Bone and Arthrosurgery Science, 2023, Volume 1, Issue 2
http://ojs.bbwpublisher.com/index.php/BAS

Analysis of Negative Pressure Sealing Drainage Technology for the Treatment of Orthopedic Trauma Infection

Moyun Zhu*, Jianming Gao, Longqing Feng, Yongjing Xin

Xishan Traditional Chinese Medicine Hospital, Wuxi 214000, Jiangsu Province, China

Corresponding author: Moyun Zhu, zhumoyun1992@163.com

Copyright: © 2023 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: To explore the effective treatment of orthopedic trauma infection, the cases selected were 35 patients with orthopedic trauma infection. The study period was from January 2020 to December 2022. They were divided into the study group (n = 18) and the control group (n = 17) through the double-blind randomization of the medical record numbered envelopes. The patients in the control group were treated with conventional debridement and dressing change, and the patients in the study group were treated with negative pressure sealing drainage technology. The frequency of dressing changes, visual analogue scale (VAS) score, wound healing time, hospitalization time, and good wound healing rate were compared between the two groups. The number of dressing changes, VAS score, wound healing time, and hospitalization time in the study group were lower than those in the control group ($P < 0.05$), and the rate of good wound healing in the study group was higher than that in the control group ($P < 0.05$). Negative pressure sealing drainage technology for orthopedic trauma infection patients can decrease the number of dressing changes, reduce pain, accelerate the time for wound healing, shorten hospitalization time, and improve wound healing effect, which has the value of popularization and application.

Keywords: Orthopedic trauma infection; Dressing change; Debridement; Negative pressure sealing drainage

Online publication: September 22, 2023

1. Introduction

Orthopedic trauma infection is a common orthopedic clinical lesion, and if it is not treated early and effectively, it will negatively affect the wound healing. The conventional clinical treatment of orthopedic trauma infection is debridement and dressing change, followed by suture or skin grafting after the formation of granulation tissue, and some patients with severe infection need to be treated with flap transfer. The treatment cycle is too long, and the patient feels severe discomfort during the treatment [1]. Negative pressure sealing drainage technology is an emerging treatment plan for orthopedic trauma infection, which can ensure the cleanliness of the wound surface in the drainage area, improve blood circulation, and accelerate wound healing [2]. In this study, 35 samples of orthopedic trauma infection patients were selected to explore the therapeutic effect of negative

pressure sealing drainage technology.

2. Materials and methods

2.1. Demographic of study population

The relevant matters of this study were approved by the hospital's medical ethics committee. The cases selected were 35 patients with orthopedic trauma infection. The study period was from January 2020 to December 2022. The patients were divided into the study group (n = 18) and the control group (n = 17) through the double-blind randomization of the medical record numbered envelopes. The study group consisted of 11 males and 7 females, with an age range of 28–61 years, with a median of (44.52±3.64) years old, including 12 cases of fresh wounds and 6 cases of old wounds. In the control group, there were 11 males and 6 females. The age range was 26–63 years old, with a median of (44.48±3.69) years old. There were 10 cases of fresh wounds and 7 cases of old wounds. The general data of the two groups were comparable ($P > 0.05$).

The inclusion criteria included infected orthopedic wounds that could not be sutured at the first stage, completed clinical treatment, and signed the research informed consent document.

The exclusion criteria were wounds with critical complications, severe infection, and unable to cooperate to complete the research.

2.2. Methods

Patients in the control group were treated with conventional debridement and dressing change. Physicians observed the condition of the wound, performed routine debridement, and changed the dressing once every 1–2 days. If the wound area of the patient was large, drainage strips were placed. Etiological examination and drug sensitivity test were performed on the wound tissue, and highly sensitive antibiotics were injected for anti-infection. If the patient's wound area grows rosy with fresh granulation tissue, it needs to be sutured. If the granulation growth condition of the patient is not good or the wound area is too large, skin flap transfer is performed.

The patients in the study group were treated with negative pressure sealing drainage and routine debridement. The negative pressure sealing drainage dressing was cut according to the size and shape of the wound so that the dressing could completely cover the wound tissue. The surface area is covered with a translucent membrane. After completing the above operations, the negative pressure sealing drainage operation was performed, the negative pressure value was set to –125 ~ –450mmHg, if the dressing sags, it indicates that the negative pressure sealing drainage is effective. Antibacterial drugs were used to clean the wound tissue, and the negative pressure sealing drainage dressing was taken out at intervals of 5–7 days. Wound samples were collected for pathogenic testing, and the condition of the wound was observed. If fresh ruddy new granulation tissue was visible, suturing was performed. If the skin tissue is defective in the wound area, repeated negative pressure sealing drainage is required, and suturing is performed after fresh ruddy new granulation tissue is produced.

