Bone and Arthrosurgery Science, 2024, Volume 2, Issue 2
http://ojs.bbwpublisher.com/index.php/BAS

Clinical Efficacy of Jiegu San External Application Combined with Small Splint External Fixation Following Closed Reduction in Distal Radius Fracture Patients

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Abstract: *Objective:* To explore the clinical efficacy of the external application of Jiegu San combined with small splint external fixation after closed reduction in treating patients with distal radius fracture. *Methods:* A total of 397 cases with distal radius fractures admitted from October 2019 to December 2023 were recruited as study subjects and divided into the control group (n = 180) and the observation group (n = 217) according to the treatment method. The control group was treated with small splint external fixation after closed reduction, while the observation group was treated with Jiegu San external application in addition to small splint external fixation following closed reduction. The clinical efficacy, circumference of the fracture site, and pain level of both groups were observed and compared. *Results:* The total clinical efficacy rate of patients in the observation group (97.70%) was significantly higher than that of patients in the control group (88.88%; P = 0.000). Additionally, the circumference of the fracture site of the observation group was significantly smaller than that of the control group after 3 weeks of treatment (P = 0.000). Moreover, the pain score of the patients in the observation group was significantly lower than that of the control group after 3 weeks of treatment (P = 0.000). *Conclusion:* In the treatment of distal radius fracture, the combination of Jiegu San external application combined with small splint external fixation following closed reduction can effectively improve the clinical efficacy of patients, promote the reduction of swelling, and reduce the pain level of patients, which is worthy of further promotion.

Keywords: Jiegu San; Closed reduction; Small splint external fixation; Distal radius fracture; Clinical efficacy

Online publication: June 7, 2024

1. Introduction

Distal radius fracture is one of the common types of surgical fracture, accounting for nearly 80% of all forearm fractures [1], which is commonly caused by the palm-first position when falling in the clinic. With the accelerated pace of life and the arrival of an aging society, the incidence of this fracture has been increasing yearly [2]. Due

to the close relationship between the distal radius and the wrist joint, its fracture often affects the recovery of the wrist function, which in turn has a serious impact on patients' quality of life [3]. Therefore, enhancing the therapeutic outcomes of distal radius fractures, minimizing the incidence of complications, and improving patients' quality of life are pressing issues in current orthopedic research and clinical work. For closed fractures that do not require surgical treatment, external fixation techniques have been widely used. External fixation is commonly carried out using plaster or splint, which is used to keep the fracture end in the result of reduction to facilitate the healing of the fracture, but too long fixation time and too rigid fixation may lead to the emergence of complications such as joint stiffness and muscle atrophy. As a result, some auxiliary therapeutic means, such as the external application of Jiegu San combined with closed reduction and other traditional Chinese medicine methods, have been gradually applied to the treatment of distal radius fracture, and certain clinical results have been achieved. Thus, this study was carried out to observe the healing status of patients with distal radius fractures treated with Jiegu San external application combined with small splint external fixation following manipulative redundancy, thereby providing a more scientific and effective therapeutic basis and a new clinical plan for the non-operative treatment of distal radius fracture to improve the prognosis of the patients, decrease the number of complications, and enhance the quality of life.

2. Materials and methods

2.1. General information

A total of 397 cases with distal radius fractures admitted between October 2019 and December 2023 were recruited and divided into the control group (n = 180) and the observation group (n = 217) according to the treatment. There was no significance in the basic data statistics of the two groups of patients ($P > 0.05$).

Inclusion criteria: (1) Diagnosed as distal radius fracture by imaging examination (such as X-ray, CT, etc.); (2) Closed fracture; (3) Within 48 hours from the occurrence of fracture to the event of admission to the hospital; (4) No dysfunction of heart, lungs, liver, kidneys and other important organs, and able to tolerate closed reduction and external fixation treatment; (5) Patients or their legal guardian signed an informed consent form, agreeing to participate in this study.

Exclusion criteria: (1) Patients with pathological fractures caused by tumors, osteoporosis, metabolic diseases, etc.; (2) Patients who have been injured for more than 2 weeks, and the fracture ends have obvious scab growth, which is unsuitable for closed reduction; (3) Patients with fracture ends exposed to the external environment, which has the risk of infection; (4) Patients with a history of allergy to the components of Jiegu San or the materials of small splint; (5) Patients with severe systemic disorders, such as heart failure, respiratory failure, severe hepatic and renal insufficiency, etc.; (6) The presence of mental disorders or cognitive disorders; (7) The presence of severe soft tissue contusions at the fracture site.

