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Efficacy of Special Coatings in the Treatment of Trophic Ulcers

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ABSTRACT

Background. Trophic ulcers are the cause of household and cosmetic inconveniences, often patients experience pain, fear of physical exertion, and fear of damaging the lower limb since minimal trauma can lead to a rapid progression of the pathological process.

Material and methods. A total of 186 patients with trophic leg ulcers of venous etiology, who were hospitalized in the multidisciplinary clinic of the Tashkent Medical Academy for the period from 2014 to 2022, were examined. All patients were randomized into a study group and a control group.

Results. Based on the studies carried out, it has been shown that the method of using moisturizing wound coverings in patients with trophic ulcers of the lower extremities helps to improve the indicators of local microcirculation, stimulates the processes of purulent necrotic cleansing of ulcers from purulent-necrotic masses and bacterial flora, accelerates the appearance of granulation tissue and reduces the time of epithelialization of ulcer defects.

Conclusion. The method of using moisturizing wound dressings against the background of complex pathogenetic therapy in patients with venous trophic ulcers of the lower extremities leads to a significant reduction in the treatment period.

Keywords: Trophic ulcers of the lower extremities, treatment of chronic wounds of the extremities.

INTRODUCTION

Treatment of trophic leg ulcers is one of the most urgent and complex problems of modern medicine [1].

The medical and social significance of the problem is associated with the widespread of this pathology, the disease of people of working age, a high level of disability, a long period of treatment, a tendency to recurrence of trophic ulcers, and significant economic costs [2].

Trophic ulcers are the most common complication of chronic venous insufficiency of the lower extremities and occur in 2% of the working-age population of industrialized countries [3].

In the elderly, the incidence of trophic ulcers reaches 4-5% [4].

Trophic ulcers are the cause of household and cosmetic inconveniences, often patients experience pain, fear of physical exertion, and fear of damaging the lower limb, since a minimal injury can lead to a rapid progression of the pathological process [5].

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Trophic ulcers lead to social maladaptation of patients, increase the period of disability and, thus, reduce the quality of life of patients [6].

Trophic ulcers of the lower extremities are the most severe form of chronic venous insufficiency accompanying varicose veins and post-thrombotic disease of the lower extremities [7].

Trophic ulcers of a venous nature account for more than 52% of all leg ulcers [8].

Treatment of trophic leg ulcers, especially with a decrease in reparative processes and a tendency to recurrence, is usually long-term and consists of several methods, which leads to significant economic costs [9].

The real economic losses of society are further increased by the loss of the patient's ability to work and the exclusion of caregivers from production [10].

Taking into account the above, it can be concluded that the treatment of trophic ulcers is not only an urgent medical but also a significant socio-economic problem for modern society.

Over a long period of history in the treatment of trophic leg ulcers, more than 300 methods have been developed and tested [11].

A huge number of treatment methods only testifies to their insufficient effectiveness [12].

At present, along with surgical methods, mechanical, physical, and chemical methods, ultrasound, light therapy, laser and plasma flow treatment are widely used [13].

The increase in the number of elderly patients with severe concomitant diseases and a high risk of surgical intervention dictates the need for minimally invasive treatment methods [14].

One of the minimally invasive methods of treatment is the use of wound dressings. The therapeutic effect of wound dressings is due to the effect of the drugs that are part of them. In addition, a special microclimate with optimal temperature and humidity is formed under the dressing, which helps to accelerate the epithelialization of the ulcer defect. However, many issues related to the effects of moisturizing wound dressings have not been sufficiently studied [15].

The study aimed to improve the results of complex treatment of venous trophic ulcers in gerontological patients by using moisturizing wound coverings.

MATERIAL AND METHODS

To achieve the aim of the study, we examined 186 patients with trophic ulcers of the lower extremities of venous etiology, who were on inpatient treatment in the multidisciplinary clinic of the

Tashkent Medical Academy for the period from 2014 to 2022. All patients were randomized into a study group and a control group.

Patients with trophic leg ulcers of venous etiology, who were treated with modern wound dressings and created a moist environment, formed the main group (101).

The control group consisted of patients (85) who were treated with standard conservative therapy with the local use of indifferent ointment dressings.

Of the 186 patients examined, 128 were women and 58 were men. In the study group, there were 30 men and 71 women, and in the control group, 28 men and 57 women. The mean age of the patients was 81.4 ± 3.9 years. The average duration of non-healing trophic ulcer was at least 5 years. The localization of the ulcer defect in patients of both groups was typical – mainly in the area of the medial malleolus and the lower third of the tibia. 82.2% of patients had large and giant ulcers.