2.3. Evaluation criteria

The number of dressing changes, visual analogue scale (VAS) score, wound healing time, and hospitalization time of patients in the two groups were counted. The good wound healing rate of the two groups of patients was also evaluated. Wound healing was evaluated as good wound healing if the wound tissue is completely healed within 14 days, the dressing does not require changing, the wound coverage is good, or the wound forms new granulation tissue, the total amount of secretions is less, the wound area is reduced, or the wound area is

reduced after skin grafting.

2.4. Statistical methods

SPSS23.0 software was used to analyze the research data, measurement data ($\bar{x}\pm s$) was *t* test, count data % was x^2 test, $P < 0.05$ indicated that there was a statistical level difference.

3. Results

3.1. Comparing the dressing change frequency, VAS score, wound healing time and hospitalization time

The frequency of dressing changes, VAS score, wound healing time, and hospitalization time were compared between the two groups. The data in **Table 1** confirmed that the frequency of dressing changes, VAS score, wound healing time, and hospital stay in the study group were lower than those in the control group ($P < 0.05$).

Table 1. Comparison of dressing change frequency, VAS score, wound healing time, and hospitalization time between the two groups ($\bar{x}\pm s$)

Group	Dressing change (times)	VAS score (points)	Wound healing time (d)	Length of hospital stay (d)
Study group (n = 18)	2.14±0.35	1.64±0.51	15.84±2.05	19.27±3.11
Control group (n = 17)	9.72±1.68	2.98±0.84	22.79±3.84	26.04±4.83
t value	24.593	7.592	8.890	6.562
P value	0.000	0.000	0.000	0.000

3.2. Comparing the good rate of wound healing

The data in **Table 2** confirmed that the rate of good wound healing in the study group was higher than that in the control group ($P < 0.05$).

Table 2. Comparison of good wound healing rates between the two groups (n/%)

Group	Good wound healing	Poor wound healing	Rate of good wound healing
Study group (n = 18)	16	2	16 (88.9)
Control group (n = 17)	10	7	10 (58.8)
t value	-	-	4.137
P value	-	-	0.041

4. Discussion

Trauma infection in orthopedics is a common disease. The causes of the disease are low immunity of the patient, insufficient blood supply in the wound area, improper dressing operation, etc., which can lead to prolonged wound healing time, aggravated pain, and increased difficulty in debridement and dressing. It is not conducive to the rehabilitation of orthopedic diseases, so it is necessary to implement an effective treatment intervention plan [3].

The routine clinical treatment of orthopedic trauma infection is debridement and dressing change, its main function is to remove necrotic tissue, relieve inflammation, and promote the formation of granulation tissue, but frequent debridement and dressing changes can lead to aggravated pain in patients, and damage the new granulation tissue, resulting in prolonged wound healing time [4]. Negative pressure sealing drainage is an

emerging treatment approach for orthopedic trauma infection. Some studies have confirmed that this approach can protect the wound surface, remove exudate and necrotic tissue in time, inhibit bacterial reproduction, keep the wound surface clean, accelerate swelling and anti-inflammation, and make the wound heal early. Negative pressure sealing drainage technology uses biological translucent film to seal wound tissue, which can effectively prevent bacterial infection and reduce the incidence of complications [5]. At the same time, with the negative pressure sealing drainage technology, the drainage tubes with strong plasticity are evenly distributed in the dressing, which can ensure that each drainage area can obtain effective negative pressure, and the liquid produced by the wound tissue can be sucked out in time through continuous negative pressure suction. It also reduces the vascular permeability of the wound area, thereby effectively relieve edema, gradually restore the blood circulation of the wound, and effectively stimulate the epidermal growth factor in the wound area, significantly improve the phagocytosis of leukocytes, reduce the level of harmful bacteria, accelerate the synthesis of wound collagen tissue, and induce new granulation tissue formation and early wound healing [6]. In addition, the negative pressure sealing drainage technology does not require frequent debridement and dressing changes, which can reduce the pain of patients and the workload of medical staff.

