночасного видалення усіх некротичних утворень із погляду моніторингу загального стану пацієнта або утворення додаткового/повторного некрозу застосовували тактику комплексного лікування за стандартними клінічними протоколами, тактику повторних програмних санацій/рениектомій та антибактеріальну терапію. Запропоновані нами клінічні критерії класифікації та адаптована клінічна стратегія NODITE прості та легкі у використанні. Суттєве зменшення больового синдрому, ознак гнійно-некротичного запалення, ефективна вторинна профілактика ускладнень становлять комплекс критеріїв ефективності та економічної доцільності, який, на нашу думку, визначає можливість упровадження у клінічну практику. За стратегією NODITE у половини пацієнтів основної групи ми виявили повне загоєння ускладнених пролежнів до 60 днів, тоді як у контрольній групі цей показник становив лише 35,7%. Показано, що адекватне локальне обмеження, санація проблемної зони та використання спеціальних протипролежневих матраців у відділеннях паліативної допомоги сприяють регресу патологічного процесу, появи грануляції та крайової епітелізації рани.

Стратегія профілактики, догляду та лікування ускладнених пролежнів включає N (Nutrition) – адекватну нутритивну підтримку; O (Offloading) – розвантаження, декомпресію – зменшення зовнішнього тиску на ділянку пролежнів за допомогою спеціальних засобів догляду та ортопедичних пристроїв, що сприяє проліферативній фазі ранового процесу; D (Debridement) – розтин, видалення гною та некрозу з рани з точною прецизійною поетапною некр- та (за необхідності) секвестрнекротомією, дренаванням гнійної порожнини; I (інфекція) – найбільш доцільна комбінація загальної антибіотикотерапії та місцевого застосування антисептиків і антибіотиків; T (tissue management) – створення відповідного середовища в рані, догляд та стимуляція крайової епітелізації; E (навчання) – надання відповідного комплексного догляду, спостереження за динамікою пролежнево-раневого процесу та корекція місцевого венозного та/або лімфатичного стазу.

Ключові слова: місцевий гнійно-некротичний процес, компресійні виразки (пролежні, декубітальні виразки), критерії класифікації, особливості профілактики, тактика комплексного лікування.

Introduction. Bedsores (syn. pressure ulcers – Decubitus ulcers) are caused by chronic compression, soft tissues ischemia and neurotrophic changes, inadequate nutrition and care, urinary and fecal incontinence, metabolic disorders due to the underlying disease; localized microcirculatory disorders; metabolic disorders [1, 4–6]. Continuous pressure of about 70 mm Hg for two days due to the atrophy, maceration and local ischemia causes irreversible changes in tissues [6, 7, 10]. At the same time, with a decrease in the duration of compression or external pressure on the tissues, minimal parabolic changes occur in the latter without any consequences [8, 10–12]. The most relevant in the problem of pressure ulcers is to increase the efficiency and improve methods of preventing the formation of pressure ulcers (PrU) in cases where adequate elimination of shear force, pathological moisture of soft tissues [2–4], diabetes mellitus and some other endocrine / metabolic pathology, obliterative diseases, contact with the skin of physiological secretions with subsequent maceration against the background of a long-standing forced position of the patient and physical inactivity [6, 11, 12]. Bedsores are, in fact, necrosis of the skin and underlying tissues due to impaired microcirculation as a result of their prolonged compression (lying on the back, abdomen, in a semi-sitting position), and sometimes in artificially created positions and prolonged compression of tissues (plaster casts, contractures, etc.), especially in the locations of bone protrusions where the greatest pressure gradient are observed (sacrum, buttocks, heels, back of the head, knees, chest, ischial tuberosities, tibia, etc.) [11–13], prolonged or persistent loss of motor activity, arise as a result of injuries or diseases of the spinal cord and brain, severe somatic pathology, accompanied by impaired innervation and tissue trophism [3–6, 13, 14]. In developed countries, the prevalence of decubitus ulcers is approximately the same and accounts for 16% of complications of other diseases [2–5, 13, 14, 16]. However, if patients are cared for by specially trained nurses, the prevalence of

PrU is reduced to 8.1% [5–7, 16–19]. Over the past five years, about 500,000 patients annually need professional palliative care in the final period of life [8–11]. In addition, family members of palliative care patients also need professional help [19]. The most common direct cause of soft tissue PrU is some chronic traumatic injuries, 94%, etc. [17–19]. Shear forces, pathological humidity of soft tissues, ingress of physiological secretions on the skin with subsequent maceration against the background of a long-standing forced position of the patient, physical inactivity determine the occurrence of local tissue ischemia [6–8, 10, 11, 20, 21].

