

BENEFITS OF HYDROCOLLOID-ABSORBENT DRESSINGS IN “DIABETIC FOOT” THERAPY

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Abstract: The incidence of diabetes is constantly increasing, so in 2014 about 8, 5% of adults over the age of 18 had diabetes worldwide. Also mortality in patients with diabetes is increased, only in 2015 being the direct cause for 1.6 million deaths worldwide. Worldwide, there are currently 425 million people living with diabetes; by 2045, 629 million people are expected to have diabetes. The authors present the case of patient I.A. 46 years old, male, from urban area, known with type 2 diabetes mellitus insulinotreated, secondary to acute pancreatitis, necrotico-haemorrhagic, operated on antecedents, which is presented in our service accusing spontaneous sensitivity and palpation of the lower limb right, premaleolar ulceration on the inner face of the lower right limb, with Celsian signs at this level, paresthesias at the level of the right leg, muscular weakness, weight loss. Alternative absorbent-hydrocolloid therapy is a feasible therapeutic option for patients with varicose ulcer wounds, especially in those with diabetic background. The combination of targeted antibiotic therapy, systemic treatment, local surgical treatment followed by local colloidal-absorbent treatment has very good results in a much shorter time than conventional, conservative therapy. Prophylaxis of any “diabetic foot” disease is extremely important. Therapeutic education is a major role in preventing the complications of diabetes. The diabetic patient should be trained and learned in order to prevent problems that may occur in the foot.

INTRODUCTION

Diabetes mellitus is a chronic pancreatic disease, a heterogeneous syndrome, from the etiological, pathogenic, clinical and therapeutic point of view being characterized by chronic hyperglycemia, caused by the decrease of the insulin resistance and/or the reduction of the insulin sensitivity (insulin resistance) of various tissues, mainly the muscle, adipose and liver.

The term “diabetic foot” encompasses more foot disorders in patients with diabetes mellitus, which can lead to tissue damage, and eventually lead to lower limb amputations. It refers to the specific pathology determined in the lower limbs as a result of the diabetes evolution over several years.

The phrase “diabetic foot” has come into use as a concept that integrates several disorders or complications of diabetes mellitus (diabetic polyneuropathy, diabetic microangiopathy, diabetic foot ulcers, gangrene).(1,2)

The incidence of diabetes is constantly increasing, so in 2014 about 8,5% of the adults over 18 years old had diabetes, worldwide. Also, the mortality in the cases of patients with diabetes is increasing. In 2015, it represented the direct cause for 1.6 million deaths, worldwide.(3)

Worldwide, there are currently 425 million people with diabetes mellitus; by 2045, there will be 629 million people with diabetes. The number has been estimated by applying the prevalence estimated in the “IDF Diabetes” Atlas to the number of people aged 20-79 years estimated by the United Nations Population Division. The estimation includes both diagnosed and undiagnosed diabetes.(4)

Today, diabetes affects 1 in 10 Romanians. According to a study of the National Institute of Statistics, in 2015, Romania was ranked 109 out of 224 in a world ranking of life expectancy, at national level, the average life expectancy being 75.4 years. Also, Sibiu County is in the top of counties where patients with type 2 diabetes have high life expectancy, within the context of a generally high life expectancy (according to the National Institute of Statistics).(5)

Diabetes is mentioned since ancient times, by the presence of its symptoms represented by polyphagia, polydipsia, polyuria and weight loss, but also by flies, bees and other insects that were attracted to the urine of individuals suffering from diabetes mellitus.