The data of this study showed that the number of dressing changes, VAS scores, wound healing time, and hospital stay in the study group were lower than those in the control group, and the rate of good wound healing was higher than that in the control group. Based on this, negative pressure sealing drainage technology can decrease the number of dressing changes, reduce pain, accelerate, and improve wound healing. In the conventional treatment mode, medical staff performed debridement and dressing changes on the wound area many times, resulting in severe pain for patients and damage to new granulation tissue, which is not conducive to wound healing. The main advantages of negative pressure sealing and drainage technology are as follows. Through continuous negative pressure suction on the wound area, wound bacteria, exudate, and necrotic tissue can be removed in time to prevent such substances from accumulating on the wound, thereby ensuring a clean environment around the wound and providing a favorable condition for wound healing [7]. In addition, the negative pressure sealing drainage technology uses a biological translucent film to cover the wound surface, which can isolate bacteria, create a closed environment for the wound surface, and prevent cross-contamination and infection. Plus, negative pressure sealing drainage technology can significantly reduce the interstitial pressure in the wound area, promote the disappearance of edema, improve the blood circulation of the wound, effectively remove bacteria and necrotic tissue on the wound, accelerate the formation of granulation tissue, and improve the effect of wound healing. Importantly, negative pressure sealing drainage technology does not require frequent dressing changes, which can reduce the pain of patients [8].

This study believes that the negative pressure sealing drainage technique has outstanding clinical value in the treatment of orthopedic trauma infection, and is suitable for application in medical institutions at all levels. In order to ensure the treatment effect of negative pressure sealing drainage technology, physicians need to accurately grasp its indications and contraindications. Indications mainly include orthopedic wounds that cannot be sutured at the first stage, wounds that require drainage or infection after surgery, sinuses or fistulas in body surface areas, acute and chronic bone marrow wound repair, chronic wounds and wound tissues that are difficult to heal in a short time. Contraindications mainly include malignant transformation in the wound area, active bleeding in the wound area, osteomyelitis via organs or body cavities. During clinical negative pressure sealing drainage operation, physicians need to complete wound cleaning in a standardized manner. After debridement, the wound often oozes blood, physicians need to observe whether there is active tissue structure and remove it properly, and remove the skin edge of the wound to avoid residual cavity on the wound. Negative pressure needs to be controlled during the operation to ensure that the pipeline is unobstructed and moist, and lidocaine

can be used to relieve pain before removing the dressing. During the treatment using negative pressure sealing drainage technology, doctors need to strengthen the monitoring of wound tissue, focus on observing the growth of granulation tissue, conduct bacterial culture and drug sensitivity test regularly, and adjust the anti-infection plan in time to effectively prevent bacterial infection. Physicians also need to provide health guidance to patients, such as to protect the wound area to avoid damage to the drainage tube, and to inform the physician in time if the symptoms of discomfort in the wound area are aggravated.

In summary, the negative pressure sealing drainage technology for orthopedic trauma infection patients can decrease the number of dressing changes, reduce pain, accelerate wound healing, shorten hospitalization time, and improve wound healing effect, which has the value of popularization and application. The number of patients with orthopedic trauma infection included in this study is relatively small, and no multi-center comparative study has been carried out. The analysis and evaluation process still need to be improved and adjusted, and the relevant mechanism of negative pressure sealing drainage technology for orthopedic trauma infection patients still needs to be analyzed and studied.

Disclosure statement

The authors declare no conflicts of interest.

References

[1] Liu M, Chen K, Huang S, 2021, The Effect of Negative Pressure Sealing Drainage in the Treatment of Orthopedic Trauma Infection and its Influence on Inflammatory Markers. China Health Standard Management, 12(9): 62–64.

[2] Ma L, 2021, Nursing Analysis of Negative Pressure Sealing Drainage Technique in the Treatment of Orthopedic Trauma and Infected Wounds. China Disability Medicine, 29(9): 74–75.

[3] Huang K, 2019, Application of Negative Pressure Sealing Drainage Technology in Postoperative Infection of Trauma Orthopedics. Health Vision, 2019(17): 2.

[4] Luo J, Zhu P, Hou J, et al., 2018, Analysis of the Curative Effect of Closed Negative Pressure Drainage Technology in the Treatment of Orthopedic Trauma Infection. China Emergency Medicine, 38(z2): 23.

[5] Zhang L, Peng X, Zhang W, et al., 2017, Nursing Research on the Treatment of Orthopedic Trauma and Infected Wounds with Negative Pressure Sealing Drainage Technology. Journal of Practical Clinical Medicine, 21(4): 98–100.

[6] Zhou H, 2020, Clinical Effect of Negative Pressure Sealing Drainage Technique on Orthopedic Trauma and Infected Wounds. Chinese Community Physician, 36(22): 71–72.

[7] Li X, 2020, Observation on the Effect of Closed Negative Pressure Drainage in the Treatment of Trauma Infection in Orthopedic Patients. China Health and Nutrition, 30(28): 71–72.

[8] Zeng W, 2020, The Clinical Effect of Negative Pressure Sealing Drainage Technology in the Treatment of Patients with Orthopedic Trauma Infection. China Health Standard Management, 11(13): 43–45.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.