The presence of an incurably ill person in the family, especially in the terminal stage, leads to a decrease in the quality of life of the whole family and causes severe psychological, social and economic disorders of its functioning. Thus, about 1.5 million people in Ukraine need palliative care every year, which is also a major medical, social, moral, psychological and economic problem worldwide [22, 23]. PrU in the vast majority of cases are formed in the elderly and senile [9, 11–14]. Over the past decades, the percentage of older people with severe comorbidities complicated by ulcers has increased significantly in Europe and North America [9, 11, 12]. In these countries, significant efforts, resources, and organizational measures are directed to the management of this category of patients. Often, bedsores, as a type of chronic wound, are treated by specialists of different profiles who prescribe local treatment at their discretion, which can last for many weeks or months [6–8].

Both in our country and in most countries of the world, PrU are mostly treated conservatively [1, 2, 5, 15, 16]. The reason for the low surgical activity is the high percentage of postoperative complications, namely: suture separation, wound suppuration in 50–75% and relapses in 30% of patients [3–5, 18–20, 22]. In the rest of the cases, additional long-term conservative therapy or reoperation is required [21]. The presence of severe neurodystrophic process in the soft tissues and osteomyelitis of the underlying

bone also stops surgeons from radical operations [1–3, 21–23]. Exacerbation of this process, despite a successful operation, often leads to recurrence of pressure ulcers and the formation of purulent soft tissue fistulas [3, 12, 23].

The most important thing in bedsores preventing and the progression of ulceration is to identify the risk of developing this complication. Many scales and classification have been proposed for this purpose, including those of Norton (1962), Waterlow (1985), Braden (1987), Medley (1991), etc. In 2017, we also proposed an optimized clinical DecU classification [5–9, 20–23] and formulated risk factors for some complications that require repeated necrectomy (Fig. 1) and sequestrum necrectomy [2, 4–7, 13, 24, 28]. The originality of the method in the Ukraine Patent are confirmed [27–29].

The presence of pressure ulcers can determine the development of inflammatory, some purulent and necrotic complications, which have a specific and are difficult to treat with complex surgical sanitation [10–14, 16, 17, 22–24]. Prevention and treatment of uncomplicated and complicated DecU (Fig. 2) are some basic issues in palliative care, requiring careful study in the context of creating and further development of medical care (services) algorithms [5, 8, 10, 11, 13]. Unfortunately, modern scientific research is mainly aimed at developing new methods of treating pressure ulcers that have already complication [10, 11, 21–23]. The main role of treatment at this stage is to protect the wound from repeated infection and further exposure to damaging factors [3, 5, 7, 10–13, 26, 27].

In addition to specific preventive measures, it is necessary to treat any concomitant diseases and syn-

dromes that contribute to the formation of DecU of various localizations (diabetes mellitus, occlusive arterial diseases, etc.), to provide adequate pain relief, and to correct the water and electrolyte balance [2, 12–14, 24]. There is no clear consensus on the criteria for readiness of bedsores (which affects the outcome of surgery) for surgical treatment, which ultimately determines the hospital length of the palliative patient's [7–12, 22–25].

The aim of the work. Considering this, we have planned this study to optimize the strategy of complex surgical treatment of stage III–IV bedsores and purulent complications in some palliative care clinic.

Clinical materials and methods. The total sample of the retro- and prospective analysis included the results of complex treatment of 412 patients aged 40–93 years: 174 males and 238 females who were treated inpatient over a 10-year period in the palliative care unit of the municipal non-profit enterprise "Lviv Territorial Medical Union No.2, Planned Complex Treatment, Rehabilitation and Palliative Care", a separated department "4th Hospital", the clinical cases of the disease was characterized by the formation of soft tissue DecU. Stage I and II pressure ulcers were treated conservatively. 128 patients (31.07% of the sample) aged 72–87 years were treated: 82 men and 46 women with stage I and II pressure ulcer with maceration, wetting, desquamation of the epidermis, and formation of superficial ulcers, who were treated in the palliative care unit with decompression measures, the use of antiseptic sanitation [1–5, 8–13, 23–27], silica- (zeolite), streptocide-, and antibiotic-containing powders [4, 5, 6, 12–14, 21–23] and a standard treatment regimen according to generally accepted guidelines, clinical strategies, and local pro-



