

Application of Modified Fixation Technique in Self-prepared Negative Pressure Drainage for Difficult-to-fix Sites

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Abstract

Objective: To investigate the application of a modified fixation method in self-made negative pressure drainage for difficult-to-fix areas.

Methods: Thirty-four chronic wound patients admitted to our department from April 2020 to May 2021, who underwent self-made negative pressure therapy for wounds in difficult-to-fix areas such as the axillary-shoulder region, sacro-coccygeal region, buttocks, perineum, popliteal fossa, etc., were selected as the control group. Thirty-four chronic wound patients admitted from July 2021 to August 2022 with similar conditions were selected as the observation group. The control group used traditional transparent film dressing for fixation in self-made negative pressure, while the observation group used the modified fixation method. The incidence of dressing edge lifting, negative pressure leakage, frequency of negative pressure dressing changes, and incidence of peripheral skin tension injury were compared between the two groups.

Results: The incidence of dressing edge lifting, negative pressure leakage, frequency of negative pressure dressing changes, and incidence of peripheral skin tension injury in the observation group were all lower than those in the control group, with statistically significant differences ($P < 0.05$).

Conclusion: In self-made negative pressure drainage technology for difficult-to-fix areas, the modified fixation method is more stable and effective than traditional fixation, effectively reducing the incidence of peripheral skin tension injury, ensuring the effectiveness of negative pressure, reducing the frequency of dressing changes and treatment costs, alleviating patient pain caused by dressing changes, and improving patient satisfaction.

Full Text

Application of a Modified Fixation Method in Self-Made Negative Pressure Drainage for Difficult-to-Fix Sites

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Abstract

Objective: To investigate the application of a modified fixation method in self-made negative pressure drainage for difficult-to-fix sites. **Methods:** Thirty-four patients with chronic wounds who received self-made negative pressure therapy at difficult-to-fix sites (axillary shoulder, sacrococcygeal region, buttocks, perineum, and popliteal fossa) from April 2020 to May 2021 were selected as the control group. Another 34 patients with chronic wounds treated at similar sites from July 2021 to August 2022 were selected as the observation group. The control group used traditional transparent film fixation for self-made negative pressure drainage, while the observation group employed an improved fixation method. The incidence of membrane curling, negative pressure leakage, replacement frequency, and tension injury of surrounding skin were compared between the two groups. **Results:** The observation group showed significantly lower rates of membrane curling, negative pressure leakage, replacement frequency, and tension injury of surrounding skin compared to the control group ($P < 0.05$). **Conclusion:** In self-made negative pressure drainage techniques for difficult-to-fix sites, the modified fixation method is more secure than traditional fixation. It effectively reduces the incidence of tension injury to surrounding skin, ensures negative pressure effectiveness, decreases replacement frequency and treatment costs, alleviates patient pain from dressing changes, and improves patient satisfaction.

Keywords: chronic wound; self-made negative pressure drainage; modified fixation method; difficult fixation site

Introduction

Negative pressure wound therapy (NPWT) is a common and effective method for treating soft tissue injuries. NPWT utilizes a negative pressure suction device connected to semi-permeable membrane dressings to maintain continuous negative pressure at the wound site, thereby achieving adequate drainage, infection control, improved tissue perfusion, and promotion of wound healing. The key to closed negative pressure drainage nursing care lies in ensuring wound sealing and effective negative pressure delivery, where effective membrane fixation is a critical factor for maintaining negative pressure efficacy and stability. Poor wound sealing can lead to air and fluid leakage, rendering negative pressure drainage ineffective.

However, for challenging anatomical sites such as the axillary shoulder, sacrococcygeal region, buttocks, perineum, and popliteal fossa, our team observed that conventional membrane fixation for self-made negative pressure therapy often results in edge curling, leakage, detachment, and tension injury to surrounding skin. These complications increase replacement frequency, hospitalization costs, and patient pain during dressing changes. Therefore, our team developed a modified fixation protocol for self-made negative pressure membrane fixation. From July 2021 to August 2022, we applied this modified fixation method for self-made negative pressure drainage at difficult-to-fix sites and achieved favorable clinical outcomes.

Methods

1.1 General Data This study enrolled 68 patients with chronic wounds. The control group comprised 34 patients admitted between April 2020 and May 2021 who received self-made negative pressure therapy at difficult-to-fix sites (axillary shoulder, sacrococcygeal region, buttocks, perineum, and popliteal fossa). The observation group consisted of 34 patients admitted between July 2021 and August 2022 with similar wound locations. There were no statistically significant differences between the two groups in terms of gender, age, wound location, or other general characteristics ($P > 0.05$), as shown in Table 1. Wound area, average indwelling time, and wound types are presented in Table 2 ($P > 0.05$). All patients and/or family members provided informed consent for self-made negative pressure therapy after understanding its purpose and methodology. This study was approved by the Ethics Committee of Liuzhou Workers' Hospital (KY2021031).

1.2 Inclusion and Exclusion Criteria **Inclusion Criteria:** (1) Chronic wounds suitable for negative pressure therapy; (2) Wounds located at difficult-to-fix anatomical sites; (3) Patients and/or family members who agreed to self-made negative pressure treatment.

Exclusion Criteria: (1) Wounds with contraindications for negative pressure

therapy; (2) Patients allergic to hydrocolloid dressings or transparent films; (3) Patients who refused self-made negative pressure treatment.

