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# Treatment Analysis of Limb Fractures Combined with Traumatic Shock

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**Abstract:** *Objective:* To evaluate the treatment regimen and efficacy for limb fractures combined with traumatic shock (TS). *Methods:* A total of 88 patients with limb fractures combined with TS, admitted between January 2021 and December 2023, were selected. Patients were divided randomly using a numerical grouping method. The observation group underwent restricted fluid resuscitation combined with comprehensive treatment, while the reference group received conventional fluid resuscitation combined with comprehensive treatment. Recovery time, fracture prognosis, complications, severity of the condition, and post-fracture joint function were compared between the two groups. *Results:* The observation group showed shorter symptom recovery times, a higher rate of anatomical fracture reduction, and a lower complication rate compared to the reference group ($P < 0.05$). After one week of treatment, the severity score of the condition in the observation group was lower than that of the reference group, and all joint function scores were higher in the observation group ($P < 0.05$). *Conclusion:* Restricted fluid resuscitation combined with comprehensive treatment for limb fractures with TS can alleviate symptoms, improve fracture prognosis, reduce related complications, decrease the severity of trauma, and enhance joint function. The therapeutic effect is excellent.

**Keywords:** Limb fractures; Traumatic shock; Comprehensive treatment; Complications; Severity of condition

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## 1. Introduction

The etiology of limb fractures combined with traumatic shock (TS) is mainly due to falls from heights or traffic accidents, resulting in severe conditions [1,2]. Traumatic shock, accompanied by visceral bleeding, leads to abnormal cerebral microcirculation, and severe pain symptoms in patients can easily induce compensatory dysregulation syndrome, which negatively affects disease prognosis. The conventional treatment for this condition includes symptomatic treatment for shock and limb fractures, aiming to reduce the severity of the condition, improve fracture prognosis, and minimize the adverse impact on the patient's long-term quality of life [3]. Based on this, the study selected 88 patients with limb fractures combined with TS to evaluate the

clinical efficacy of restricted fluid resuscitation combined with comprehensive treatment.

## 2. Materials and methods

### 2.1. General information

A total of 88 patients with limb fractures combined with traumatic shock (TS) admitted between January 2021 and December 2023 were selected. They were randomly divided into two groups using a random number table. The observation group included 44 cases: 24 males and 20 females, with ages ranging from 22 to 67 years, and a mean age of (38.65 ± 3.41) years. Causes of injury included falls from heights (13 cases), crush injuries (10 cases), traffic accidents (16 cases), and others (5 cases). Fracture locations were as follows: upper limb (12 cases), lower limb (10 cases), and both upper and lower limbs (22 cases). The reference group also included 44 cases: 25 males and 19 females, with ages ranging from 21 to 64 years, and a mean age of (38.90 ± 3.53) years. Causes of injury included falls from heights (15 cases), crush injuries (8 cases), traffic accidents (17 cases), and others (4 cases). Fracture locations were as follows: upper limb (13 cases), lower limb (11 cases), and both upper and lower limbs (20 cases). There were no significant differences between the two groups ($P > 0.05$).

Inclusion criteria: (1) Fracture located in the limbs; (2) clear signs of TS; (3) complete clinical data; (4) normal communication and cognitive abilities; (5) informed and agreed to participate in the study.

Exclusion criteria: (1) Patients with malignant tumors or other major diseases; (2) those with psychiatric disorders; (3) those with fractures in other parts of the body; (4) those who withdrew from the study midway.

### 2.2. Methods

(1) Assessment of TS severity: Dynamic monitoring of the patient's cardiac output, blood pressure, and pulse was conducted to assess consciousness. The Abbreviated Injury Scale-Injury Severity Score (AIS-ISS) was used to evaluate the severity of the condition. A score < 16 indicated minor injury; 16–25 indicated severe injury, and > 25 indicated critical injury. The shock index was calculated as pulse rate ÷ systolic blood pressure, with a value of approximately 0.5. If the shock index was > 1, it indicated a significant reduction in blood volume. Capillary refill was measured to assess cardiac output; slow refill indicated shock. In cases where patients had no head trauma but showed signs of confusion, it indicated inadequate perfusion and continuous monitoring of shock symptoms was necessary to prevent disease deterioration.