Fig. 1. Stage IV pressure ulcer of the sacroiliac region with extensive soft tissue necrosis (intraoperative photography) in patient M, 88 years old. Necrotomy was performed, the stage of removal of most of the necrosis (necrotomy, primary necrectomy and sanitation)



Fig. 2. Gluteal area stage IV pressure ulcer with colliculative necrosis of soft tissues, putrefactive phlegmon, cellulitis, epifasciitis in an 88-year-old woman

protocols [6, 8, 10–13, 19–22]. Stage III and IV bedsores with complication were complex surgically treated in the palliative care unit/department (strategy with repeated necrectomy and complex local sanitation in main group and primary standard treatment in control group) with secondary decompression measures according to generally clinical strategies [2–5, 10–13, 20–23]. The results of the treatment were statistically analyzed. The safety assessment included registration and analysis of side effects. The Bioethics Committee of Danylo Halytsky Lviv National Medical University found no violations of clinical and ethical standards.

Results and discussion. There are many classifications of pressure ulcers, both by individual authors and those adopted by major medical forums. From the point of view of clinical application, the optimal classification is one that combines the criteria of epidemiological studies, clinical evaluation and assessment of the effectiveness of patient treatment methods. The classification of Shea JD (1975) was widely used in the world practice. In addition, in order to unify the scientific approach to clinical issues [6–8, 14, 23–25], the modern international classification of pressure ulcers was presented in the joint guidelines for the prevention and treatment of pressure ulcers of the European Pressure Ulcer Expert Commission and the National Pressure Ulcer Expert Commission, E&NPUAP, 2009, etc. Some authors of the guidelines agreed on four levels of tissue damage, which are designated as stages (I, II, III or IV) [1, 9, 11]. Stages of pressure ulcers are defined on the basis of the idea that progression occurs from stage I to stage III or IV, although in practice this is not always the case [20–23, 25–27].

Stage I. Persistent redness of the skin area. The integrity of the skin is not compromised, but there is a limited area of persistent redness (erythema), which is most often located over the protruding bone. This area may be painful, harder or softer, warmer or cooler than the surrounding skin. The appearance of this area usually indicates a high risk of pressure ulcers [1, 5, 11, 12, 14, 17, 21].

Stage II. Partial loss of skin thickness. Partial loss of skin thickness, which looks like a flat open ulcer with a wet or dry pink wound bottom without necrotic masses and signs of deeper tissue damage. It may also look like a blister filled with serous or serous-bloody fluid. This category is not recommended for describing skin lacerations, burns, dermatitis, maceration, or abrasions [3–5, 12, 14, 17–21].

Stage III. Complete loss of skin thickness. Damage to the entire skin (dermis and subcutaneous

adipose tissue). The depth of the wound depends on the anatomical features of the body part where it is located (for example, pressure sores on the ears, back of the head or ankles can be flat, and on the buttocks – very deep) [9–13]. Subcutaneous fat can be seen in the wound, but bones, tendons, or muscles cannot be seen or felt (by probing or finger inspection). There may be infiltrations – "pockets" and "tunnels" and / or necrotic masses, but the latter do not allow to see and verify the depth of the skin damage [20–23].

Stage IV. Deep tissue damage (muscles or bones are visible). Tissue damage is deep enough that bones and tendons and/or muscles (Fig. 3) can be seen (or felt by touch during probing or finger inspection). There may be necrotic masses or scabs, and there are often "pockets" and "tunnels" filled with pus, necrosis, and necrotic detritus. The presence of focal "conglomerate" and "blanched" necrosis is characteristic [22, 23]. The depth of the wound depends on the anatomical features of the body part where it is located, in particular, where there is no subcutaneous (fatty) tissue, wounds can be shallow. Extension to muscles, tendons, and fascia dramatically increases the risk of osteomyelitis [5, 9–12, 22].