Areteu from Cappadocia (81-138 BC) gave it the name “diabetes” (siphoned urination), and Avicenna (930-1037) was the first great clinician, who in his basic work “The Canon”, analysed and treated many ill, describing some of its complications.(6)

The most important moment in the history of diabetes is represented by Langerhans, who, in 1869, describes the existence of cell formations in the pancreas of particular shape with respect to the rest of the pancreatic tissue, which were later named the islets of Langerhans.(7)

In 1912, after careful studies on the hepatic glycogenic function and demonstrating the role that the function of the antidiabetic hormone has on it, the great physiologist and clinician, N.C.Paulescu (1869-1931), predicts the function of the pancreas as we know it today: the pancreas is a gland with mixed secretion, an external one, which by producing enzymes

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ensures the digestion of carbohydrate, lipid and protein foods to convert them into absorbable compounds in the intestines; and another internal one, to make these substances: carbohydrates, lipids and proteins to be used in peripheral tissues.(8,9,10,11)

CASE PRESENTATION

The authors present the case of patient I.A. 46 years old, male, from urban area, known with type 2 diabetes mellitus insulinotreated, secondary to acute pancreatitis, necrotico-haemorrhagic, operated on antecedents, which is presented in our service accusing spontaneous sensitivity and palpation of the lower limb right, premalleolar ulceration on the inner face of the lower right limb, with Celsian signs at this level, paresthesias at the level of the right leg, muscular weakness, weight loss.

Male patient, I.A. 46 years old, from urban area, known with insulinotreated type 2 diabetes mellitus, secondary to acute necrotizing-haemorrhagic pancreatitis, previously operated, presents in our service complaining about sensitivity, spontaneously and on palpation of the lower right limb, premalleolar ulceration on the inner face of the lower right limb, with Celsian signs at this level, paresthesia at the level of the right leg, muscular weakness, weight loss.

Family medical history is insignificant, and from the personal medical history we note that the patient was diagnosed with chronic toxic hepatitis, diabetic retinopathy, stage III polyneuropathy, without any other significant conditions.

Living and working conditions are inadequate, the patient being a smoker with a smoking index of 375 (15 cigarettes / day for about 25 years) associated with chronic heavy drinking.

The general clinical examination revealed a patient with a moderately altered general condition, conscious, afebrile. The skin and mucosa were slightly pale, with the presence of an oval round ulceration of approximately 12 cm in the largest diameter, located at the level of the right premalleolar region, on the internal side showing Celsian signs, with cellulite on the inside of the right leg. The ulceration shows areas of necrosis and sphacelus, being intensely fetid (figure no. 1).

Figure no. 1. The ulceration shows areas of necrosis and sphacelus



Normal adipose cell tissue represented - BMI 19.03 kg / m², Ta = 84 cm, Height - 189 cm, W = 68.5 kg, non-palpable superficial ganglion-lymphatic system, undamaged and mobile osteo-articular system, normotonic, normokinetic muscular system. Without other pathological changes in the respiratory, cardio-vascular, digestive and uro-genital systems.

The patient has had paresthesia in the lower limbs for about 5 years and the recent loss of tactile sensation.

Laboratory tests showed a marked increase of glycosylated hemoglobin to 11.5%, Complete Blood Count without changes except for 12000/mm leukocytosis, creatinine and urea within normal limits, TGO =82, TGP=110, slightly increased alkaline phosphatase, high inflammatory markers ESR= 25mm / h, CRP = 5mg / dL, fibrinogen = 440.

Urine examination showed rare leukocytes and dysmorphic red blood cells, rare microbial flora, relatively frequent flat epithelial cells.

Oscillometry: 1/3 lower right leg = 0 div, left = 1 div.

The right-leg radiograph showed no bone changes at this level.

Doppler ultrasound of veins: Bilateral permeable deep venous system of the lower legs, compressible with reflux following provocation manoeuvre. Permeable, compressible internal bilateral saphenous vein with significant reflux during Valsalva's manoeuvre at the level of the bilateral arch and after provocation manoeuvre on the bilateral thigh and calf line. External saphenous vein was bilaterally permeable, compressible, without reflux at provocation manoeuvre.

Package of varicose veins in the inner surface of the right leg, permeable, compressible, with significant reflux observed with provoked manoeuvre, tributary veins both in the saphena magna, and in the right saphena parva.

Doppler ultrasound of arteries: arterial flow present in the superficial and deep right femoral arteries, and significantly diminished by narrowing of the popliteal artery.

