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Clinical Effect of Integrated Traditional Chinese and Western Medicine Treatment on Early Postoperative Inflammatory Small Bowel Obstruction

Sidian Xiao*

Zhenjiang Hospital of Traditional Chinese Medicine, Zhenjiang 212000, Jiangsu Province, China

***Corresponding author:** Sidian Xiao, 13775371148@sina.cn

Abstract: *Objective:* To observe the clinical effect of integrated traditional Chinese and Western medicine treatment on patients with early postoperative inflammatory small bowel obstruction (EPISBO). *Methods:* 86 EPISBO cases admitted from October 2021 to October 2023 were grouped based on the double-blind method. The control group received conventional comprehensive treatment with Western medicine, and the observation group received integrated treatment with traditional Chinese and Western medicine. The clinical treatment effectiveness, general observation indicators, inflammatory factors, and adverse reactions were compared between the two groups after treatment. *Results:* The total effective rate of clinical treatment of the observation group was higher than that of the control group. The post-operative bowel sound recovery time, anal exhaust time, first defecation time, and hospitalization time of the observation group were shorter than those of the control group. The post-treatment level of inflammatory factors of the observation group was lower than that of the control group. These results were statistically significant ($P < 0.05$). There were no serious adverse reactions in either group. *Conclusion:* Implementing integrated traditional Chinese and Western medicine therapy can help post-appendectomy patients with EPISBO improve clinical treatment effectiveness, accelerate symptom improvement, and reduce inflammation without causing serious adverse reactions. Therefore, it is worthy of promotion and clinical application.

Keywords: Integrated traditional Chinese and Western medicine; Appendicitis; Early postoperative inflammatory small bowel obstruction

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1. Introduction

Early postoperative inflammatory small bowel obstruction (EPISBO) is a relatively prominent type of early postoperative complication in patients with abdominal surgery. In the past, clinical treatment was often based on Western medicine, involving methods such as fasting, gastrointestinal decompression, and anti-infection. Comprehensive treatments such as nutritional support can speed up the relief of intestinal obstruction symptoms, but it is found that the actual application effect is unsatisfactory. This may be related to the patient's

physical weakness and poor gastrointestinal function recovery, making it challenging to effectively undertake the drug-related effects. Therefore, it is necessary to consider combining it with other treatments to improve the therapeutic efficacy [1]. In recent years, with the continuous improvement of the clinical application rate of traditional Chinese medicine, integrated traditional Chinese and Western medicine treatment has gradually become a popular trend. By complementing the advantages of the two dominant disciplines, the clinical treatment efficiency can be greatly improved, with the purpose of treating both the symptoms and root causes. From the perspective of traditional Chinese medicine, EPISBO can be classified into the categories of "abdominal pain," "intestinal knots," "Guange," etc., which are mainly caused by deficiency of qi and blood, weak spleen and stomach, unfavorable intestinal qi movement, and blocked viscera qi. Therefore, the key to treatment is unblocking the fu organs and promoting qi, activating blood circulation, and relieving stagnation in the fu organs [2]. This study explored the clinical benefits of the combination of traditional Chinese and Western medicine therapy in 86 cases of EPISBO after appendectomy.

2. Materials and methods

2.1. Materials

86 EPISBO cases admitted to our institute from October 2021 to October 2023 were selected. Using the double-blind method, 86 cases were divided into two groups with 43 cases each. The control group included 20 males and 23 females, the age range was 24–85 years old, with an average of 54.52 ± 6.89 years; the time from surgery to the occurrence of EPISBO ranged from 5 to 14 days, with an average of 9.51 ± 2.64 days; the body mass index (BMI) was 15–29 kg/m^2, with an average of 22.51 ± 3.98 kg/m^2. There were 22 males and 21 females in the observation group, the age range was 26–85 years old, with an average of 55.01 ± 6.97 years; the time from surgery to the occurrence of EPISBO ranged from 5 to 15 days, with an average of 9.55 ± 2.68 days; BMI was 15–30kg/m^2, with an average of 22.59 ± 4.03 kg/m^2. The data between the groups were statistically processed and showed no differences ($P > 0.05$).

Inclusion criteria included patients with a recent history of appendectomy; patients with onset of disease about 1–2 weeks after surgery and EPISBO confirmed by clinical physical examination, X-ray, and other examinations; patients with no missing information in medical records; patients with no unconscious disorder, and can communicate normally; patients with no previous history of mental, cognitive or psychological diseases; patients who are informed with documents to prove the patient's independent wishes. Exclusion criteria were patients with other types of intestinal obstruction; patients with severe dysfunction of important organs such as heart and lungs; patients with coagulation disorders and immune system diseases; patients who are intolerant to study drugs or exhibit allergic reactions; patients with extremely low medical compliance behavior; patients who leave the group before the completion of the study.

2.2. Methods

For patients in the control group, comprehensive treatment of conventional Western medicine was carried out in an orderly manner based on their actual conditions, including fasting and gastrointestinal decompression treatment, rational use of drugs such as antibiotics, proton pump inhibitors, H-receptor antagonists, growth hormone, statin, adrenal glucocorticoid, etc., prompt nutritional support and attention to the correction of water and electrolyte disorders, acid-base balance disorders, etc. The treatment was continued for 5–7 days. The observation group received the combination of the above treatments with relevant traditional Chinese medicine treatments and acupuncture.

(1) Traditional Chinese medicine treatment: Tongfu Chengqi Decoction was prepared for modified retention

enema treatment. The basic prescription is 30g fried radish seeds, 12g *Magnolia officinalis*, 12g *Fructus aurantii*, 12g peach kernel, 10g *Astragalus*, 10g raw rhubarb (added later), 9g Natrii sulfas, 9g red peony root, 9g *Costus*, 9g *Codonopsis pilosula*, 6g licorice. Adjustments can be made according to the syndrome. For those with obvious nausea and vomiting, 12g *Pinellia*, 12g *Inula*, and 9g ginger were added; for those with abdominal distension and pain, 20g of black root and 20g greenbark were added; for those with fever, 10g *Forsythia suspensa* and 10g honeysuckle were added. The decoction was prepared with 500ml of water until approximately 250ml of juice remained, 1 dose was administered daily. Retention enema treatment was performed twice in the morning and evening for 5–7 days.

(2) Acupuncture: Patients were instructed to take the supine position. The surgical incision was avoided, and based on the Zhongwan point, acupoints such as Tianshu point, Shangjuxu point, Zusanli point, etc., were acupunctured. Additionally, the lifting, inserting, twisting, and relieving techniques were adopted. At the same time, moxibustion therapy was performed. 2–3 acupoints were selected for treatment in each rotation, and the needles were retained for 20–30 minutes. This treatment was carried out 1–2 times a day, for 7 days. During the process, the distance between the moxa roll and the skin should be focused on and the patient's tolerance considered.

