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POSSIBILITIES OF VACUUM-INSTILLATION THERAPY WITH DIMEXIDUM AND BETADINE IN THE TREATMENT OF PURULENT WOUNDS

MATMUROTOV K.J.,
ISMAILOV U.S.,
YAKHUBOV I.Y.,
RAKHIMOV D. Dj.
Department of General Surgery, Tashkent

State Medical University, Tashkent, Uzbekistan.

With the use of vacuum therapy in the treatment of purulent wounds, it is not possible to actively localize the microflora in the wound, since the last is for a long time covered by an insulating sealed bandage. In addition, unlike with traditional methods of treating wounds with daily dressings, there is no effect of "washing away" detritus, necrotic masses, accumulations of leukocytes. The aim of the work was to develop a technique for vacuum-instillation therapy of wounds using dimexidum and betadine and to evaluate its effectiveness in comparison with the isolated application of controlled negative pressure in patients with purulent wounds of various origins. 58 patients with chronic purulent wounds, trophic ulcers with atherosclerotic lesions of the vessels of the extremities and diabetic angiopathy were examined. The first group of patients received isolated vacuum therapy, the second group was managed with vacuuminstillation therapy with dimexidum and betadine, the control group received traditional treatment with water-soluble ointments. Evaluation of the results of treatment was based on growth of granulation tissue, reduction of defect size, and level of cytokines in traumatic discharge. Vacuum therapy significantly improves the course of the wound process, which leads to faster cleaning, granulation of the defect and a decrease in its size. When added to NPWT instillations of antiseptics, anti-inflammatory, antioxidant and anabolic effects are enhanced, which facilitates more pronounced regenerative response and, accordingly, a reduction in the duration of treatment.

Key words: injury, wound infection, vacuum therapy, cytokines

INTRODUCTION

Wound infection is one of the main complications in surgery. Its relevance is explained by the significant number of primary purulent-inflammatory processes, as well as purulent-inflammatory complications after surgery, injuries, and trauma. Purulent complications most frequently occur in patients with diabetes mellitus, which significantly reduces the effectiveness of their treatment.

Modern methodology for local treatment of patients with wound infection is based on the use of various antibacterial drugs and biologically active dressings with specific properties, taking into account the phase of the wound healing process. One of the new methods for treating purulent wounds is vacuum therapy. The main positive effects of using NPWT (negative pressure wound therapy) are: active evacuation of wound secretions; maintenance and preservation of a moist tissue environment; Reduction of bacterial tissue contamination; reduction of interstitial edema

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[1, 3, 5]. This method has been shown to be significantly superior to traditional wound treatments using ointment dressings [2, 4, 7].

However, it is not possible to actively locally influence the microflora in the wound, as it is covered with an insulating, airtight dressing for a long period. Furthermore, there is no "washing out" of detritus, necrotic masses, or leukocyte accumulations, as occurs with traditional wound treatments using daily dressings. There are isolated reports in the literature on the positive effect of vacuum instillation therapy (NPWTi) in the treatment of purulent wounds with the administration of polymyxin B, bacitracin, silver nitrate solution, and polyhexanide (Prontosan) [6, 8, 9].

OBJECTIVE OF THE STUDY

To test a method of vacuum instillation wound therapy using external application of dimethyl sulfoxide and betadine and evaluate its effectiveness, compared to the use of isolated vacuum, in patients with purulent wounds of various origins.

MATERIALS AND METHODS

A total of 58 patients aged 54.3 ± 7.4 years were examined and were treated in the Purulent Surgery Department of Twins Medical Center from 2023 to 2025. Inclusion criteria for the study were the presence of chronic purulent wounds, trophic ulcers associated with atherosclerotic lesions of the extremity vessels, and diabetic angiopathy.

Exclusion criteria included decompensated cardiovascular and respiratory diseases, the consequences of a previous cerebrovascular accident, lower paraparesis, and paraplegia; mental disorders that prevent the patient from controlling the vacuum aspirator; and patient refusal.

The defect sizes ranged from 6 to 64 cm2, and the microbiological background consisted primarily of E. coli, Staphylococcus epidermidis, and Staphylococcus aureus.

All patients were divided into two groups:

Group 1 (20 patients) received isolated vacuum therapy; Group 2 (38 patients) received vacuum instillation therapy with topical application of the antiseptic and anti-inflammatory agents Betadine (n = 18) and Dimexide (n = 20). The groups were similar in wound size, degree of arterial insufficiency, bacterial contamination of the wounds, and comorbidities.

Data obtained from 10 patients with similar wounds and general somatic status were used as control parameters. They received traditional therapy using daily dressings, wound treatment with 3% H2O2 solution and 1:5000 furacilin solution, and application of water-soluble Levomekol ointments in combination with antibacterial therapy.