Chronic obstructive pulmonary disease was diagnosed in 7.14% of the subsample, and type II diabetes mellitus in 2.68% of the other patients. We consider it axiomatic that dry skin should be moisturized and wet skin should be dried [2–5, 7–12, 16, 18–22, 27–29]. The skin should be irrigated with saline solution; alcoholic agents such as some alcohol-containing solutions, camphor alcohol, etc. and lotions are used in patients with oily skin [7, 12–15, 21–24, 26]. Complex surgical sanitation has been performed in complicated stage III–IV soft tissue DecU [5, 7–9] (Fig. 4).



Fig. 3. Stage IV pressure ulcer with necrosis of soft tissues in an 87-year-old woman. The necrotic area of the Achilles tendon are visualized



Fig. 4. Stage IV sacroiliac bedsore with collicative necrosis of soft tissues in an 85-year-old woman. Putrefactive phlegmon, epifasciitis, perifasciitis. The necrectomy stage with sanitation of the main soft tissues purulent focus

Care plans and complex treatment of pressure ulcers based on the TIME, DOMINATE and NODITE strategies include adequate nutritional support, orthopedic decompression of problem areas [6, 8, 17], sanitation of the pressure ulcer with antiseptics (including surgery if necessary), adequate local and systemic control of infection, correction of background comorbidities. Adequate care and treatment of patients with chronic wounds and, in particular, pressure ulcers is possible only with the use of complex strategies and algorithms. The TIME (Tissue management) strategy is actively used, including necrectomy, care, control of infection, creation of an appropriate moist environment in the wound, stimulation of granulations and marginal epithelialization [6, 17, 18].

A new step in the treatment of chronic purulent wounds is the DOMINATE strategy, which can be considered a clinical protocol [1–5, 16–18]. This strategy involves the removal of non-viable tissue from the wound in the presence of colliquative (wet) necrosis or demarcated dry necrosis areas [8–11, 21–23, 29–31].

During necrectomy, cells in necrobiosis are also removed, reducing the wound infection, trypsin, chymotrypsin, and collagenase powders are widely used [4–7]. For the effective treatment of this category of patients, the most appropriate combination of treatment is general antibiotic therapy and local application of antiseptics and topical antibiotics [7, 23, 28–30]. The use of orthopedic decompression devices to reduce the "chronic" pressure on the tissues in the area of the pressure ulcer reduces the likelihood of necrobiosis progression compared with patients who do not use decompression devices. The correct

choice of adsorbent bandage [2, 5–7, 9, 13, 18–21] allows you to control the exudation process, prevent the breakdown of collagen structures, optimize the granulation process and neovascularization in the proliferative phase [16–19, 22, 24–26].

Adequate nutrition, vitamins C, A, E, K, and chemical elements such as zinc, copper, etc. are of great importance in the management of patients with chronic wounds / bedsores. For successful healing, it is necessary to improve blood supply and ensure tissue oxygenation, some anticoagulants, antiaggregants, and vasodilators are used. However, these strategies do not fully correspond to the limited possibilities of DecU treatment in palliative care department and the necessary sequence of application of the main stages of complex treatment for uncomplicated and complicated soft tissue injuries [9–11, 24, 26, 27].

Based on the DOMINATE strategy [10–14], we have developed the NODITE strategy [27–29], which is pathogenetically based and adapted to the treatment of pressure ulcers with appropriate implementation of the principles of care and therapy. N (Nutrition), adequate nutritional support with sufficient proteins, amino acids, carbohydrates, and fats. In addition, fluid loss occurs during the hydration phase of the wound process [6–8, 12–21, 22–26]. If the patient has no signs of heart or kidney failure, he or she needs about 30 ml/kg/day of fluid. Multivitamin complexes and necessary trace elements complexes play an additional important role in wound healing. This part of the strategy also includes the use of parenteral nutrition and anabolic steroids (if indicated).

O (Offloading), offloading, decompression. In this stage, the external pressure on the problem soft tissues and DecU, etc. is reduced by the use of special care products and orthopedic devices. The changes that occur are characteristic of the proliferative phase of the wound process – cell regeneration and healing of the destroyed tissue [2, 11–14]. The fact of offloading also ensures marginal epithelialization of the wound. D (Debridement), removal of non-viable tissue from the wound in the presence of colliquative (wet) necrosis or limited (demarcated) areas of dry necrosis in the wound reduces the number of bacteria and the intensity of their growth respectively reduces the perifocal inflammatory process [2, 5–8, 11, 13–15]. It also includes the opening and drainage of purulent effusions with precise step-by-step necro- and, if necessary, sequesternecrectomy. At the same time, simultaneously during necrectomy, cells in the state of necro- and parabiosis are also removed. I (infection), effective antibacterial / antibiotic treatment of this patients [25–28, 30, 31]. It includes the