2.2. Methods

The control group was treated with small splint external fixation after closed reduction. The patient took the sitting or lying position, and according to the type of fracture and displacement, the doctor used appropriate traction, folding top, pressing, and other techniques to restore the fracture end to its normal anatomical position. After the completion of closed reduction, according to the patient's fracture site and stability after reduction, appropriate small splints were chosen, placed on the fracture site of the distal radius, and fixed with a bandage or cloth tape to maintain the stability and alignment of the fracture end. The tightness of the splint was adjusted regularly to ensure the fixation outcomes and avoid discomfort or injury caused by excessive compression.

In the observation group, in addition to the treatment received by the control group, the method of Jiegu

San external application was carried out. The appropriate amount of Jiegu San was taken and mixed with the appropriate amount of 75% alcohol to make a paste. After the completion of closed reduction and repositioning, the Jiegu San paste was applied to the skin of the fracture site, covered with cotton, and gently wrapped with a bandage to immobilize the Jiegu San, keeping it moist, and ensuring its absorption. A small splint bandage was then added. Jiegu San paste was replaced every 2 to 3 days, and the external application site was kept clean and dry to avoid infection and allergy.

2.3. Observation indicators

The clinical efficacy of patients according to their clinical symptom performance, the circumference of the fracture site before and 3 weeks after treatment, and the visual analog scoring (VAS) method for pain level assessment (0–10 points) of both groups were observed and compared.

2.4. Statistical analysis

SPSS 20.0 software was used for statistical processing. Measurement data were expressed as mean ± standard deviation (SD) while count data were expressed as [*n* (%)], and the comparison of the two groups was performed using two-sample *t* or χ^2 tests, with statistically significant differences indicated by *P* values of less than 0.05.

3. Results

3.1. Clinical efficacy

As shown in **Table 1**, the total clinical efficacy rate of patients in the observation group (212/97.70%) was significantly higher than that of the control group (160/88.88%; $\chi^2 = 12.933$, $P = 0.000$).

Table 1. Comparison of clinical efficacy between the two groups [*n* (%)]

Efficacy indicators	Very effective	Effective	Ineffective	Total effective rate
Control group (*n* = 180)	35 (19.44%)	125 (69.44%)	20 (11.12%)	160 (88.88%)
Observation group (*n* = 217)	168 (77.42%)	44 (20.28%)	5 (2.30%)	212 (97.70%)
χ^2				12.933
P				0.000

3.2. Fracture site circumference before and after treatment

Table 2 shows that there was no significant difference between the two group's fracture site circumferences. However, after 3 weeks of treatment, the observation group showed a significantly smaller fracture site circumference as compared to the control group ($P = 0.000$).

Table 2. Comparison of fracture site circumference before and after treatment between the two groups (mean ± SD)

Time	Before treatment	After 3 weeks of treatment
Control group (*n* = 180)	39.61 ± 2.46	31.56 ± 2.05
Observation group (*n* = 217)	39.54 ± 2.53	27.35 ± 1.64
t	0.278	22.730
P	0.781	0.000

3.3. Pain score

Before treatment, the pain scores of both groups were not significantly different ($P > 0.05$), but after 3 weeks of treatment, the observation group had a significantly lower pain score as compared to the control group ($P = 0.000$), as presented in **Table 3**.

Table 3. Comparison of pain scores between the two groups (mean ± SD)

Time	Before treatment	After 3 weeks of treatment
Control group ($n = 180$)	7.68 ± 1.08	3.98 ± 0.72
Observation group ($n = 217$)	7.61 ± 1.07	2.23 ± 0.31
t	0.646	32.375
P	0.519	0.000

4. Discussion

Distal radius fracture is a fracture within 2–3 cm above the articular surface of the distal radius, and this region includes the radial wrist joint surface and the proximal carpal joint surface. The types of fracture can be categorized into extension fracture, flexion fracture, and Barton fracture according to the direction of the fracture line, the direction of displacement of the fracture end, and the degree of fracture. Fractures of the distal radius are mostly caused by traumatic injuries, such as landing on the palm during a fall, automobile accident injuries, sports injuries, etc. In these cases, the direct action of external forces can lead to fractures of the distal radius. The severity and type of fracture depend on the size, direction, and duration of the external force.