A characteristic feature of all the studied patients was the presence of severe concomitant diseases due to their advanced age. In most cases, it was two or more diseases. At the same time, the vast majority of the examined patients suffered from concomitant diseases of the cardiovascular system. 46.7% of patients had angina pectoris, and 45.6% suffered from hypertension.

The clinical study was carried out according to traditional rules and consisted of clarification of the patient's complaints, collection of anamnesis, and study of general and local status. All patients were examined for organs and systems, with special attention paid to the external examination of the affected limbs. The lower extremities were carefully examined from all sides in natural daylight, in the horizontal and vertical positions of the patient. The nature and degree of trophic disorders of the lower extremities, the presence of symmetrical lesions on both limbs, changes in the shape of the nails and hair loss were taken into account, and the circumference of the lower extremities was measured at various levels.

A prerequisite for the examination was the determination of the pulsation of the main arteries of the lower extremities at various levels.

In addition to general clinical examination methods, the state of the coagulation and anticoagulation systems of the blood was studied (clotting time in minutes, platelet count, hematocrit, activated calcification time (ATR), activated partial thromboplastin time (APTT), prothrombin index, thrombin time, fibrinogen, fibrinolytic activity, international normalized ratio (INA), blood clot retraction). duplex angioscanning, microcirculation studies, and cytological studies.

During the clinical assessment of the local status, attention was paid to the condition of the edges, walls and floor of the wound (color, the presence of areas of necrosis, fibrinous plaque), the nature and amount of wound discharge, the condition of the surrounding tissues (the severity of hyperemia, edema, infiltration).

The state of granulation tissue (color, gloss, granularity, bleeding) and the dynamics of epithelialization of wound edges were studied.

The indicators were evaluated according to a 4-point system:

1 – significant edema, pronounced hyperemia of the wound edges, purulent discharge, absence of signs of epithelialization and granulation in the wound,

2 – moderate edema and hyperemia of the wound edges, serous-purulent discharge, single granulations, weak marginal epithelialization,

3 – slight edema and hyperemia, serous discharge in the wound, islet and confluent granulations, marginal epithelialization,

4 – there is no edema or hyperemia of the wound edges, the discharge in the wound is scanty and serous, granulations occupy the entire area of the wound, and pronounced marginal epithelialization.

Separately, the degree of pain in the wound was assessed in time, before and after dressing.

The data were compiled after interviewing the patient and were evaluated on a 4-point system:

1 – absence of a sign,

2 – mild manifestations of the sign (the presence of pain in the wound that does not require the prescription of analgesics),

3 – moderate manifestations of the sign (the presence of pain with the need to prescribe analgesics),

4 – a pronounced manifestation of the sign (the need for general anesthesia during dressing).

The study of venous hemodynamics was carried out using ultrasound duplex angioscanning on ultrasound scanners.

Dilated saphenous veins, horizontal and vertical venous refluxes, insufficiency of the valvular apparatus of the main and perforating veins, and quantitative characteristics of venous flows, as well as the state of the arterial bed, were determined.

Statistical processing of treatment results was carried out using the statistical processing program "Statistica 6.0».

RESULTS

After the examination, it was revealed that the cause of trophic ulcers of the lower extremities in 34% of patients was varicose veins and in 66% - post-thrombophlebitic syndrome.

The main cause of ulcers was pathological reflux. It was revealed that there was no significant difference in the localization of pathological reflux in the study and control groups. In the study group, the use of moisturizing wound dressings showed significantly better indicators of the dynamics of the wound process, primarily due to the rapid cleaning of wounds after the application of modern wound dressings (3.8 ± 0.4 days) compared to the control group (10.3 ± 0.6 days). At the same time, the complex use of dressings with moisturizing wound coverings did not hurt the subsequent dynamics of the wound process, and reduced the time of appearance of granulations and marginal epithelialization to 6.8 ± 0.7 and 9.6 ± 0.9 days, respectively, compared to the control group of 14.3 ± 0.9 and 16.6 ± 0.9 days.

The median duration from the start of treatment to wound closure was 18.4 ± 1.2 days in the study group and 24.8 ± 1.6 days in the control group. In the case of large ulcers (larger than 5 cm^2), after cleaning the ulcers and clean granulations, surgical interventions were performed on skin grafting, both in the main and in the control groups. Postoperative management of patients in the study and control groups was identical. Autodermoplasty of long-term non-healing wounds and trophic ulcers was performed in 48 (61.6%) patients, subfascial ligation of tibia perforants, one-stage autodermoplasty of trophic tibia ulcer in 15 (19.2%), partial phlebectomy, subfascial ligation of tibia perforants with one-stage autodermoplasty of trophic leg ulcer in 15 (19.2%).