(2) Symptomatic treatment for shock: Patients were placed in a supine position with their legs elevated 20° and their heads raised 15° to increase cardiac output and improve circulation. In patients with vomiting symptoms, the head was tilted to one side to prevent aspiration of vomit. A urinary catheter was inserted, and vital signs were continuously monitored. The reference group received conventional fluid resuscitation: one intravenous line was established for patients with mild shock, and more than two intravenous lines were established for patients with moderate to severe shock. One line was used for the infusion of saline/low-molecular-weight dextran, with large-volume fluid resuscitation performed within 1 hour of admission. The ratio of crystalloid to colloid was 1:1. The other line was used for blood transfusion. The observation group received restricted fluid resuscitation, adjusting the rate and volume of fluid administration from the time of trauma until complete hemostasis. If systolic blood pressure was > 80 mmHg, the infusion rate was slowed to reduce fluid input and maintain stable blood

pressure. Low-flow oxygen therapy was administered to patients, with an oxygen flow rate set at 2–4 L/min. Respiratory function was assessed, and if respiratory failure was detected, immediate intubation and mechanical ventilation were provided. In cases of severe hypoxia or shock, respiratory stimulants were administered, and a tracheostomy was performed if necessary. Severe pain was treated with analgesics, but if respiratory distress occurred, pain relief was stopped and resumed only after shock symptoms subsided.

(3) Symptomatic treatment for limb fractures: The extent of the fractures was assessed, and conservative treatments such as manual reduction with plaster fixation or continuous traction therapy were provided. In some cases, external fixation or open reduction with internal fixation surgery was performed, with staged surgeries recommended. After surgery, patients' recovery was monitored, and both groups continued fluid resuscitation treatment.

### 2.3. Observation indicators

(1) Symptom recovery time: The time taken for limbs to warm, the time to regain consciousness, and the time for sweating to stop were recorded.

(2) Fracture prognosis: Prognostic indicators such as anatomical fracture reduction, fracture nonunion, and functional recovery of fractures were observed.

(3) Complications: Complications such as deep vein thrombosis, pulmonary infection, wound infection, and pressure ulcers were monitored.

(4) Severity of condition: The AIS-ISS scale, which includes assessments of the head, neck, body surface, and face, was used to evaluate the severity of the condition before treatment and one week after treatment. The scale scores range from 1 to 75 points, with higher scores indicating greater severity.

(5) Post-fracture joint function: During the same period, the Majeed scoring system was used to assess joint function, including work capacity (20 points), standing ability (36 points), pain level (30 points), sitting ability (10 points), and sexual function (4 points), for a total score of 100 points, with higher scores indicating better joint function.

### 2.4. Statistical analysis

Data were processed using SPSS 28.0 software. Measurement data were expressed as mean ± standard deviation (SD) and compared using *t*-tests. Count data were expressed as [*n* (%)] and compared using chi-squared tests. Statistical significance was considered at $P < 0.05$.

## 3. Results

### 3.1. Comparison of symptom recovery time between the two groups

As shown in **Table 1**, the symptom recovery time in the observation group was shorter than in the reference group ($P < 0.05$).

### 3.2. Comparison of fracture treatment prognosis between the two groups

**Table 2** shows that the rate of anatomical fracture reduction in the observation group was significantly higher than that in the reference group ($P < 0.05$).

**Table 1.** Comparison of symptom recovery time between the two groups (mean ± SD, min)

| Group | Limb warming time | Consciousness recovery time | Sweating cessation time |
|---|---|---|---|
| Observation group ($n$ = 44) | 26.15 ± 2.31 | 16.53 ± 2.17 | 23.45 ± 2.90 |
| Reference group ($n$ = 44) | 32.18 ± 2.47 | 20.15 ± 2.36 | 26.75 ± 3.12 |
| $t$ | 11.827 | 7.490 | 5.139 |
| $P$ | 0.000 | 0.000 | 0.000 |

**Table 2.** Comparison of fracture treatment prognosis between the two groups [$n$ (%)]

| Group | Anatomical fracture reduction | Fracture nonunion | Functional fracture recovery |
|---|---|---|---|
| Observation group ($n$ = 44) | 32 (72.73%) | 2 (4.55%) | 10 (22.73%) |
| Reference group ($n$ = 44) | 25 (56.82%) | 7 (15.91%) | 12 (27.27%) |
| $\chi^2$ | 4.166 | 3.094 | 0.242 |
| $P$ | 0.041 | 0.079 | 0.623 |

## 3.3. Comparison of complication rates between the two groups

As shown in **Table 3**, the complication rate in the observation group was significantly lower than that in the reference group ($P < 0.05$).

