
Effect and Nursing Analysis of External Fixator Combined with Negative Pressure Closed Drainage in the Treatment of Open Fractures of Tibia and Fibula with Soft Tissue Defects

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Abstract: *Objective:* The purpose of this study is to explore the application advantages and nursing effects of external fixator combined with negative pressure closed drainage in the treatment of patients with open tibia and fibula fractures accompanied by soft tissue defects. *Methods:* The study included 46 patients with open tibia and fibula fractures and soft tissue defects who were treated with an external fixator combined with negative pressure closed drainage in our hospital from January 2024 to June 2025 as research samples. They were divided into an experimental group and a conventional group of 23 cases each using the random number table method. The conventional group received routine nursing measures. The experimental group adopted an individualized nursing intervention plan. The two groups of cases were compared in terms of fracture healing time, soft tissue repair time, probability of complications, and total effectiveness of treatment. *Results:* The fracture healing time and soft tissue repair time in the experimental group were shorter than those in the conventional group ($P < 0.05$). At the same time, the probability of complications in the experimental group was lower than that in the conventional group, and the total clinical nursing effectiveness of patients in the experimental group was higher than that in the conventional group ($P < 0.05$). *Conclusion:* Individualized nursing intervention for patients with open tibia and fibula fractures and soft tissue defects who are treated with external fixator combined with negative pressure closed drainage can speed up the patient's recovery process and reduce the risk of complications, improve the efficiency of clinical care for patients, and has good clinical research value.

Keywords: External fixator; Negative pressure closed drainage; Open fracture of tibia and fibula; Soft tissue defect; Nursing effect

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1. Introduction

Open fractures of the tibia and fibula are mostly caused by high-energy injuries and are often accompanied by severe soft tissue defects, making clinical treatment difficult. If such injuries are not handled properly, complications such as infection,

bone nonunion, and skin necrosis are prone to occur, which not only delays the recovery process but may also affect limb function and reduce the patient's quality of life^[1]. The subcutaneous tissue of the tibia and fibula is weak, and the blood supply is relatively scarce. Soft tissue defects after open injuries will further damage local blood supply, increase the difficulty of treatment and the risk of complications, and place a heavy burden on the patient's family and society. Current clinical treatment focuses on fracture reduction and fixation, and soft tissue repair. External fixator combined with vacuum sealing and drainage has become a common treatment option for such diseases because it can achieve a synergistic effect of reliable fracture fixation and effective wound repair. This combined treatment model can effectively remove wound secretions, improve local blood circulation, and create good conditions for tissue repair^[2,3]. However, it is found in clinical practice that the quality of nursing intervention directly affects the effect of treatment. Most patients are unable to give full play to the advantages of combined treatment due to lack of targeted nursing measures. Problems such as slow recovery and high incidence of complications still exist. At present, in clinical practice, there is no unified standard for special nursing intervention programs for patients treated with external fixators combined with negative pressure sealing drainage. Routine nursing care is mostly based on basic nursing measures, which is difficult to meet the individual needs of patients in wound recovery, fixation device maintenance, functional rehabilitation and other aspects^[4]. At the same time, scientific nursing intervention is particularly important to ensure the smooth progress of clinical treatment and reduce complications. In view of this, this study will conduct an in-depth analysis of the clinical advantages of external fixator + negative pressure closed drainage in the treatment of open tibia and fibula fractures combined with soft tissue defects, and conduct research on the application effects of targeted nursing intervention. It is expected to form a targeted nursing plan, which can provide valuable reference for clinical nursing to a certain extent, thereby continuously improving the treatment results of this disease and enhancing the quality of life of patients.

2. Materials and methods

2.1. General information

46 patients with open tibia and fibula fractures and soft tissue defects who were admitted to our hospital from January 2024 to June 2025 were selected as cases and divided into two groups using the random number table method. The experimental group included 23 patients, 14 males and 9 females, aged 32 to 67 years old, (48.52 ± 5.13) years old. There were 23 patients included in the conventional group, including 12 males and 11 females, aged 33 to 68 years old (49.15 ± 4.98) years old. There was no statistical significance in the comparison of general data between the two groups ($P > 0.05$).

2.2. Method

2.2.1. Treatment methods

Both groups were treated with an external fixator combined with negative-pressure sealing drainage. Specific treatment operations: After the patient undergoes epidural anesthesia, select appropriate needle insertion points at the distal and proximal ends of the fracture, drill holes, insert fixation nails, install an external fixator, adjust until the fracture is reduced satisfactorily, and tighten the fixing screws; after fixation, remove necrotic tissue and secretions from the wound, cut negative pressure sealing drainage materials according to the size of the wound and cover the wound, connect the negative pressure suction device after fixation, and adjust the negative pressure value to $-125 - -450$ mmHg to keep the drainage tube unobstructed and free of air leakage.