Analysis of the results after autodermoplasty with a perforated split flap showed that in the study group, complete ulcer closure was noted in 80.6% of patients, partial healing in 6.4%, and only in 13% of patients the trophic ulcer could not be closed due to its large size. In the control group, the results were 67%, 7% and 26%, respectively.

The terms of complete epithelialization of the autodermal flap with epidermal restoration in the study group were shorter and amounted to 12.8 ± 2.2 days, in the control group 22.4 ± 2.8 days.

Of the 186 patients of the control and study groups, 116 (62.4%) were operated on to eliminate pathological reflux, the remaining 70 (37.6%) were treated conservatively, including 54 (77.1%) patients due to refusal of surgery and 16 (22.9%) patients due to the impossibility of performing surgery in case of extensive trophic ulcers

and tissue induration. Of the 256 surgical interventions performed, 36 (14.1%) cases had postoperative complications, including suppuration in 12 (33.3%) cases, marginal necrosis in 11 (30.6%) cases, infiltrate in 8 (22.2%) cases, and lymphorrhea in 5 (13.9%) cases.

The analysis of the results showed that during the treatment of trophic ulcers in the control group of patients, the ulcer surface was cleared of purulent-necrotic masses on 10.3 ± 0.6 days, and the appearance of granulations on 14.3 ± 0.9 days. The area of the ulcer defect in the control group decreased to an average of $94.9 \pm 2.8\%$ on day 7, $86.7 \pm 3.4\%$ on day 14, $74.5 \pm 2.4\%$ on day 20, and $62.9 \pm 1.9\%$ on day 30.

The results of the planimetric studies in the main group revealed that against the background of the treatment, ulcer defects decreased to an average of $92.5 \pm 1.8\%$ on the 7th day, $76.4 \pm 2.7\%$ on the 14th day, $57.3 \pm 2.3\%$ on the 20th day and up to $44.3 \pm 3.2\%$ on the 30th day. There was a marked acceleration in the reduction of the ulcer surface area in the study group compared to the decrease in the ulcer area in the study of patients in the control group.

In the main group of patients, the time of purulent-necrotic masses was cleared 8 days earlier than in the control group. In the control group, the appearance of bright red granulation tissue was noted on days 14.3 ± 0.9 , in the study group, granulation tissue developed on days 6.8 ± 0.7 .

During the cytological examination of the smear impressions before the start of treatment, a large amount of mixed microflora in the form of rod and coccal forms of microorganisms was observed. In patients of the control group, according to the cytological examination before the start of treatment, neutrophil indicators were $93.8 \pm 1.3\%$, later on the 5th day $92.4 \pm 1.5\%$. By 10 days, there was a further decrease in the number of microflora and neutrophils. There is an increase in the number of macrophages and fibroblasts, and young and mature fibroblasts are detected. Cytograms acquire an inflammatory and regenerative character.

The number of mononuclear phagocytes in the cytograms of patients in the control group increased from $1.4 \pm 0.2\%$ to $2.0 \pm 0.2\%$ on day 5 of treatment, on day 10 it was $2.6 \pm 0.1\%$, on day 15 it was $3.1 \pm 0.2\%$, and on day 20 it was $3.9 \pm 0.2\%$.

The number of immature macrophages also increased from $1.2 \pm 0.1\%$ to $2.0 \pm 0.1\%$ on day 5, $3.8 \pm 0.2\%$ on day 10, $5.2 \pm 0.2\%$ on day 15, $6.7 \pm 0.3\%$ on day 20, young fibroblasts from $1.2 \pm 0.2\%$ to $1.6 \pm 0.1\%$ on day 5, $2.7 \pm 0.1\%$ on day 10, $3.4 \pm 0.2\%$ on day 15, $4.3 \pm 0.2\%$ on

day 20 and mature fibroblasts from $0.8 \pm 0.1\%$ to $1.5 \pm 0.2\%$ on day 5, $2.4 \pm 0.2\%$ on day 10, $3.7 \pm 0.1\%$ on day 15, $4.8 \pm 0.2\%$ on day 20.

On day 20, the appearance of fibroblasts of $0.8 \pm 0.1\%$ was noted. There was a decrease in coccal and bacillus flora. The amount of detritus decreased (3 times on the 20th day).