Prior to the start of the therapeutic manoeuvres, tissue was collected from the wound that was sent for bacteriological examination and antibiogram (table no. 1). The germ developed was *Proteus mirabilis*, with maximum sensitivity to Ciprofloxacin, Amikacin etc., according to the antibiogram result.

Table no. 1. The antibiogram results

VITEK automated microbial identification system	
Amikacin- <i>Proteus mirabilis</i>	Sensitive
Amoxicillin/Clavulanic acid- <i>Proteus mirabilis</i>	Sensitive
Ampicillin- <i>Proteus mirabilis</i>	Sensitive
Cefepime- <i>Proteus mirabilis</i>	Sensitive
Cefotaxime- <i>Proteus mirabilis</i>	Sensitive
Ceftazidime- <i>Proteus mirabilis</i>	Sensitive
Ciprofloxacin- <i>Proteus mirabilis</i>	Sensitive
Gentamicin- <i>Proteus mirabilis</i>	Sensitive
Imipenem- <i>Proteus mirabilis</i>	Intermediary
Piperacillin/Tazobactam- <i>Proteus mirabilis</i>	Sensitive
Trimethoprim/Sulfamethoxazole- <i>Proteus mirabilis</i>	Sensitive
Ertapenem- <i>Proteus mirabilis</i>	Sensitive
Meropenem- <i>Proteus mirabilis</i>	Sensitive
Wound (abscess, ulcer etc.) – bacteria cultivation	On culture medium, pathogenic germs have developed/ Aerobic germs have not been developed

Based on the clinical and paraclinical data, we diagnosed varicose ulcer, premalleolar region of the right leg, internal face. Chronic venous insufficiency, hydrostatic varicose veins stage CEAP VI, type 2 diabetes mellitus insulinotreated, unbalanced, diabetic retinopathy, diabetic polyneuropathy stage III, chronic toxic hepatitis.

From the therapeutic point of view, immediately after the collection of samples for the bacteriological examination and the antibiogram, a broad spectrum antibiotic treatment was instituted by combination of Amikacin 2 ampoules daily and Ciprofloxacin 2 times 3 ampoules daily. The correction of glycemic values was started by administering an insulin regimen.

Venotonics - 4 tablets of Endolox was administered daily, antithrombotic - Vessel Due, anticoagulants - Fragmin 5000 and elastic contension with declive drainage.

The local treatment of the wound began after the mechanical debridement of the wound with excision of the

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sphacelus and the necrosis areas and took place in the Sibiu County Clinical Emergency Hospital polyclinic's surgery ward under local anesthesia.

The loss of the substance being high, the treatment began with the local application of moist, TenderWet absorbent dressings of 10 cm diameter (sterile dressing in pillow shape with superabsorbent polymer, ready for use, being activated with Ringer solution). They are applied after washing the wound only with saline without using other astringent, irritating solutions.

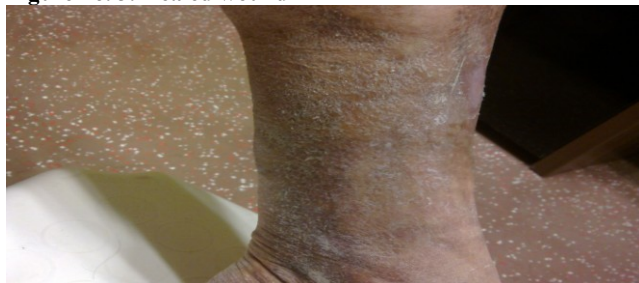
Above the patch, a self-adhesive elastic band of the Peha-Haft type was applied and then the compression stocking was put on to be worn throughout the day. The dressing thus applied will be changed every 48 hours. We changed it 3 times a week. After 3 weeks of dressing of this kind the wound looked clean, without sphacelus and necrosis, with the appearance of granulation buds (figure no. 2).