2.3. Observation indicators

(1) Clinical treatment effectiveness

Markedly effective: Observed symptoms of abdominal distension, abdominal pain, nausea and vomiting, and others were resolved. The abdomen felt soft and non-tender when palpated. X-ray, CT (computed tomography), and other examinations showed no signs of intestinal obstruction, and there was no recurrence of the disease 2–3 days after eating. Effective: Relevant symptoms and signs showed significant improvement, X-ray, CT, and other examinations indicated significant improvement in intestinal obstruction signs, and a small amount of liquid food can be taken without discomfort. Ineffective: The relevant content does not meet the above standards [3].

(2) General observation indicators

The postoperative bowel sound recovery time, anal exhaust time, first defecation time, and hospitalization time of the two groups of patients were carefully recorded, and the observed values were compared.

(3) Inflammatory factor levels

Before and after treatment, 4ml of early morning fasting blood was drawn from two groups of patients to accurately measure the specific concentrations of C-reactive protein (CRP) and interleukin-6 (IL-6), and the measurement results were compared.

(4) Adverse reactions in the two groups were observed.

2.4. Statistical analysis

Using SPSS25.0 software for Windows as the statistical basis, all the obtained data were divided by nature. Measurement data were displayed as mean ± standard deviation (SD) and a parallel *t* test was performed. Count data were displayed as %. At the same time, the chi-square test was performed. $P < 0.05$ indicated that there was statistically significant difference.

3. Results

3.1. Comparison of clinical treatment effectiveness between the two groups

Based on **Table 1**, the total effective rate of clinical treatment in the control and observation groups was 67.44%

and 93.02%, respectively, with significantly higher total effective rate in the observation group ($P < 0.05$).

Table 1. Comparison of total effective rates of clinical treatment [n (%)]

Group	Number of cases	Markedly effective	Effective	Ineffective	Total effective rate
Control group	43	9 (20.93)	20 (46.51)	14 (32.56)	29 (67.44)
Observation group	43	15 (34.88)	25 (58.14)	3 (6.98)	40 (93.02)
χ^2	-	-	-	-	8.871
P	-	-	-	-	0.003

3.2. Comparison of general observation indicators between the two groups

In **Table 2**, the observed values of relevant indicators in the observation group were lower than those in the control group ($P < 0.05$).

Table 2. Comparison of general indicator observation results (mean ± SD, days)

Group	Number of cases	Bowel sound recovery time	Anal exhaust time	First defecation time	Length of hospital stay
Control group	43	4.93 ± 1.87	5.74 ± 2.65	8.45 ± 3.65	14.12 ± 6.29
Observation group	43	3.12 ± 1.12	4.21 ± 1.87	5.81 ± 2.69	10.21 ± 5.02
t	-	5.445	3.093	3.818	10.519
P	-	0.001	0.003	0.001	0.001

3.3. Comparison of inflammatory factor levels between the two groups

As shown in **Table 3**, before the treatment, the levels of inflammatory factors in the two groups showed no difference ($P > 0.05$); after the treatment, the CRP and IL-6 levels of the two groups decreased, with greater decline in the observation group ($P < 0.05$).

Table 3. Comparison of observed values of inflammatory factors (mean ± SD)

Group	Number of cases	CRP (mg/L)		IL-6 (μg/L)	
		Before treatment	After treatment	Before treatment	After treatment
Control group	43	43.12 ± **8.87**	23.25 ± **4.57**	55.54 ± **9.40**	27.65 ± **5.44**
Observation group	43	42.98 ± **8.57**	12.99 ± **2.65**	55.49 ± **9.37**	15.04 ± **3.12**
t	-	0.074	12.736	0.025	13.186
P	-	0.941	0.001	0.980	0.001

3.4. Comparison of adverse reactions between the two groups

After observation, no serious adverse reactions occurred in either group. Only one case (2.23%) of dizziness and one case (2.23%) of rash occurred in the control group. However, the symptoms were relatively mild and did not require special treatment. They subsided spontaneously after discontinuing the drug for some time.

4. Discussion

Appendectomy is a common clinical surgical procedure. It is mainly performed to relieve the inflammatory

reaction of the appendix. The operation is not complex, but there may be complications in the early postoperative period (usually 1–2 weeks after the operation). Intestinal obstruction refers to the edema and exudation of the intestinal wall caused by surgical trauma or intra-abdominal inflammation, resulting in a mechanical and dynamic intestinal obstruction [4]. Although EPISBO exhibits clinical manifestations such as abdominal distension, abdominal pain, vomiting, cessation of flatus, and defecation that are common to other types of intestinal obstruction, most of the symptoms manifest themselves one after another in the early postoperative period with a small amount of flatulence and defecation after eating, and the symptoms of abdominal distension and abdominal pain are relatively mild. The manifestation of symptoms must be taken seriously and resolved promptly and effectively, otherwise it will hinder the recovery of gastrointestinal function and induce abdominal infection, and even lead to severe outcomes such as intestinal fistula, short bowel syndrome, and even death. Considering the complex surgical operation of EPISBO and that the patient suffered a major surgical trauma not long ago and is relatively weak, it is unfeasible to perform a second surgery in a short period. Therefore, conservative treatment is often recommended for EPISBO in clinical practice [5].

Conservative treatment of EPISBO can be divided into Western medicine treatment and traditional Chinese medicine treatment, each with their own advantages. The former can reduce the inflammatory response of the patient's intestinal wall through comprehensive intervention such as fasting, continuous gastrointestinal decompression, anti-infection, and nutritional support. It can provide a certain degree of relief and can also help improve systemic nutritional levels, but the effect of a single application is relatively limited [6]. Traditional Chinese medicine, as China's characteristic medicine, adheres to the principle of "syndrome differentiation and treatment," asserting that the occurrence of diseases is closely related to the body's organs and meridians. For example, the primary disease location in EPISBO is within the intestines, which are one of the six internal organs and are responsible for transmitting and transforming waste. Once healthy qi is damaged, with stagnant blood and qi, it will lead to transmission loss. Therefore, treatment must consider unblocking the fu organs and dispersing stagnation, strengthening vital qi and lowering adverse qi, removing blood stasis, and promoting blood circulation [7]. The self-prepared Tongfu Chengqi Decoction contains radish seeds, which can relieve qi and stagnation. Rhubarb and Natrii sulfas can help relieve heat in the fu organs, relieve constipation, and moisturize the intestines. *Magnolia officinalis* and *Citrus aurantium* can relax the spleen and stomach and regulate qi, eliminate pimples, and resolve phlegm, peach kernel and red peony root can clear away heat and toxins, *Codonopsis pilosula*, *Astragalus*, and *Costus* can strengthen the spleen, replenish qi, and relieve pain, and licorice coordinating drug actions of various medicines. All medicines can strengthen the body, dispel evil, and relieve blood stasis when used together. Decocting the above medicinal materials into warm medicinal liquid and performing an enema treatment can directly treat the focus of the disease, help relieve the spasm of intestinal smooth muscle, and speed up blood circulation in the intestinal wall. Moreover, the enema treatment can retain the medicinal liquid longer, which is more conducive to promoting the healing process [8]. In addition, acupuncture and moxibustion at Zhongwan, Tianshu, Zusanli, and other acupuncture points can further stimulate qi in the spleen and stomach, help dredge the meridians, and improve the intestinal transmission and transformation capacity. The above treatments are green therapies that are easy to administer without financial burden. Combination of the mentioned traditional Chinese medicine treatments with conventional Western medicine can achieve complementary benefits, helping patients achieve more satisfactory rehabilitation outcomes [9,10]. The results of this study have also showed that the total clinical treatment effectiveness of the observation group was 93.02%. Compared with the control group, the observation group has a shorter postoperative recovery time, lower levels of inflammatory factors, and no adverse reactions.