**Table 3.** Comparison of complication rates between the two groups [$n$ (%)]

| Group | Deep vein thrombosis | Pulmonary infection | Wound infection | Pressure ulcer | Incidence rate |
|---|---|---|---|---|---|
| Observation group ($n$ = 44) | 1 (2.27%) | 1 (2.27%) | 1 (2.27%) | 0 | 3 (6.82%) |
| Reference group ($n$ = 44) | 3 (6.82%) | 2 (4.55%) | 4 (9.09%) | 1 (2.27%) | 10 (22.73%) |
| $\chi^2$ | - | - | - | - | 4.423 |
| $P$ | - | - | - | - | 0.036 |

## 3.4. Comparison of severity scores between the two groups

Before treatment, there was no significant difference in the severity scores between the two groups ($P > 0.05$). After one week of treatment, the severity scores in the observation group were lower than in the reference group ($P < 0.05$), as shown in **Table 4**.

**Table 4.** Comparison of severity scores between the two groups (mean ± SD, points)

| Group | Before treatment | After treatment |
|---|---|---|
| Observation group ($n$ = 44) | 38.41 ± 5.24 | 27.53 ± 4.19 |
| Reference group ($n$ = 44) | 38.52 ± 5.17 | 31.59 ± 4.27 |
| $t$ | 0.099 | 4.502 |
| $P$ | 0.921 | 0.000 |

### 3.5. Comparison of post-fracture joint function scores between the two groups

Before treatment, there was no significant difference in post-fracture joint function scores between the two groups ($P > 0.05$). After one week of treatment, the post-fracture joint function scores in the observation group were higher than in the reference group ($P < 0.05$), as shown in **Table 5**.

**Table 5.** Comparison of post-fracture joint function scores between the two groups (mean ± SD, points)

| Group | Before treatment | After treatment |
|---|---|---|
| Observation group ($n = 44$) | 52.36 ± 4.19 | 67.29 ± 4.83 |
| Reference group ($n = 44$) | 52.32 ± 4.27 | 63.11 ± 4.71 |
| $t$ | 0.044 | 4.110 |
| $P$ | 0.965 | 0.000 |

## 4. Discussion

The pathological manifestation of fractures involves a continuous or intermittent disruption of the bone, significantly impairing its integrity. Based on the etiology of fractures, they are classified into pathological fractures and traumatic fractures [4,5]. The former is induced by disease factors, often accompanied by decreased mobility and severe pain, which can reduce a patient's ability to work and function, and has a low cure rate. The latter, caused by violent factors, often leads to fractures accompanied by bleeding and TS, which tend to have a high severity, rapid progression, and poor prognosis. Limb fractures are common among traumatic fractures, characterized by intense pain and a high likelihood of TS symptoms [6,7]. TS in these patients is caused by abnormal blood volume circulation, which drastically reduces tissue perfusion, leading to metabolic disorders and severe cell function impairment, posing significant risks. Delayed treatment for patients with limb fractures and TS can result in sustained organ damage, ultimately increasing the mortality rate [8].

Currently, the standard treatment for limb fractures with TS is early restrictive fluid resuscitation combined with surgical intervention. The treatment principle is to restore vital signs to normal ranges to meet the body's physiological needs, stabilize the condition, and then proceed with surgical and other treatments. The treatment sequence follows a pattern of symptomatic shock management followed by fracture treatment, which has shown favorable clinical efficacy [9].

The results showed that the observation group had a shorter symptom recovery time than the reference group, a higher rate of anatomical fracture reduction, a lower complication rate, and a lower severity score one week after treatment. Additionally, the observation group had higher post-fracture joint function scores than the reference group ($P < 0.05$). This is because fluid resuscitation combined with surgical treatment can replenish blood volume, regulate the microcirculatory system, restore bodily stability, and correct cellular stress responses, thereby improving shock symptoms [10]. Symptomatic treatment for limb fractures can effectively realign the fracture ends, preventing further damage and thus improving fracture prognosis and restoring joint function. The continuity of this treatment strategy enables rapid control of active bleeding and other symptoms, dynamically assessing the patient's condition and providing timely blood and fluid replacement based on the severity of the trauma and fracture [11]. Furthermore, restrictive fluid resuscitation can maintain fluid balance effectively, rapidly alleviate shock symptoms, and quickly establish multiple intravenous access points, thus improving respiratory and circulatory system functions. This treatment process is comprehensive, standardized,

and scientific, enhancing the effectiveness of the intervention [12].

## 5. Conclusion

In conclusion, restrictive fluid resuscitation combined with comprehensive treatment for patients with limb fractures and TS can shorten symptom recovery time, optimize fracture treatment outcomes, reduce complication rates, decrease the severity of the condition, and effectively restore joint function, achieving superior therapeutic results.

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## Disclosure statement

The authors declare no conflict of interest.

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