Figure no. 2. The clean wound, without sphacelus and necrosis with the appearance of granulation buds



At this point we passed to the second dressing of the Hydrocol type (it is a self-adhesive absorbent dressing with hydrocolloid, with a semipermeable upper layer, waterproof for microorganisms and water.). It was applied after wound washing with saline, changing it initially at 48 hours, and then at 3 and 4 days. At 4 weeks of applying the dressings with Hydrocol, the wound was completely healed having the appearance as in figure no. 3

Figure no. 3. Healed wound



We mention that after a week of Tender Wet dressing, the patient was discharged, the rest of the treatment being performed in outpatient clinic.

DISCUSSIONS

Tender Wet bandages are hydroactive, superabsorbent dressings whose main component is a polyacrylate polymer (SAP). The substance with bactericidal role, PHMB (polyhexamethylene biguanide), is bound to SAP and activated with Ringer's solution. The part that comes in contact with the wound has silicone striations that prevent the bandage from sticking.

Active TenderWet softens and removes necrosis and

fibrin, reduces the number of germs in the wound and creates a moist environment, optimal for the healing process. The dressing is indicated in the case of chronic wounds of varied etiology (diabetic gangrene, decubitus ulcer, varicose ulcer etc.).

The Hydrocol dressing is a self-adhesive absorbent dressing with hydrocolloid, with a semipermeable top layer, impermeable for microorganisms and water. The hydrocolloid transforms into a gel when in contact with wound exudate and forms a moist environment which has a stimulating effect on granulation and epithelialisation. It is recommended in case of uninfected wounds, in the phase of granulation and epithelialization.

The dressing is changed when a vesicle appears on its surface, visibly discoloured (approx. 3 days).

Another alternative is vacuum therapy which involves sealing the wound in vacuum being an adjuvant treatment that uses the negative pressure to drain fluids from an open wound, occluded with a membrane impermeable to germs and liquids, but permissive to vapours and a system of tubes attached to a vacuumed collection container.(12,13) These conditions determine the stimulation of the granulation and diminish the bacterial colonization, and the negative pressure contributes to the closure of the wound walls, diminishing its volume in the absence of the suture material, the increase and the improvement of the vascularization of the wound, the permanent evacuation of the secretions and the local detritus, isolation of the septic outbreak, decreasing the frequency of dressing change which causes the reduction of treatment costs, visualization of the wound due to the transparency of the film and also bacteriological analysis of the secretions in the container. The method allows for the resorption of chronic edema causing increased local blood flow and can be combined with local lavage.(12,14)

The mechanism of action of vacuum therapy in suppurative wounds is not yet known. One of the hypotheses (15,16) shows that the application of micromechanical forces at the wound level stimulates the cell division being demonstrated that the cells undergoing elongation tend to divide while the retracted cells are inert.

Other studies (17,18) show that the local blood flow increases four times when a depression of -125mmHg is applied, and the formation of the granulation tissue significantly increases, respectively by $63.3 \pm 26.1\%$ in continuous vacuum application and $103\% \pm 35.3\%$ in discontinuous technique. McCallon (19) demonstrates a shorter healing time for diabetic foot in much shorter days (22.8 ± 17.4) for vacuum therapy than for simple wound dressing treatment where the healing time was almost doubled (42.8 ± 32.5).

In this case, we considered the optimal alternative therapy by absorbent-hydrocolloid treatment due to the comorbidities and the appearance of the wound.

CONCLUSIONS

Alternative absorbent-hydrocolloid therapy is a feasible therapeutic option for patients with varicose ulcer wounds, especially in those with diabetic background.

Easy local therapy makes outpatient treatment accessible through the polyclinic service or even at home through the dressing programme at home.

The combination of targeted antibiotic therapy, systemic treatment, local surgical treatment followed by local colloidal-absorbent treatment has very good results in a much shorter time than conventional, conservative therapy.

Prophylaxis of any "diabetic foot" disease is extremely important. Therapeutic education plays a major part in preventing the complications of diabetes.

The diabetic patient should be trained and educated in

order to prevent problems that may occur at foot level.

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