5. Conclusion

In summary, the integrated traditional Chinese and Western medicine treatment for patients with early postoperative inflammatory small bowel obstruction can significantly improve the patient's clinical symptoms, enhance the treatment efficiency, and ensure greater treatment safety. It is worth widespread application and promotion.

Disclosure statement

The author declares no conflict of interest.

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Comparative Study on the Treatment Efficacy of Direct Anterior Approach and Direct Lateral Approach for Irreducible Intertrochanteric Fractures in the Elderly

Yong Qin*, Dongqian Feng, Bin Zhang, Xingqiu Wu, Jianfei Xu

Shuyang County Traditional Chinese Medicine Hospital, Suqian 223600, Jiangsu Province, China

***Corresponding author:** Yong Qin, qyooog@outlook.com

Abstract: *Purpose:* To explore the clinical effects of the direct anterior approach (DAA) and the direct lateral approach in elderly patients with irreducible intertrochanteric fractures. *Methods:* A retrospective analysis method was used to collect samples of 18 elderly patients with irreducible intertrochanteric fractures of the femur admitted to our hospital from January 2020 to January 2023, and they were divided into a study group (n = 9) and a control group (n = 9) according to different surgical plans. Both groups of patients underwent internal fixation with proximal femoral nail anti-rotation (PFNA). The patients in the control group were treated through the direct lateral approach, and those in the study group were treated using DAA. The surgical conditions, recovery conditions, and indicators of postoperative complications were compared between the two groups. *Results:* The operation time and intraoperative blood loss of the study group were lower than that of the control group ($P < 0.05$); there was no significant difference in the degree of hip flexion and extension recovery between the two groups after surgery, as well as the functional scores ($P > 0.05$); the study group had a lower incidence of complication than the control group ($P < 0.05$). *Conclusion:* Compared with the direct lateral approach, the DAA to the hip joint in elderly patients with irreducible intertrochanteric fractures can shorten the operation time, reduce intraoperative blood loss, and shorten the recovery period of joint function. With a satisfactory prognosis and low incidence of complications, it can be promoted and applied in medical institutions.

Keywords: Intertrochanteric fracture of femur; Direct anterior approach to hip joint; Direct lateral approach

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1. Introduction

Intertrochanteric fractures account for a high proportion of all types of orthopedic fractures. It involves the hip joint and surrounding tissues, commonly affecting the elderly. The main clinical symptoms are swelling in the fracture area, pain, limited activity, and deformity of the affected limb [1]. Proximal femoral nail anti-rotation (PFNA) internal fixation is the primary clinical treatment option for intertrochanteric fractures in the

elderly. It can fix the fracture end and promote the recovery of joint function. The therapeutic effect of PFNA internal fixation is related to the intraoperative exposure of the proximal femur and the fracture reduction effect. For this reason, an appropriate surgical approach should be selected [2]. Open treatment is usually required for irreducible intertrochanteric fractures since satisfactory reduction through closed traction cannot be achieved. The conventional direct lateral hip approach is widely used in clinical practice, but it exhibits drawbacks of excessive soft tissue dissection, poor exposure, and a high incidence of postoperative complications. The direct anterior approach (DAA) provides access to the hip through the natural gap of the human body, which can reduce surgical trauma and improve reduction and fixation effects [3,4]. This study selected 18 elderly patients with irreducible intertrochanteric fractures to compare and analyze the clinical effects of the direct anterior approach and the direct lateral approach.

2. Materials and methods

2.1. General information

This study conducted a retrospective analysis on 18 elderly patients with irreducible intertrochanteric fractures treated in the hospital from January 2020 to January 2023, and they were divided into a study group (n = 9) and a control group (n = 9) based on different surgical plans. There were 7 males and 2 females in the study group, with an age range of 65–79 years old and an average age of 72.68 ± 3.59 years. There were 6 males and 3 females in the control group, with an age range of 66–78 years old and an average age of 72.62 ± 3.64 years. There was no significant difference in the general data of the two groups of patients ($P > 0.05$).

Inclusion criteria included patients with irreducible intertrochanteric fractures clearly diagnosed through physical and imaging examinations, with no fractures or lesions in other parts; patients meeting the indications for PFNA internal fixation, and the basic physical condition can tolerate the surgery; patients who signed the research informed consent form.

Exclusion criteria were bilateral hip fracture; pathological fracture; combined with severe osteoporosis or history of fracture surgery.

2.2. Methods

Patients in both groups were treated through PFNA internal fixation. The patients were anesthetized after lying down on the operating table. The anesthesia plan selected was continuous epidural anesthesia, while some patients underwent general anesthesia. When the anesthesia was in effect, an indwelling traction bed was placed, with a soft pad under the hip joint, and the traction and reduction operation was performed on the fracture site to keep the patient in a comfortable supine position. The reduction was completed with closed reduction and PFNA internal fixation. If the reduction was unsuccessful, the lateral approach to the patient's hip joint was performed for patients in the control group. The vastus lateralis muscle was peeled off toward the rear to fully expose the trochanter and proximal end of the femur and the fracture end, the fracture was reduced and temporarily fixed. The guide pin was inserted through the greater trochanter of the femur at a fixed point. After the operation was completed, a C-arm machine inspection was performed. If the position of the guide pin is normal, the medullary reaming will be completed in a standardized manner and the PFNA main nail will be properly inserted. When placing the main screw, it was ensured that the extension line of the center point of the lag screw groove was above the longitudinal axis of the lower one-third of the femoral neck. After the operation, the position of the main screw was checked and the guide pin was removed. Under the guidance of the lateral aiming rod, the protective sleeve was accurately inserted, the spiral blade guide pin was inserted inside the femoral head and neck, and the position of the guide pin was checked with the C-arm machine (the

correct position is that the guide pin is at the middle and lower one-third area of the femoral head and neck as viewed from the anteroposterior), the lateral radiograph guide pin was in the middle of the femoral head and neck, and the distance between the guide pin and the lower part of the femoral head was about 5–10mm. A spiral blade was placed inside the femoral head neck, and the distance between its tail and the area below the femoral head was controlled to 5–10mm. The C-arm machine was utilized to fluoroscopically assess the effectiveness of the fracture fixation, the site was closed subsequently, and the locking nail and tail cap were installed. After the operation, the incision was sutured and a drainage tube was placed.