In the study of smear impressions in the study group on day 5, a characteristic cytological picture corresponding to the inflammatory type of cytogram was observed, but the microbial contamination of wounds was insignificant, there was no intracellular microflora, wound detritus and destroyed leukocytes.

On day 10, the cytological picture was characterized by an increase in the number of unchanged leukocytes, corresponding to the regenerative-inflammatory type of cytogram, mature macrophages and fibroblasts were detected.

On day 5, there was a decrease in the volume of fibrous-necrotic masses and the degree of neutrophilic infiltration from $93.8 \pm 1.2\%$ to $85.3 \pm 1.4\%$.

On day 10, the decrease reached $77.2 \pm 1.7\%$, on day 15 $67.8 \pm 1.8\%$ and on day 20 $61.4 \pm 2.1\%$. The number of mononuclear phagocytes increased from $1.4 \pm 0.2\%$ before treatment to $3.9 \pm 0.2\%$ on day 5 from the moment of treatment, $5.2 \pm 0.1\%$ on day 10, $8.4 \pm 0.2\%$ on day 15, $9.3 \pm 0.2\%$ on day 20, immature macrophages from $1.2 \pm 0.1\%$ to $3.7 \pm 0.1\%$ on day 5, $5.4 \pm 0.2\%$ on day 10, $7.3 \pm 0.2\%$ on day 15, $8.7 \pm 0.3\%$ on day 20, young fibroblasts from $1.2 \pm 0.2\%$ to $2.6 \pm 0.1\%$ on day 5, $4.9 \pm 0.1\%$ on day 10, $6.7 \pm 0.2\%$ on day 15, $7.3 \pm 0.2\%$ on day 20 and mature fibroblasts from $0.8 \pm 0.1\%$ to $2.7 \pm 0.2\%$ on day 5, $4.8 \pm 0.2\%$ on day 10, $5.7 \pm 0.1\%$ on day 15, $6.8 \pm 0.2\%$ on day 20.

The appearance of fibroblasts of $0.8 \pm 0.1\%$ on day 5, $5.3 \pm 0.1\%$ on day 15, and $6.1 \pm 0.1\%$ on day 20 was noted. A rapid decline in coccal and bacillus flora was characteristic. The amount of detritus decreased, and on the 15th day, its absence in the smears was noted. On the 10th day, the appearance of epithelial cells was noted.

DISCUSSION

The study analyzed changes in cytogram types during treatment. At the beginning of treatment, necrotic types of cytograms prevailed in the study and control groups (79.2% and 70.6%, respectively). By day 5, the inflammatory type of cytograms prevailed in the study group (76.2%), while in the control group, all cytograms were necrotic and degenerative-inflammatory. By day 10, cytograms of wound impres-

sions in the main group were predominantly inflammatory (36.6%) and inflammatory-regenerative (42.6%), which corresponded to clinical changes in trophic ulcers. In the control group, inflammatory and regenerative types of cytograms began to prevail by 15 days [16].

Upon admission to the department, patients were cultured from trophic ulcers to determine the microflora and its sensitivity to antibiotics. The use of antibiotic therapy in patients with trophic ulcers is regulated by the international standards of the Oregon Protocols. Systemic antibiotic therapy was carried out in patients after the isolation of wound microflora and the determination of its sensitivity according to antibiogram data. In pure form, 47 (66.9%) cultures of the main pathogens of purulent soft tissue infection and 23 (33.1%) associations were isolated.

St. aureus was most often singled out in monoculture and associations (17.2% and 10.0%, respectively). The other most common pathogens were *St. epidermidis* (8.6% and 4.3%), *E. coli* (7.1% and 4.3%), *Proteus mirabilis* (7.1% and 4.3%), and *P. aeruginosa* (5.6% and 5.6%). Other microorganisms were less common. The degree of microbial contamination was comparable in the control and study groups at the beginning of treatment and ranged from 106 to 108 mt/ml. In wound cultures on day 7 from the beginning of treatment, wound contamination in the study group did not exceed 105 mt/ml, and in the control group, it was 10-107 mt/ml in all cultures.

Histological examination of trophic ulcers before treatment revealed necrotic and fibro-leukocyte layers extending to adipose tissue infiltrated by neutrophils.