2.2.2. Nursing methods

The routine group received routine care, including vital sign monitoring, routine wound cleaning and dressing change, medication according to the doctor's instructions, and basic health education. The experimental group adopted a targeted nursing intervention, the content of which is as follows:

- (1) Wound and drainage care

Closely observe the bleeding and exudation on the wound surface, record the color, amount and properties of the drainage fluid, and regularly check the sealing of the negative pressure device and whether the negative pressure value is stable every day. If any abnormality such as loss of negative pressure or blockage of the drainage tube occurs, immediately investigate and deal with it, and replace the drainage material if necessary; regularly replace the drainage device and dressing, and perform strict aseptic operations. Fully disinfect the operating environment and equipment before changing dressings to prevent cross-infection; for wounds with a lot of secretions, increase the frequency of observation appropriately and adjust the drainage plan on time.

(2) External fixator care

Observe the looseness of the external fixator nails and the redness, swelling and exudation of the fixed nail channels every day. Disinfect the fixed nail channels regularly. The scope of disinfection is 3 cm of the skin around the fixed nail channels. After disinfection, apply antibacterial ointment to protect the fixed nail channels. Instruct the patient to avoid the external fixator from being impacted or pulled. Inform the patient of precautions in daily life, such as choosing loose clothes when dressing, avoiding weight-bearing on the affected limb, etc., to ensure the fixation effect. Regularly assist the patient in position changes to prevent the external fixator from compressing local skin and causing pressure ulcers.

(3) Pain care

Use the digital pain scoring method to evaluate the patient's pain level, and take corresponding intervention measures based on the pain score. Mild pain can be relieved by adjusting body position, playing soothing music, limb massage, etc. For moderate to severe pain, use analgesics as directed by the doctor. Strictly control the drug dosage and medication time, and observe the drug's onset time and adverse reactions. At the same time, pay attention to the impact of the patient's psychological state on pain perception, and provide timely psychological counseling to reduce the patient's anxiety and reduce pain sensitivity.

(4) Functional exercise care

In the early stage after surgery, the patient is instructed to perform passive and active exercises such as toe flexion and extension, muscle contraction, and a personalized exercise plan is developed. The intensity and scope of exercise are gradually increased according to the fracture healing status to avoid premature weight bearing. The purpose and method of exercise are explained to the patient before exercise, and the patient's reaction is closely observed during the exercise. Once pain, swelling, etc. occur, the exercise is stopped immediately and corresponding measures are taken to prevent over-exercise. Regular imaging examinations are performed to understand the fracture healing situation, and the exercise plan is dynamically adjusted. Later, the patient is guided to perform joint activities, walking training and other exercises to promote the recovery of limb function.

(5) Nutritional support care

Develop a personalized diet plan based on the patient's condition and nutritional status, understand the patient's nutritional status through routine blood tests, serum albumin and other tests, and promptly adjust the diet structure for those with nutritional deficiencies; guide patients to eat high-protein, high-vitamin, and high-calcium foods to promote wound healing and fracture healing; instruct patients to avoid eating spicy and greasy foods, and inform patients to quit smoking and drinking, because tobacco and alcohol will affect local blood circulation and tissue repair. Follow up the patient's diet regularly, adjust the diet plan according to the patient's taste and digestion, and improve the patient's dietary compliance.

(6) Psychological nursing

In order to prevent patients from having negative emotions, nursing staff should explain to patients the role of positive psychology and the harm of negative psychology, and inform patients of the latest progress in treatment. Provide patients with psychological counseling on time and show them the successful treatment experience of similar cases in the past, so that patients can actively cooperate with subsequent treatment and care, improve their confidence in the disease, and recover as soon as possible.

2.3. Observation indicators

- (1) Compare the fracture healing time and soft tissue repair time between the two groups of patients.
- (2) Compare the incidence of complications between the two groups of patients. Complications include infection, nonunion, skin necrosis, and nail track inflammation.
- (3) Compare the clinical nursing effects of the two groups of patients. The clinical nursing effects of the patients are determined by the nursing staff based on the patients' subjective vital signs, and are divided into three types: markedly effective, effective, and ineffective.

2.4. Statistical methods

Data were analyzed using SPSS26.0. Use χ^2 to test the counting data, and use *t* to test the measurement data. $P < 0.05$ is considered a statistically significant difference.

3. Results

3.1. Comparison of fracture healing time and soft tissue repair time between two groups of patients

The fracture healing time and soft tissue repair time in the experimental group were shorter than those in the conventional group ($P < 0.05$). See **Table 1** for details.

Table 1. Comparison of fracture healing time and soft tissue repair time between two groups of patients (mean \pm SD, d)

Group	Fracture healing time	Soft tissue repair time
Regular group ($n = 23$)	14.68 \pm 2.35	21.36 \pm 3.12
Experimental group ($n = 23$)	11.25 \pm 1.86	15.78 \pm 2.45
<i>t</i>	5.489	6.746
<i>P</i>	0.000	0.000

3.2. Comparison of the incidence of complications between the two groups of patients

The incidence of complications in the experimental group was lower than that in the conventional group ($P < 0.05$). See **Table 2** for details.