The patients in the study group adopted the DAA to the hip joint. The patients were anesthetized after lying down on the operating table. The anesthesia plan chosen was continuous epidural anesthesia, with some patients undergoing general anesthesia. After the anesthetic drugs were in effect, a traction bed was placed and soft padding was provided under the hip joint. A pad was used to perform a traction reduction operation on the fracture site to keep the patient in a comfortable supine position. The reduction was performed with closed reduction and PFNA internal fixation. If the reduction was unsuccessful, the DAA to the hip joint was performed for patients in the study group. Taking the anterior superior iliac spine as an anatomical landmark, starting from 2cm outside and 4–5cm below and extending distally, an incision about 6cm long was made, separating the sartorius muscle and tensor fascia lata, and entering along the Hueter interval, the ascending branch of the lateral circumflex femoral artery running between the two muscles needed to be carefully ligated during the operation. A Hohmann retractor was inserted and retracted laterally to fully expose the greater and lesser trochanters of the femur, the anterolateral bone surface of the proximal femur, and the intertrochanteric fracture area, the fracture end was reduced and temporarily fixed, and the reduction effect was checked. After completing the above operations, PFNA internal fixation was performed similarly to that of the control group. After the operation, the incision was sutured and a drainage tube was placed.

Within 48 hours after surgery, the drainage tubes were removed from both groups of patients, and antibiotics were administered to prevent infection. The affected limb was maintained in a neutral position with 30° abduction, and the patients were instructed to perform passive and active movements. Regular reviews were performed. The internal fixation could be removed 1 year after surgery.

2.3. Evaluation criteria

(1) Various indicators of the surgical conditions and recovery conditions were compared between the two groups, including operation time, intraoperative blood loss, number of intraoperative fluoroscopy, postoperative drainage volume, postoperative weight-bearing time, and hospitalization time.

(2) The hip joint function scores of the two groups of patients before surgery and 3 months after surgery were compared. The Harris Hip Score was used for the assessment, with a full score of 100. The higher the score, the better the hip joint function. The recovery degree of hip joint flexion and extension of the two groups of patients 3 months after surgery was compared, and the calculation formula was the joint flexion and extension of the affected side divided by the joint flexion and extension of the unaffected side.

(3) The incidence of complications in the two groups of patients was observed and compared.

2.4. Statistical methods

SPSS23.0 software was used to analyze the research data. The measurement data, mean ± standard deviation (SD), were used as t test, and the count data % were used as χ^2 test. $P < 0.05$ indicated that there was a statistically significant difference.

3. Results

3.1. Comparison of the surgical and postoperative recovery indicators between the two groups

The patients in the study group had shorter operation time and less intraoperative blood loss than those in the control group ($P < 0.05$). There was no significant difference in postoperative drainage volume, postoperative weight-bearing time, and hospitalization time between the two groups ($P > 0.05$). The details are shown in **Table 1**.

Table 1. Comparison of surgery and postoperative recovery indicators between the two groups (mean ± SD)

Group	Operation time (minutes)	Intraoperative blood loss (ml)	Number of intraoperative fluoroscopy (times)	Postoperative drainage volume (ml)	Postoperative weight-bearing time (days)	Length of stay (days)
Study group (n = 9)	62.89 ± 5.72	368.48 ± 22.53	2.11 ± 0.42	164.25 ± 18.96	20.62 ± 2.47	13.28 ± 1.96
Control group (n = 9)	78.94 ± 7.25	409.84 ± 27.62	5.08 ± 0.95	164.29 ± 19.04	20.55 ± 2.39	13.31 ± 2.05
t value	5.214	3.481	8.578	0.004	0.061	0.032
P value	0.000	0.000	0.000	0.996	0.952	0.975

3.2. Comparison of the hip joint function scores and hip flexion and extension recovery degrees between the two groups

There was no significant difference in hip joint function scores and hip flexion and extension recovery between the two groups after surgery ($P > 0.05$), as shown in **Table 2**.

Table 2. Comparison of hip joint function scores and hip flexion and extension recovery degrees between the two groups (mean ± SD)

Group	Hip joint function scores (points)		Hip flexion and extension recovery degrees
	Before surgery	After surgery	
Study group (n = 9)	18.22 ± 1.96	77.38 ± 5.69	86.24 ± 3.58
Control group (n = 9)	18.19 ± 2.04	77.42 ± 5.71	86.21 ± 3.64
t value	0.032	0.015	0.018
P value	0.975	0.988	0.986

3.3. Comparison of the incidence of complications between the two groups

The study group has lower incidence of complications than the control group ($P < 0.05$), as shown in **Table 3**.

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

Group	Incision infection	Malunion	Screw withdrawal or slippage	Complication rate
Study group (n = 9)	0	0	1	1 (11.1)
Control group (n = 9)	2	2	1	5 (55.6)
χ^2 value				4.000
P value				0.045

4. Discussion

Intertrochanteric fracture is also called extracapsular fractures of the proximal femur, occurring in the area between the greater and lesser trochanters of the femur. The cause of the injury is mostly low-energy injuries such as falls. The primary symptoms include severe pain and swelling on the affected side, limb shortening or external rotation, limb movement limitation, etc. [5,6]. This type of fracture can be treated with conservative or surgical treatment. The main drawbacks of conservative treatment are extended bed rest and high incidence of complications and mortality. Therefore, surgical treatment is often used in clinical practice [7].

PFNA internal fixation is a routine surgical treatment for intertrochanteric fractures. The key advantage is its firm and strong fixation, which facilitates early postoperative rehabilitation training and weight-bearing activities. In order to ensure the effect of PFNA internal fixation, it is necessary to fully expose the proximal femur and accurately reduce the fracture end [8]. Under the conventional direct lateral hip approach, the doctor performed the surgery through the lateral area of the femur. This approach has the disadvantages of large surgical incision, heavy trauma, damaged muscle tissue during the operation, and heavy bleeding. In addition, the vastus lateralis muscle is directly incised through the lateral area during the operation, which can lead to lateral femoral incision. There is tear damage to muscle fibers that in turn triggers scar healing in the incision area, affects soft tissue elasticity, and causes callus adhesion in the fracture area, which is not conducive to postoperative hip joint functional recovery [9]. Clinical studies have shown that during the surgical treatment of irreducible intertrochanteric fractures in the elderly, it is necessary to achieve anatomical reduction as much as possible on the basis of functional reduction, at the same time shorten the operation time in order to reduce surgical risks and enhance patient safety [10]. Under the DAA to the hip joint, the patient's anterior superior iliac spine area is selected as the starting point of the surgical incision. Through the natural gap between the sartorius muscle and tensor fascia lata, the fracture end can be fully exposed through the front side of the femur. This approach reduces damage to soft tissues and intraoperative blood loss significantly. Fracture reduction can be completed under direct vision, thereby ensuring the effects of reduction and fixation, and creating favorable conditions for early postoperative rehabilitation training. At the same time, the DAA to the hip joint is relatively safe without damaging the blood vessels and nerve tissue in the area surrounding the fracture, which can significantly reduce the incidence of postoperative complications [11].