topical use of antiseptics and antibiotic-containing liniments and, if necessary (if indicated), systemic antibiotic therapy, both empirical, clinically based, and antibiotic therapy according to the results of bacteriological examination (culture of wound discharge with antibiogram) [4, 10–12, 27, 28]. T (Tissue management), creating an appropriate environment in the DecU, wound care and stimulation of marginal epithelialization. Tissue management measures also include mechanical effects, stepwise removal of bacterial and fibrinous layers containing pathogenic microorganisms and small areas of necrosis; the use of wet and dry bandages, sessions of therapeutic ultrasound exposure to wounds, laser therapy, autolytic therapy, gel, and absorbent bandages [2, 6, 10, 11, 13–15, 20–23], which have an osmotic effect. Local enzyme therapy in the form of trypsin, chymotrypsin, collagenase powder; hyperbaric oxygenation, negative pressure wound therapy, aspiration drainage, cell therapy, “artificial skin”, early autodermplasty, etc. are widely used [9–12, 27–30]. E (Educations) – provides adequate care, monitoring of the dynamics of the wound process of pressure ulcers, and correction of local venous or lymphatic stasis. Physiotherapy courses are prescribed for this category of patients. The use of non-steroidal anti-inflammatory therapy, systemic enzyme therapy with serratiopeptidase, vasodilators, lymphovenotonics is also indicated [7–9, 24–27].

The cause of stage II-III pressure ulcers of the sacroiliac region was prolonged forced body position in combination with physical inactivity [7, 8, 11, 18, 20] in 16% of patients after cerebral circulatory disorders of the ischemic type, in 12% of patients with incurable oncological pathology, in the remaining 4% after an unoperated femoral neck fracture (derotation

bandage was applied), in patients with some polyarthritis and 1% of patients with multiple sclerosis. Ischemic disease and grade II-III hypertension were diagnosed in all cases. Local hyperemia, epidermal desquamation, and maceration with suppurative wounds were noted in 16% of patients, coagulation necrosis in 79%, colliquative necrosis with purulent discharge in 51% of the subsample, and purulent effusion in 15% patients. Adequate surgical interventions was performed in all cases of colliquative necrosis and suppuration [18–22]. The absence of granulations, pathological exudation from the DecU, redness of the skin in the wound area, the presence of non-viable loci, and an unpleasant odor (foul-smelling purulent discharge) indicate critical pathogenic colonization of the bedsores and at the same time the need for combined treatment with general antibiotic therapy and topical use of antiseptics and antibiotics [8, 9–12, 17–20] including ofloxacin liniment, bacitracin zinc with neomycin sulfate, etc. In 22% of the subsample of patients, a staged simplified NODITE strategy adapted for use in palliative care units (department) was used. The area of colliquative (wet) necrosis in DecU was precisely surgically removed by excision en block within healthy and / or necrobiotic tissue with the removal of pus and necrotic detritus [7, 16–20] (Fig. 5, 6).

Under visual and tactile control, purulent leaks were diagnosed, opened, and sanitized intraoperatively in stages with precise step-by-step necro-, and in 7% of patients – sequestrectomy, the formed cavity was washed with a solution of hydrogen peroxide, chlorhexidine, and an aqueous solution of the antiseptic Polividone-iodine, which also achieved complete evacuation of pus and the remains of necrotic detritus. If necessary, counterparts were



Fig. 5. Gluteal area stage IV pressure ulcer with colliquative necrosis of soft tissues, putrefactive phlegmon in an 88-year-old woman



Fig. 6. Stage IV pressure ulcer with necrosis in an 87-year-old woman. The necrectomy stage with sanitation of the main soft tissues and the Achilles tendon purulent-necrotic area

applied. Purulent effusions were drained with hydrophilic liniment, with rubber, latex or polyethylene outlets and tampons moistened with Polividone-iodine solution, etc [27–30].

The necrectomy stage with sanation of the main soft tissues purulent focus. If it was impossible to remove of necrotic masses at once from the standpoint of Damage control of the patient's general condition or additional/repeated necrosis formation [4, 6–8, 12, 21–23], the tactics of repeated, programmed DecU renelectomies were used [28–30].