Edema, perivascular and focal hemorrhages, hyperemia, and spasm were detected. On the 7th day, during the study of traditional methods of treatment, ulcers are cleared of fibro-necrotic and fibro-leukocyte masses and the formation of granulation tissue of a focal nature, mainly in the area of the ulcer edges. Granulation tissue is represented by numerous randomly located vessels, in which hyperemia, spasm, and microthrombi are detected. Numerous neutrophils are also found among the vessels, often forming perivascular infiltrates. Areas of fibrinoid necrosis are found in the surrounding fibrous tissue. On the 7th day after treatment of the trophic ulcer with moisturizing wound coverings, there are no fibrinous overlays on the bottom of the ulcer and areas of necrosis. The appearance of marginal epithelialization against the background of the growth of granulation tissue is noted, and the phenomena of hyperemia and leukocyte infiltra-

tion of the underlying layers are insignificantly expressed.

The immediate results of treatment within 3 months after discharge from the hospital were observed in 101 patients of the study group and 85 patients of the control group. In the study group, no ulcer recurrences were observed in the operated patients during the next 3 months. In 5% of patients in the control group, ulcer recurrence was noted [10].

Thus, it has been established that the local application of moisturizing wound dressings to create optimal healing conditions accelerates the process of cleansing the wound surface from purulent-necrotic detritus and microbial flora, enhances phagocytosis, reduces the inflammatory response, normalizes regional microcirculation, accelerates the formation and maturation of granulation tissue and epithelialization of ulcers.

CONCLUSION

According to clinical data, cytological and planimetric studies, the use of moisturizing wound dressings accelerates the process of clearing the surface of a trophic ulcer from purulent-necrotic detritus by 8 days faster than in the control group, as well as a sharp decrease in microbial flora, rapid relief of the inflammatory reaction and increased phagocytosis. Treatment of trophic ulcers with the use of wound dressings with a moisturizing effect: according to laser Doppler data, indicators of regional microcirculation by 30% compared to the control group. Scarring and epithelialization of trophic ulcers during treatment with wound coverings with a moisturizing effect occurs 7-10 days faster than in the control group. Comparative analysis showed that the method of local application of wound coverings, which creates a moisturizing effect in the treatment of trophic ulcers, in contrast to other methods of local treatment, makes it possible to improve the percentage of complete engraftment of transplanted skin flaps from 67% in the control group to 80.6% in the main group and thereby significantly improve the immediate and long-term results.

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Conflict of interest - The authors declare that the research was conducted in the absence of any commer-

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Data availability statement - The original contributions presented in the study are included in the article material, further inquiries can be directed to the corresponding authors.

Ethics approval and consent to participate - All patients gave written informed consent to participate in the study.

Consent for publication - The study is valid, and recognition by the organization is not required. The authors agree to open the publication.

Availability of data and material - Available

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**TROFIK YARALARNI DAVOLASHDA MAXSUS
BOG'LAMLARNINIG SAMARADORLIGI**

Atakov S.S.

Toshkent tibbiyot akademiyasi

ABSTRAKT

Dolzarbligi. Trofik yaralar uy va kosmetik noqulayliklarning sababi bo'lib, ko'pincha bemorlarda og'riq, jismoniy zo'riqishdan qo'rqish, pastki oyoq-qo'llarga zarar etkazishdan qo'rqish kuzatiladi, chunki minimal travma patologik jarayonning tez rivojlanishiga olib kelishi mumkin.

Material va usullar. 2014 yildan 2022 yilga qadar bo'lgan davr uchun Toshkent tibbiyot akademiyasining ko'p tarmoqli poliklinikasida shifoxonaga yotqizilgan venoz etiologiyaning trofik oyoq yarasi bilan og'rigan jami 186 nafar bemor tekshiruvdan o'tkazildi. Barcha bemorlar o'rganish guruhi va boshqaruv guruhiga tasodifiy ravishda kirishdi.

Natijalar. Olib borilgan tadqiqotlar asosida ko'rsatildiki, pastki ekstremitalarning trofik yarasi bo'lgan bemorlarda yara qoplamalarini namlantiruvchi qo'llash usuli mahalliy mikrosirkulyatsiya ko'rsatkichlarini yaxshilashga xizmat qiladi, yiringli-nekrotik massa va bakterial floradan yaralarni yiringli nekrotik tozalash jarayonlarini rag'batlantiradi, granulyatsiya to'qimalarining ko'rinishini tezlashtiradi va oshqozon yarasi nuqsonlarini epitelizatsiya qilish vaqtini qisqartiradi.

Xulosa. Pastki ekstremitalarning venoz trofik yaralari bo'lgan bemorlarda murakkab patogenetik terapiya fonida namlantiruvchi yara kiyimlarini ishlatish usuli davolash davrining sezilarli darajada pasayishiga olib keladi.

Tayanch so'zlar: trofik yaralari, surunkali yaralarini davolash.