The results of this study confirmed that all indicators of the surgical and recovery conditions of the patients in the study group were lower than those in the control group, suggesting that the DAA to the hip joint can reduce the number of intraoperative fluoroscopy, shorten the operation time, and reduce surgical trauma. This may be due to that a longitudinal split on the vastus lateralis muscle fibers is performed under the direct lateral hip approach, which requires peeling of a large amount of soft tissue during the operation, thus affecting the blood supply status of the fracture area, and leading to prolonged postoperative recovery time and exposure of the fracture end during the operation. This approach is unsatisfactory as the screw placement operation is difficult, resulting in prolonged operation time, intraoperative blood loss, and increased number of fluoroscopy [12]. In the DAA to the hip joint, incision is made between the sartorius muscle and tensor fascia lata area without incision of muscle tissue, which can reduce the damage to the muscles, weaken the impact on the internal environment of the body, shorten the operation time, and reduce surgical trauma. This study shows that there is no significant difference in hip joint functional scores and hip flexion and extension recovery between the two groups of patients, suggesting that both the DAA and the conventional direct lateral approach can achieve good postoperative recovery results. This is because the DAA to the hip joint causes minor surgical trauma, less intraoperative blood loss, and firm hip joint fixation, which can shorten the patient's postoperative recovery time. The patient's compliance with early postoperative rehabilitation training is higher, which can improve the hip joint functional recovery [13].

The results of this study showed that the incidence of complications in the study group was lower than that in the control group, suggesting that the DAA can reduce the incidence of postoperative complications. This may be attributed to the significant anatomical structural advantages of the DAA compared with the direct lateral approach. Fracture reduction is completed under direct vision, thereby achieving early stable fixation, shortening the patient's fracture healing time, and significantly reducing the incidence of screw withdrawal or slippage and malunion. The DAA to the hip joint results in minimal trauma, reduces soft tissue damage caused by surgical operations, shortens operation time, and helps reduce the incidence of infection [14,15]. This study indicates that the clinical effect of the DAA to the hip joint in elderly patients with irreducible intertrochanteric fractures is better than that of the direct lateral approach. However, the initial anatomy requirements of this surgery are higher, and it is necessary to accurately assess the patient's injury and complete the surgery in a standardized manner, assist patients to complete active and passive movements after surgery, and dynamically assess fracture recovery to enhance prognosis.

5. Conclusion

In summary, it can be seen from the results that compared with the direct lateral approach, the DAA can shorten the operation time and reduce surgical trauma in elderly patients with irreducible intertrochanteric fractures. The patient's postoperative recovery time is shorter, with positive effect of hip joint function recovery and low incidence of complications, thus it can be promoted and applied in medical institutions. The limitations of this study include relatively small sample size of elderly patients with intertrochanteric fractures, and no cross-sectional comparative study and analysis of the same type of data was conducted. In depth analysis of the advantages and disadvantages of using the DAA in elderly patients with intertrochanteric fractures is required.

Disclosure statement

The authors declare no conflict of interest.

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Impacts of Operating Room Refined Nursing on Orthopedic Surgery Patients

Jing Sun*

The Affiliated Taizhou People's Hospital of Nanjing Medical University, Taizhou 225500, Jiangsu Province, China

***Corresponding author:** Jing Sun, 13952600159@163.com

Abstract: *Objective:* To explore the impacts of operating room refined nursing on orthopedic surgery patients. *Methods:* A sample of 62 orthopedic surgery patients admitted from March 2022 to March 2023 were randomly divided into two groups, with 31 patients each. Group A received operating room refined nursing while Group B received routine nursing. Emotion, pain, quality of nursing, quality of life, complications, and differences in nursing satisfaction were compared between the two groups. *Results:* The scores of Self-Rating Anxiety Scale (SAS), Self-Rating Depression Scale (SDS), and Visual Analogue Scale (VAS) of orthopedic surgery patients in Group A were all lower than those in Group B, $P < 0.05$; the scores of each nursing quality index in Group A were higher than those in Group B, $P < 0.05$; the SF-36 (36-Item Short Form Health Survey) scores of Group A were higher than Group B, $P < 0.05$; the complication rate in Group A was lower than that in Group B, $P < 0.05$; the nursing satisfaction in Group A was higher than that in Group B, $P < 0.05$. *Conclusion:* Operating room refined nursing can reduce postoperative pain, soothe the emotions of orthopedic surgery patients, strengthen the quality of nursing, and reduce postoperative complications, which is efficient and feasible for clinical application.

Keywords: Orthopedic surgery; Refined nursing; Operating room nursing

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1. Introduction

Fractures are related to soft tissue damage, tumor compression, violent trauma, and other factors, and require surgical repair to correct the bone tissue structure and restore bone function. Orthopedic surgery encompasses various levels of complexity and can address a range of conditions, including lumbar spinal lesions, joint lesions, broken fingers, and fractures in different areas of the body [1]. Routine clinical nursing typically involves assessing perioperative drainage and providing symptomatic treatment for postoperative complications. This passive service model has limitations, resulting in poor overall nursing quality [2]. With a high clinical emphasis on the quality of orthopedic nursing, the refined nursing model has been gradually improved to provide patients with orthopedic diseases with comprehensive psychological, mental, and disease nursing, improve the content of refined nursing, and make orthopedic nursing services more scientific, standardized, and efficient [3]. This article explores the impacts of an operating room refined nursing model on 62 orthopedic surgery patients

admitted from March 2022 to March 2023.

2. Materials and methods

2.1. Materials

A sample of 62 orthopedic surgery patients admitted from March 2022 to March 2023 were randomly divided into two groups. There was no difference in the data of orthopedic surgery patients in Group A and Group B, $P > 0.05$. The details are presented in **Table 1**.

Table 1. Analysis of the data of orthopedic surgery patients

Group	n	Gender		Age (years)		Surgery type			
		Male	Female	Range	Mean	Spine surgery	Joint replacement surgery	Fracture surgery	Other surgeries
Group A	31	16 (51.61)	15 (48.39)	35–68	52.84 ± 2.36	6 (19.35)	9 (29.03)	10 (32.26)	5 (16.13)
Group B	31	17 (54.84)	14 (45.16)	35–69	52.82 ± 2.39	7 (22.51)	8 (25.81)	11 (35.48)	4 (12.90)
χ^2/t	-	0.0648		0.0332		0.0498			
P	-	0.7991		0.9737		0.9918			

2.2. Inclusion and exclusion criteria

Inclusion criteria included patients with orthopedic diseases consistent with the "Clinical Disease Diagnosis and Treatment Criteria" [4]; imaging shows indications for orthopedic surgery; patients with informed consent; and patients with stable vital signs.

Exclusion criteria were patients with malignant tumors; patients with abnormal coagulation indexes; and patients with systemic infection.