Drainage was removed for 3–5 days, after which local application of ointment bandages was performed until the wound / bedsores was completely cleaned and granulated [4, 8, 11–13]. The criterion for the effectiveness of care was the formation of a granulating wound surface with minimal exudation, which we observed in all clinical observations, or (and) with the presence of marginal epithelialization (Fig. 7) and (or) local crust formation ($\chi^2=25.21$, $p\leq 0.05$).

Taking into account the peculiarities of the pathogenesis, morphogenesis, and clinical course of DecU with colliquative soft tissue necrosis and purulent complications that affect the course of healing, the use of not only antibiotic therapy but also removal of necrosis, adequate drainage, and local treatment led to a significant reduction in the signs of purulent necrotic inflammation and an improvement in the rate of wound healing from $3.4 \pm 0.39\%$ to $4.2 \pm 0.23\%$ ($\chi^2 = 32.01$). The changes that occur are characteristic of the proliferative phase of the wound process – healing of the destroyed matrix, and cell regeneration [15, 18–21].



Fig. 7. Stage IV pressure ulcer of the sacroiliac region with extensive soft tissue necrosis (intraoperative photography) in patient M, 88 years old. Granulating wound. Marginal epithelialization. The condition after partial plastic of the soft tissues wound defect and use of secondary sutures

Signs of purulent necrotic inflammation and effective secondary prevention of complications constitute a set of criteria for effectiveness and economic feasibility, which, in our opinion, determines some clinical possibility in the palliative practice [14]. Some methods of autodermoplasty are of choice in case of a large skin defect, predicted significant changes in the surrounding tissues (bedsores ulcer), and close location of bone formations. It should be noted that the use of decompression orthopedic devices to reduce "chronic" constant pressure in the area of the DecU provides a positive effect in 60% of patients, halves the likelihood of necrobiosis progression, compared to patients who do not use unloading (decompression) devices. Using the NODITE strategy, we found that half of the patients in the main group had complete healing of complicated pressure ulcers within 45–60 days, compared to 35.7% in the control group ($\chi^2=31.14$, $p\leq 0.05$). Adequate necrotomy, local decompression of the problem area and the use of special anti-decubitus mattresses contribute to the regression of the pathological wound process and marginal epithelialization.

Conclusions

1. Successful prevention and treatment of decubitus ulcers (bedsores) in a palliative care department (unit) are possible, appropriate, and reasonable. We have modified the DOMINATE sequence taking into account the clinical features of pressure ulcers, created a pathogenetically sound and adapted for treatment original scheme (NODITE strategy) with an adequate sequence of care and complex therapy.

2. It is necessary to take into account the peculiarities of the wound process in the formation of purulent pressure ulcers, the composition of the microflora, which affects the course of healing and requires not only antibiotic therapy but also the use of topical antiseptics, the need to correct background and comorbid pathology.

3. Methods and strategies for the treatment of bedsores with soft tissue necrosis and purulent complications are based on the DOMINATE strategy and include a clinically sound sequence of care measures, systemic and local therapy; precision necrectomy with revision of leaks, and combined drainage with tamponade of the surgical wound.

4. The strategy for the prevention, care, and treatment of decubitus ulcers includes N (Nutrition), adequate nutritional support; O (Offloading), offloading, decompression – reduction of external pressure on the pressure ulcer by the use of special care products and orthopedic devices, which contributes to the proliferative phase of the wound process; D (Debridement), removal of non-viable tissue from

the wound, opening, and drainage of purulent effusion with precise step-by-step necro- and, if necessary, sequestrectomy; I (infection), the most appropriate combination of general antibiotic therapy and topical application of antiseptics and antibiotics; T (tissue management), creating an appropriate environment in the wound, care, and stimulation of marginal epithelialization; E (education), providing appropriate care, monitoring the dynamics of the bedsores wound process and correcting local venous and/or lymphatic stasis.

5. Our proposed the NODITE strategy (simplified palliative modification of the DOMINATE strategy) for the complex treatment of pressure ulcers is based on clinical criteria, is simple and easy to use; a significant reduction in pain, signs of purulent necrotic inflammation and effective secondary prevention of complications constitute a set of criteria for effectiveness and economic feasibility, which, in our opinion, determines the possibility of its implementation in the clinical practice of some palliative care unit.

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