1.3 Interventions Control Group Method: (1) The wound was disinfected using conventional dressing change methods, necrotic tissue was debrided, and surrounding normal skin was cleaned with 75% alcohol to remove surface oils and allowed to dry. (2) A sponge was cut to match the wound size, and a gastric tube was inserted through the sponge. (3) A transparent film was applied, the drainage tube was secured using a “dumpling-wrap” method, and cotton padding was applied. (5) The system was connected to a central negative pressure device, and sealing was tested; effective negative pressure was confirmed when the dressing collapsed under suction.

Observation Group Method: Based on the control group protocol, 3M liquid film dressing and ultra-thin hydrocolloid dressings were added. After cleaning with 75% alcohol and allowing the skin to dry, 3M liquid film dressing was sprayed on the surrounding skin and allowed to dry. Ultra-thin hydrocolloid dressings were then applied to the surrounding skin, with the transparent film covering the hydrocolloid by 1 cm.

Both groups received negative pressure at 0.02-0.06 kPa, with drainage tubes maintained patent. Negative pressure dressings were replaced every 5-7 days, with immediate replacement indicated if loosening, leakage, or tube dislodgement occurred.

1.4 Observation Indicators The following parameters were compared between groups: membrane curling incidence (number of curling cases/total negative pressure cases $\times$ 100%), negative pressure leakage incidence (number of leakage cases/total cases $\times$ 100%), tension injury incidence of surrounding skin (number of injury cases/total cases $\times$ 100%), and negative pressure replacement frequency.

1.5 Statistical Methods SPSS 20.0 software was used for statistical analysis. Measurement data were expressed as ($\bar{x} \pm s$) and analyzed using t-tests. Count data were expressed as (n, %) and analyzed using χ^2 tests. $P < 0.05$ was considered statistically significant.

Results

In the control group, negative pressure leakage occurred in 15 cases, tension injury of surrounding skin in 9 cases, and membrane curling in 23 cases, with a total of 52 negative pressure replacements (average every 3 days). In the observation group, negative pressure leakage occurred in 6 cases, tension injury of surrounding skin in 1 case, and membrane curling in 8 cases, with a total of 40 replacements (average every 6 days). The observation group demonstrated

significantly lower rates of negative pressure leakage, tension injury of surrounding skin, membrane curling, and replacement frequency compared to the control group ($P < 0.05$), as shown in Table 2 .

Discussion

Negative pressure wound therapy is widely used in surgical wound treatment. However, standardized negative pressure devices are expensive, typically costing hundreds to thousands of yuan. Chronic wound patients often require prolonged hospitalization, creating substantial financial burden for families. Self-made negative pressure drainage devices offer advantages including convenient material sourcing, simple operation, flexible shaping, easy customization, low cost, and bedside reproducibility, making them more acceptable to patients.

In self-made negative pressure systems, sealing integrity is crucial for maintaining effectiveness. For difficult-to-fix sites such as the axillary shoulder, sacrococcygeal region, buttocks, perineum, and popliteal fossa, negative pressure failure often occurs with transparent film alone due to: (1) anatomical challenges that hinder fixation; (2) patient movement, nursing procedures, and position changes that cause film curling and detachment; (3) lack of exudate absorption capacity, leading to detachment when skin perspires; and (4) contamination from urinary or fecal incontinence that loosens dressings. Improper membrane application can also cause skin swelling or shear forces during joint movement, resulting in epidermal-dermal separation and tension injuries or blisters.

3M liquid film dressing is an alcohol-free, non-irritating transparent liquid dressing composed of acrylate copolymer, hexamethyldisiloxane, polyethylbenzylsiloxane, and isooctane. It rapidly forms a breathable protective film on skin surface, protecting against liquids, adhesives, and friction. It prevents epidermal water loss, maintains dry skin, and features non-stretch properties that facilitate skin respiration and improve patient comfort. The liquid dressing protects and repairs skin with 72-hour longevity, naturally degrading with skin metabolism without residue, ensuring safety and reliability.

Hydrocolloid dressings consist of three components: highly water-absorbent hydrophilic polymer particles (such as carboxymethyl cellulose and pectin), self-adhesive rubber, and semi-permeable protective film. The hydrophilic particles and hydrophobic polymers promote cell proliferation, differentiation, and migration; enhance collagen synthesis and microvascular growth; and maintain normal local metabolic function. They maintain local hypoxia tension, promote blood circulation, improve ischemia and hypoxia symptoms, accelerate exudate absorption and local inflammation resolution, and facilitate toxin metabolism and absorption. Hydrocolloid dressings absorb exudate, maintain local skin dryness, and offer excellent elasticity, compliance, and adhesiveness.

Combined use of 3M liquid film dressing and hydrocolloid dressings provides

dual skin protection, maintains skin dryness, and enhances adhesiveness for more secure fixation. Therefore, in self-made negative pressure sealing for difficult-to-fix sites, applying 3M liquid film dressing followed by ultra-thin hydrocolloid dressings before final transparent film application provides dual skin protection and increased dressing adhesiveness. This approach reduces membrane curling, negative pressure leakage, and surrounding skin tension injury while decreasing replacement frequency, reducing healthcare workload, and improving patient comfort and satisfaction.

In conclusion, using 3M liquid film dressing and ultra-thin hydrocolloid dressings as clinical interventions for self-made negative pressure at difficult-to-fix sites effectively reduces negative pressure leakage, surrounding skin tension injury, membrane curling, and replacement frequency. This ensures negative pressure effectiveness, promotes rapid patient recovery, and warrants clinical promotion and application.

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