2.3. Methods

Group A received operating room refined nursing:

(1) Preoperative refined management

Psychological counseling was provided for the patients. Orthopedic patients are prone to fear and anxiety related to their condition and concerns about the effectiveness of surgery, which can adversely affect the patient's physical and mental health. Therefore, increasing communication with patients, soothing patients' emotions, providing education on surgical knowledge, and sharing successful surgical cases can help patients cope with the surgery in a positive physical and mental state.

Instrument and environment preparation was carried out before surgery. This included disinfecting operating room surfaces and instruments before surgery; preparing sterilized cotton balls, hemostatic gauze, and other dressings; preparing the instruments required for orthopedic surgery, including traction instruments, clamping instruments, cutting instruments, sutures, lines and drainage materials, etc.; and classifying the medical clothing in the operating room.

Furthermore, clothes were changed before surgery. Hand disinfection was done by using disinfectant and hand sanitizer, sterile clothes were put on after disinfection, and the non-contact dressing method was strictly followed. Clothes and caps were changed before entering the surgical operation area and special shoes were put on. Using pants to secure the top when wearing surgical gowns can prevent exposure to iatrogenic infections and protect the safety of medical staff. The medical staff undergo a skin check for infections and nail length before entering the operating room, approval

for entry is granted only when they meet the requirements of the operating room.

Preoperative drugs and anesthesia preparation was another aspect in operating room refined nursing. Once inside the operating room, a recheck of the required drugs for the operation was conducted to ensure nothing was missing, and preparations for anesthesia were made. Patients under general anesthesia must enter the operating room 30–40 minutes in advance.

Additionally, appropriate limb placement of the patients was ensured. In order to ensure safety and comfort during the orthopedic surgery, the patients were assisted in placing their limbs appropriately before surgery. The limb placement should be fully exposing the surgical site, avoiding compression of blood vessels and nerves, and protecting circulatory function, with the limbs properly fixed and the vital signs monitored.

Disinfection of the surgical area was performed. The surgical incision area and the area within 15cm from the center of the incision were disinfected. When performing the incision process in orthopedic surgery, the scope of disinfection can be appropriately expanded.

(2) Intraoperative nursing

During the surgery, nurses cooperated with doctors in the delivery of surgical supplies in a prompt and accurate manner, and paid attention to adjusting the lights, temperature, and humidity in the operating room. Nurses also monitored the vital signs of orthopedic surgery patients, and actively cooperated with doctors to complete orthopedic surgery rescue work. The specimens obtained during the operation were properly stored and submitted for examination in a timely manner. After the operation and before closing the incision, a check for any missing surgical-related items was conducted and the surgical items were recounted.

(3) Postoperative nursing

Routine postoperative intervention included wiping the blood stains on the patient's body, assisting the patient in dressing, informing the patient of the successful result of the operation, soothing the patient's emotions, transporting the patient, informing the patient of postoperative precautions, and patiently answering the patient's doubts. The patient was consulted about the operation and their opinions on operating room nursing to continuously improve operating room nursing strategies in practice and enhance service quality in the operating room.

Postoperative nursing also involved informing patients about the methods to prevent and control postoperative complications. Firstly, to prevent pressure ulcers, family members were instructed to help patients alter their limb placement to avoid long-term maintenance of the same posture, and prepare soft cushions to place on bone protruding areas, and regularly assist patients in massaging the pressure areas to stimulate local blood supply. Secondly, for the prevention of high fever, changes in body temperature after surgery were regularly monitored and prophylactic antibiotics were given to enhance the body's resistance. For patients with a body temperature higher than 38°C, the cause of high fever should be identified promptly and treated symptomatically. In order to prevent limb swelling, cold therapy was used to stimulate limbs with abnormal skin temperature, promote vasoconstriction, and increase the limb's pain tolerance threshold. Furthermore, to prevent lower limb thrombosis, the lower limbs were kept warm after surgery to avoid cold stimulation that may cause blood stasis and deep vein thrombosis. Family members were instructed to correctly massage the quadriceps muscles to promote blood supply to the affected limbs, and patients were instructed to consume low-fat diet and pay attention to skin blood supply and color changes. Moreover, for the prevention of bone cement leakage, since some patients with thoracolumbar fractures require bone cement during surgery, it is necessary to

evaluate whether bone cement has a heat accumulation effect after surgery, such as burning sensation, abdominal distension, and other symptoms, as well as evaluate whether there is bone cement leakage. For example, with the occurrence of symptoms such as nerve compression, spinal cord compression, or severe lower back pain, manual massage can be used to improve the uncomfortable symptoms while preventing the heat accumulation effect.

Group B received routine nursing, which included calming the emotions of orthopedic surgery patients before surgery; assisting orthopedic surgery patients in completing preoperative examinations and preparations and disinfecting the surgical area; monitoring vital signs during surgery and reporting any abnormalities immediately; following the doctor's instructions for medication after surgery.

2.4. Observation indicators

(1) Emotion and pain scores: Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS) were positively correlated with anxiety and depression in orthopedic surgery patients, simultaneously. Visual Analogue Scale (VAS) was positively correlated with pain in orthopedic surgery patients.

(2) Nursing quality score: Nursing quality included service attitude, theoretical knowledge, nursing operations, nursing documents, sanitation and disinfection, health education, equipment management, environmental safety, and other dimensions, each with a score of 0–100.

(3) Quality of life score: SF-36 (36-Item Short Form Health Survey) was positively correlated with the quality of life of patients undergoing orthopedic surgery.

(4) Complications: Pressure sores, high fever, limb swelling, lower limb thrombosis, bone cement leakage, etc., were observed and recorded.

(5) Satisfaction: Assessment of a self-made orthopedic operating room nursing satisfaction scale was conducted.

2.5. Statistical analysis

The data of orthopedic surgeons were processed with SPSS21.0. Count data of orthopedic surgeons (χ^2 test) were recorded as %, the measurement data of orthopedic surgeons (t test) were recorded as mean ± standard deviation (SD). There was a statistically significant difference if $P < 0.05$.

3. Results

3.1. Emotion and pain scores

After nursing, the SAS, SDS, and VAS scores of orthopedic surgery patients in Group A were lower than those in Group B, $P < 0.05$, as shown in **Table 2**.

Table 2. Comparison of emotion and pain scores (mean ± SD)

Group	SAS (points)		SDS (points)		VAS (points)	
	Before nursing	After nursing	Before nursing	After nursing	Before nursing	After nursing
Group A (n = 31)	53.18 ± 2.41	31.44 ± 1.89	53.51 ± 2.48	31.25 ± 1.82	8.94 ± 1.56	3.25 ± 0.58
Group B (n = 31)	53.21 ± 2.39	42.29 ± 2.21	53.53 ± 2.51	43.36 ± 2.19	8.96 ± 1.58	4.88 ± 0.79
t	0.0492	20.7741	0.0316	23.6785	0.0502	9.2602
P	0.9609	0.0000	0.9749	0.0000	0.9602	0.0000

3.2. Nursing quality score

In **Table 3**, each nursing quality score in Group A was higher than that in Group B, $P < 0.05$.