All patients had wound fluid collected at the beginning of treatment, on days 4–5, and on days 8–10 (during the change of vacuum dressings). Interleukin-6 (IL-6) and -10 (IL-10) and tumor necrosis factor (TNF-α) levels were assessed in the wound fluid using ELISA. Wound size was determined by application and calculation using surface area estimation formulas. Tissue was also collected from the wound edge on days 4–5 of treatment for subsequent histological examination.

Negative pressure wound therapy sessions were performed intermittently (10 min of vacuum at -125 mmHg, 3 min of no vacuum). Patients in Groups 1 and 2 received two VAC therapy sessions each over 4-5 days. NPWTi was administered using an inflow drain placed at the bottom of the wound. A 20% solution of dimethyl sulfoxide in 0.25% novocaine was administered daily. The volume depended on the wound size and averaged 20-40 ml. A 10% solution of betadine in saline was administered locally by drip daily. The average volume of solution administered was 200 ml. In addition, both groups received conventional treatment aimed at improving blood circulation, reducing bacterial loads, and, in the presence of diabetes,

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insulin therapy (antiplatelet agents, angioprotectors, hyperbaric oxygenation, and antibacterial therapy).

Statistical processing of the obtained data was performed using Statistica 6.1 for Windows. The normality of the distribution of quantitative parameters was tested using the Shapiro-Wilk test. Since not all parameters studied followed a normal distribution, nonparametric methods were used. Comparisons of independent samples were performed using the Mann-Whitney U test for paired variables. The critical significance level for testing statistical hypotheses was set at $p \leq 0.05$.

RESULTS AND DISCUSSION

In patients in the control group, wound debridement occurred 5.7 ± 0.5 days after the start of treatment, granulation tissue appeared 8.3 ± 0.6 days later, and granulation of the entire wound surface occurred 12.2 ± 0.4 days later. The reduction in ulcer size by day 10 of treatment ranged from 5 to 10%, and by day 15, from 8 to 16%. When using isolated vacuum, wound debridement and the appearance of granulation tissue were observed in all patients by days 4–5, and granulation of the entire wound surface occurred by days 8–10; the reduction in ulcer size by days 4–5 ranged from 4 to 8%, and by day 10, from 15 to 32%. With vacuum instillation therapy, coverage of virtually the entire wound surface with granulation was observed in 76.2% of cases already at the first dressing change. With NPWTi with dimethyl sulfoxide, a 6-12% reduction in wound surface size was observed by days 4-5 of treatment, with a 26-54% reduction in defect size by day 10. With NPWTi with betadine, a 8-17% reduction in wound surface size was observed by days 4-5, with a 35-64% reduction in defect size by day 10. When examining interleukin levels on days 4–5, IL-6 levels decreased by 62.1% ($p < 0.001$) and 74.5% ($p < 0.001$) in groups 1 and 2, respectively, while tumor necrosis factor levels increased by 489.1% ($p \leq 0.05$) in group 1 and by 245.2% ($p \leq 0.05$) in group 2, relative to values at the start of treatment.

Compared to the control group, IL-6 levels in Groups 1 and 2 were lower by 45.2% ($p \leq 0.05$) and 64.8% ($p \leq 0.05$), respectively, and TNF-α levels were lower by 31.3% ($p \leq 0.05$) and 59.6% ($p < 0.001$), respectively (Table 3). High tumor necrosis factor levels were detected in the control group on days 8–10 of treatment, which negatively impacted wound reparative processes.

IL-10 levels increased statistically significantly on days 4–5 in the group of patients receiving vacuum instillation therapy; in the isolated vacuum group, a statistically significant increase in IL-10 levels occurred only by day 10 of treatment. In the control group, there was a tendency for this indicator to decrease.

Histological examination of wound edge tissue in patients in groups 1 and 2 revealed significant growth of mature granulation tissue with diffuse inflammatory infiltration by lymphocytes and macrophages as early as days 4–5. Histological examination of wound edge tissue in patients in the control group revealed no growth of granulation tissue on day 5.

CONCLUSION

Vacuum therapy significantly improves the wound healing process, leading to faster debridement, granulation, and reduction in its size. When antiseptic instillations are added to NPWT, the anti-inflammatory, antioxidant, and anabolic effects are enhanced, which promotes a more pronounced regenerative response. This effect is due, firstly, to the presence of dimethyl sulfoxide in the instillation mixture, which, in addition to its anti-inflammatory effect, serves as a conduit for other medicinal substances into the surrounding tissues; secondly, it ensures an optimal ratio of IL-6 and TNF-α in the wound, which modulates phagocytosis, apoptosis, and reparation processes.

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Thus, vacuum instillation therapy of purulent wounds using betadine and dimethyl sulfoxide has advantages over traditional treatment methods and the use of isolation vacuum, allowing it to be recommended for wider use in clinical practice.

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