In the treatment of distal radius fracture, external fixation with a small splint after closed reduction is a commonly used conservative treatment method [4]. However, this method also has some disadvantages. First, external fixation with a small splint may not be as stable as plaster fixation, especially in the early period after fracture reduction, when the fracture end has not yet formed stable healing, and the fixation effect of the small splint may be affected by the patient's activities or external factors, which may lead to the re-displacement of the fracture end [5]. Secondly, although closed reduction can restore the anatomical alignment of the fracture to a certain extent, its precision and stability have a certain gap compared with surgical incisional reduction, especially for those complex and comminuted fractures, closed reduction may be difficult to achieve the ideal reduction effect. Meanwhile, after small splint immobilization, patients may feel discomfort and pain in the wrist, especially when the initial immobilization is tight, and this discomfort may affect the patient's daily activities and sleep quality. In addition, prolonged minor splint immobilization may lead to complications such as joint stiffness and muscle atrophy. Plus, if immobilization is improper or not adjusted in time, it may also lead to risks such as pressure ulcers and nerve damage. For this reason, it is necessary to combine other treatments with comprehensive treatment, and the external application of bone-splinting has become a good choice.

In this study, the total clinical effectiveness rate of patients in the observation group (97.70%) was significantly higher than that of the control group (88.88%; $P = 0.000$), and the fracture site circumference of the observation group was significantly smaller than that of the control group after 3 weeks of treatment ($P = 0.000$). This indicates that in the treatment of distal radius fracture, the combination of Jiegu San external application and small splint external fixation following closed reduction can effectively improve the clinical efficacy of the patients and promote the reduction of swelling and healing of the patient's tissues. This is because the traditional Chinese medicine components in Jiegu San have the effect of activating blood

circulation, removing blood stasis, and renewing tendons and connecting bones, which can accelerate the blood circulation of the fracture site and provide sufficient nutrition to the fracture end, thus promoting the healing process of the fracture, and this combined treatment can significantly shorten the time of fracture healing and improve the quality of the healing process. Meanwhile, small splint external fixation can effectively fix the fracture end and prevent the fracture from displacement or reoccurrence, and this stable fixation environment provides good conditions for fracture healing and avoids the risk of fracture non-healing or deformity healing caused by unstable fixation [6,7]. In addition, the Jiegu San external application can be individualized according to the patient's specific situation, and the composition and dosage of Jiegu San can be adjusted to achieve the best therapeutic effect. Small splint external fixation can also be flexibly adjusted according to the type and severity of the fracture to ensure stability and comfort of fixation. These studies are consistent with the findings of Xu [8], Xing [9], and others.

This study also found that after 3 weeks of treatment, the pain scores of the observation group were significantly lower than the control group ($P = 0.000$), indicating that in the treatment of distal radius fracture, the combination of Jiegu San external application and small splint external fixation after closed reduction can effectively reduce the degree of patient pain. This is mainly due to the following reasons: Firstly, the components in the Jiegu San have the effect of rapidly relieving pain. When Jiegu San is applied externally to the fracture site, these ingredients can rapidly penetrate the skin and effectively relieve pain [10]. Secondly, compared with oral or injectable medications, topical application of Jiegu San can provide a sustained release of components at the fracture site, maintaining a prolonged soothing effect, which helps patients maintain a lower level of pain throughout the treatment process and promotes recovery. Thirdly, after a fracture, an inflammatory reaction often occurs in the local tissues, leading to swelling and pain. The anti-inflammatory ingredients in Jiegu Sans help to reduce inflammation and pain. Through external application, these ingredients can act more directly on the fracture site and rapidly reduce the inflammatory reaction [11]. Fourthly, small splint external fixation following closed reduction provides a stable fixation environment for the fracture site. Stable fixation reduces friction and movement between fracture ends, thus reducing pain, and this stability also helps protect the surrounding tissues from further injury and pain. Lastly, the Jiegu San external application can promote blood circulation at the fracture site and help eliminate metabolites and inflammatory mediators, thus reducing pain, and good blood circulation is very important for both fracture healing and pain relief.

In conclusion, in the treatment of distal radius fracture patients, the combination of the Jiegu San external application and small splint external fixation following closed reduction can effectively improve the clinical efficacy of patients, promote the reduction of swelling and healing of patients, and reduce the degree of pain, which is worthy of further promotion.

Disclosure statement

The authors declare no conflict of interest.

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