Table 3. Comparison of nursing quality scores (mean ± SD)

Group	Service attitude	Theoretical knowledge	Nursing operations	Nursing documents	Sanitation and disinfection	Health education	Equipment management	Environmental safety
Group A (n = 31)	98.42 ± 2.25	98.11 ± 2.31	98.43 ± 2.38	98.25 ± 2.44	98.49 ± 2.56	97.87 ± 2.41	98.44 ± 2.39	97.68 ± 2.41
Group B (n = 31)	91.25 ± 1.49	92.71 ± 1.57	93.33 ± 1.61	92.81 ± 1.73	92.68 ± 1.88	93.43 ± 1.91	92.36 ± 1.89	93.25 ± 1.84
t	14.793 0	10.7646	9.8822	10.126 4	10.1848	8.0391	11.110 0	8.1347
P	0.0000	0.0000	0.0001	0.0000	0.0001	0.0001	0.0000	0.0001

3.3. Quality of life

After nursing, the SF-36 scores of Group A were higher than those of Group B, $P < 0.05$, as presented in **Table 4**.

Table 4. Comparison of quality of life (mean ± SD)

Group	Good health (points)		Mental health (points)		Physiological functions (points)		Social functions (points)	
	Before nursing	After nursing	Before nursing	After nursing	Before nursing	After nursing	Before nursing	After nursing
Group A (n = 31)	68.25 ± 2.11	87.36 ± 3.15	68.22 ± 2.13	88.29 ± 3.21	68.74 ± 2.18	88.36 ± 3.18	69.14 ± 2.24	88.42 ± 3.21
Group B (n = 31)	68.31 ± 2.13	76.33 ± 2.87	68.21 ± 2.15	76.41 ± 2.91	68.71 ± 2.21	75.79 ± 2.88	69.16 ± 2.26	76.11 ± 2.94
t	0.1114	14.4114	0.0184	15.2665	0.0538	16.3127	0.0350	15.7457
P	0.9117	0.0000	0.9854	0.0000	0.9573	0.0000	0.9722	0.0000

3.4. Complications

Based on **Table 5**, the postoperative complication rate of Group A was lower than that of Group B, $P < 0.05$.

Table 5. Comparison of surgical complications [n (%)]

Group	Pressure ulcer	High fever	Swelling of limbs	Deep venous blood circulation of lower limbs	Bone cement leakage	Incidence
Group A (n = 31)	0 (0.00)	0 (0.00)	1 (3.23)	0 (0.00)	0 (0.00)	3.23
Group B (n = 31)	1 (3.23)	1 (3.23)	2 (6.45)	1 (3.23)	1 (3.23)	19.35
χ^2	-	-	-	-	-	4.0260
P	-	-	-	-	-	0.0448

3.5. Nursing satisfaction

From **Table 6**, the nursing satisfaction of Group A was higher than that of Group B, $P < 0.05$.

Table 6. Comparison of nursing satisfaction [n (%)]

Group	Satisfied	Basically satisfied	Not satisfied	Total satisfaction rate
Group A (n = 31)	22 (70.97)	8 (25.81)	1 (3.23)	96.77%
Group B (n = 31)	16 (51.61)	9 (29.03)	6 (19.35)	80.65%
χ^2	-	-	-	4.0260
P	-	-	-	0.0448

4. Discussion

There are limitations in the conventional operating room nursing model, as it only manages and controls severe diseases and lacks refinement. In recent years, refined nursing models have been gradually implemented in operating rooms, particularly for orthopedic surgery patients. Various nursing strategies are standardized during the perioperative period, which fully reflects the humanistic nature of nursing, this model can reduce the risk of perioperative safety hazards and enhance nursing quality [5,6]. In addition, the refined nursing model exhibits distinctive characteristics. This approach calms the patient's emotions before surgery and assists the patient in preparing for surgery; it also includes timely delivery of surgical supplies during the surgery and strict control of nursing quality in all aspects of the surgery; active prevention of various complications after surgery and timely handling of orthopedic surgery accidents can prevent secondary infection and enhance the effectiveness of orthopedic surgery [7,8].

Based on the data analysis in this article, after refined nursing, the SAS (31.44 ± 1.89), SDS (31.25 ± 1.82), and VAS (3.25 ± 0.58) scores of orthopedic surgery patients in Group A were all lower than those in Group B, $P < 0.05$. It is suggested that operating room refined nursing can stabilize patients' emotions and reduce postoperative pain, which is attributable to preoperative psychological counseling in soothing patients' emotions. At the same time, strengthening the management of the operating room environment and standardizing disinfection and cleaning procedures can reduce adverse events in the operating room and relieve postoperative pain [9]. In addition, the implementation of refined nursing strategies can strengthen the sense of responsibility of nursing staff in orthopedic operating rooms and enable them to proactively serve patients. The results showed that the nursing quality scores of Group A were higher than those of Group B, $P < 0.05$; the SF-36 scores of orthopedic surgery patients in Group A were higher than those of Group B, $P < 0.05$. It is suggested that operating room refined nursing can enhance the quality of nursing and improve patient's quality of life. Strengthening nurse-patient communication during operating room refined nursing can enhance the trust between medical staff and patients, ensuring the orderly progression of subsequent nursing operations. In addition, during the operating room refined nursing, aseptic operations should be implemented to prevent iatrogenic infections; surgical supplies should be checked multiple times, and disinfection and sterilization work should be conducted out to ensure surgical safety; good limb placement and complication prevention nursing should be carried out to stabilize patients' vital signs and enhance their quality of life [10]. The results also showed that the postoperative complication rate of orthopedic patients in Group A (3.23%) was lower than that in Group B (19.35%), $P < 0.05$. It is suggested that operating room refined nursing can reduce postoperative complications. Among postoperative complications of orthopedic diseases, the incidence of pressure ulcers is relatively high, which is related to long-term bed rest after orthopedic surgery. The nursing staff guides patients to position their limbs correctly and instructs family members to turn and massage patients regularly, which can effectively prevent pressure ulcers. High fever is also a common postoperative complication, which is related to low body resistance after mechanized surgery. According to medical regulations, pyrexia can be prevented by monitoring body temperature and taking medication. Limb swelling is prone to occur after orthopedic surgery. Cold therapy can be used to adjust skin temperature and stimulate the prevention of vasoconstriction. Orthopedic patients may also develop secondary deep vein thrombosis in the lower limbs, which can be prevented by massaging and keeping warm. Bone cement is used for patients with thoracolumbar spinal lesions during surgery, which may cause secondary bone cement leakage. Thus, comprehensive evaluation and treatment of patients' discomfort symptoms need to be observed [11]. The results showed that the nursing satisfaction of orthopedic surgery patients in Group A (96.77%) was higher than Group B (80.65%), $P < 0.05$. It is suggested that operating room refined nursing can improve patient satisfaction. Operating room refined nursing can enhance the professionalism of nursing staff and optimize their operating skills. At the same time, it can refine the work process and ensure the safety of operating

room work, resulting in higher patient satisfaction [12].