Table 2. Comparison of complication rates between the two groups [n (%)]

Group	Infection	Nonunion	Skin necrosis	Nail track inflammation	Overall incidence
Regular group ($n = 23$)	4 (17.39)	3 (13.04)	2 (8.70)	3 (13.04)	12 (52.17)
Experimental group ($n = 23$)	1 (4.35)	0 (0.00)	0 (0.00)	1 (4.35)	2 (8.70)
χ^2					10.268
<i>P</i>					0.001

3.3. Comparison of clinical nursing effects between the two groups of patients

The total clinical nursing effectiveness of patients in the experimental group was higher than that in the conventional group ($P < 0.05$). See **Table 3** for details.

Table 3. Comparison of clinical nursing effects between two groups of patients [n (%)]

Group	Effective	Valid	Invalid	Always efficient
Regular group (n = 23)	8 (34.78)	7 (30.43)	8 (34.78)	15 (65.22)
Experimental group (n = 23)	15 (65.22)	6 (26.09)	2 (8.70)	21 (91.30)
χ^2				4.600
P				0.032

4. Discussions

The main purpose of treatment for open tibia and fibula fractures combined with soft tissue defects is to effectively fix the fracture, promote soft tissue repair, and reduce the occurrence of complications. External fixator combined with negative pressure sealing drainage is a commonly used clinical solution for the treatment of this type of disease. While ensuring the stability of the fracture, continuous negative pressure suction is used to remove secretions and necrotic tissue from the wound, reduce bacterial reproduction, improve local blood circulation, promote the growth of granulation tissue, and create good conditions for soft tissue repair. The combined use of the two technologies can greatly improve the effect of treatment. However, the effect of combined treatment cannot be achieved without scientific and effective nursing intervention. The targeted and comprehensive nature of nursing measures directly affects the patient's recovery process and prognosis [5,6].

The results of this study show that the fracture healing time and soft tissue repair time in the experimental group were shorter than those in the conventional group. The emergence of this result is closely related to the implementation of targeted nursing intervention. Wound and drainage care in targeted care ensures the effective operation of the negative pressure drainage device, can promptly remove wound secretions, maintain wound cleanliness, and provide a good environment for tissue repair; external fixator care ensures the stability of the fixation device and avoids recovery delays caused by problems such as loose fixation and nail track infection. The two work together to lay a solid foundation for fracture healing and soft tissue repair [7].

The incidence of complications in the experimental group was lower than that in the conventional group, which was mainly due to the comprehensive intervention of targeted nursing. Wound infection is the most common complication of open tibia and fibula fractures with soft tissue defects. Strict aseptic operation, standardized nail track disinfection, and timely treatment of abnormal drainage in targeted care reduce the risk of bacterial colonization and infection; the occurrence of nonunion is closely related to the stability of fracture fixation, local blood Circulation is closely related. Standard care of the external fixator ensures the reliability of fixation. Nutritional support care provides sufficient nutritional guarantee for fracture healing and reduces the incidence of nonunion. The reduction of skin necrosis benefits from the improvement of the local microenvironment of the wound and the relief of local compression caused by postural care.

The total clinical nursing effectiveness of patients in the experimental group was higher than that of the control group, indicating that targeted nursing intervention has clinical value. Functional exercise care in targeted care can develop personalized exercise plans based on the patient's fracture healing status, prevent muscle atrophy and joint stiffness, promote limb function recovery, and improve treatment effects; pain care reduces patient pain through multi-faceted intervention, improves patient comfort, and reduces the impact of pain on patient recovery; psychological counseling and health education improve patient care compliance, enable patients to actively cooperate with treatment and care, and further improve treatment effects [8]. Targeted nursing intervention is not a simple superposition of nursing measures, but a personalized nursing plan based on the treatment characteristics of the external fixator combined with negative pressure sealing drainage and the patient's individual conditions. Through intervention in wounds, fixation devices, pain,

functional exercise, nutrition and other aspects, a comprehensive nursing intervention system is formed to make up for the shortcomings of routine nursing. This personalized nursing model not only focuses on the patient's physiological recovery, but also pays attention to the patient's psychological state and care compliance, providing timely psychological counseling to help the patient build confidence in recovery and actively participate in recovery.

5. Conclusion

In summary, targeted nursing intervention for patients with open tibia and fibula fractures and soft tissue defects treated with external fixators combined with negative pressure closed drainage can effectively speed up the patient's recovery process, reduce the incidence of complications, improve the efficiency of clinical care for patients, and provide a reliable practice plan for the clinical care of such patients. Compared with the traditional routine nursing model, targeted nursing intervention can better meet the individual needs of patients, give full play to the advantages of combined treatment, and improve the prognosis of patients. It is more suitable for patients with severe soft tissue defects and difficult treatment, and is worthy of further promotion and use in clinical practice. On this basis, a long-term follow-up study with a larger sample size will be conducted to provide more evidence-based medical basis for the continuous optimization of the plan.

Disclosure statement

The authors declare no conflict of interest.

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