5. Conclusion

In summary, using operating room refined nursing during orthopedic surgery can reduce postoperative pain, soothe patients' emotions, and reduce postoperative complications. It is conducive to improving patients' quality of life after orthopedic surgery and has high clinical application and promotion value.

Disclosure statement

The author declares no conflict of interest.

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Influence of Ulnar Styloid Fracture Types on the Treatment of Distal Radius Fractures

Jianmin Wang*

Suzhou Industrial Park Xingpu Hospital, Suzhou 215126, Jiangsu Province, China

***Corresponding author:** Jianmin Wang, 13914001044@163.com

Abstract: *Objective:* To analyze the effect of ulnar styloid process fracture types on the treatment of distal radius fracture. *Methods:* A total of 49 patients with distal radius fractures admitted to the hospital between December 1, 2018 and November 30, 2022 were selected. Among the patients, 26 of them were complicated with type I ulnar styloid fracture (the first group), and 23 patients were complicated with type II ulnar styloid fracture (the second group), and were treated with open reduction and internal fixation using Kirschner wire and tension band. The total effective rate, anatomical indicators such as palm inclination and ulnar deviation, and the range of motion of the wrist joint were compared between the two groups. *Results:* The total effective rate of the first group was higher than that of the second group ($P < 0.05$). There was no difference in anatomical indicators between the groups before operation and 3 months after operation ($P > 0.05$). Before operation, there was no difference in the range of motion of the wrist joint between the groups ($P > 0.05$). 3 months after operation, the range of motion of the wrist joint in the first group was greater than that in the second group ($P < 0.05$). *Conclusion:* The types of ulna styloid fracture can affect the effectiveness of treatment and joint mobility of distal radius fracture.

Keywords: Types of ulna styloid fractures; Distal radius fractures; Treatment effect

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1. Introduction

Distal radius fracture is a type of fracture with a relatively high incidence, and its conventional treatment is open reduction and volar plate fixation, which can restore joint function [1,2]. Ulnar styloid fracture refers to the type of fracture in which the ulnar styloid process is damaged in the distal radius fracture. The ulnar styloid process can maintain the stability of the wrist joint, promote the recovery of hand function after fracture, and improve the long-term curative effect of fracture. Previous studies have found that different types of ulnar styloid fractures affect the overall effectiveness of the treatment of distal radius fractures, and limit the wrist joint function and range of motion after fractures [3]. Therefore, this study selected 49 patients with distal radius fractures to analyze the influence of different types of ulnar styloid process fractures on the treatment effectiveness.

2. Materials and methods

2.1. General information

A total of 49 patients with distal radius fractures admitted to the hospital from December 1, 2018 to November 30, 2022 were selected. There were 26 patients in the first group, with 15 male patients and 11 female patients; the age ranged from 27 to 73 years old, with a mean of 51.26 ± 2.78 years old; the fractures involved the right side in 16 cases and the left side in 10 cases. There were 23 cases in the second group, with 13 males and 10 females; the age ranged from 26 to 75 years, with an average of 51.20 ± 2.63 years old; the fractures involved the right side in 14 cases and the left side in 9 cases.

Inclusion criteria included patients aged no less than 18 years; patients with distal radius fracture (unilateral) confirmed by X-ray; patients with complete clinical data; patients with 3-month follow-up; and patients with informed consent. Exclusion criteria were patients with abnormal wrist function before surgery; patients with prior fractures; patients with other upper limb fractures; and patients who dropped out of the study.

2.2. Methods

Brachial plexus block anesthesia was performed, and the fractured end of the distal radius was reduced and treated using Henry approach, and internal fixation was performed with a locking plate. After confirming satisfaction, the stability of the radioulnar joint was evaluated by applying pressure. The distal radius was grasped with one hand, ensuring that the forearm was in neutral rotation, and the other hand was used to push the distal ulna toward the volar and dorsal sides of the radius. If there was a sense of relaxation and friction, differing from that of the healthy side, it indicated instability in the radioulnar joint, which was treated with long-arm plaster external fixation for 2 to 3 weeks. Surgical intervention was recommended if the ulnar styloid fracture was pronounced. The incision was made on the ulnar side of the wrist, with caution taken to protect the tendon sheath and dorsal nerve of the hand on the ulnar side. When the fracture end was fully exposed, the hematoma tissue was removed, treated with reduction, and fixed with Kirschner wires (0.8 to 1.0 mm, 1/2 pieces). The ligament at the ulnar styloid process and the bone hole at the proximal end of the fracture were effectively fixed with a figure-of-eight tension band by the non-absorbable thread. If the ulnar styloid fracture fragment was relatively intact, it was directly fixed with a hollow nail (2.0 mm, 1 piece) after reduction. If the diaphysis was damaged, a miniplate was combined for fixation.

2.3. Observation indicators

Anatomical indicators before the operation and 3 months after the operation were recorded, including palmar tilt, ulnar inclination, and radial height. Before the operation and 3 months after the operation, the range of motion of wrist joints such as ulnar deviation, wrist extension, pronation, wrist flexion, supination, and radial deviation was measured.

2.4. Efficacy evaluation criteria

The Gartland and Werley system was used to evaluate the treatment effectiveness, including 6 points for subjective evaluation, 5 points for complications, 5 points for objective evaluation, and 3 points for residual deformity, with a total of 19 points. A score of ≤ 2 points indicates a significant effect, a score between 3 and 8 indicates a preliminary effect, and a score > 8 points indicates no curative effect.

2.5. Statistical analysis

The data were processed using SPSS28.0 software, the measured values were compared/tested by t value, and the counted values were compared/tested by χ^2 value. $P < 0.05$ indicated a statistically significant difference.

3. Results

3.1. Comparison of the total effective rate between the two groups

The total effective rate of the first group was higher than that of the second group ($P < 0.05$), as shown in **Table 1**.

Table 1. Comparison of total effective rate between the two groups [n (%)]

Group	Number of cases	Significant effect	Preliminary effect	No effect	Total effective rate
The first group	26	16 (61.54)	9 (34.62)	1 (3.85)	96.15 (25/26)
The second group	23	8 (34.78)	8 (34.78)	7 (30.43)	69.57 (16/23)
χ^2	-	-	-	-	6.316
P	-	-	-	-	0.012

3.2. Comparison of anatomical indicators between the two groups

Based on **Table 2**, there was no difference in the anatomical indicators between the groups before and after the operation ($P > 0.05$).

Table 2. Comparison of anatomical indicators between the two groups (mean ± standard deviation)

Group	Number of cases	Palmar tilt (°)		Ulnar inclination (°)		Radial height (mm)	
		Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative
The first group	26	-17.65 ± 2.65	8.41 ± 1.33	4.92 ± 0.86	14.33 ± 1.85	2.88 ± 0.34	9.22 ± 1.76
The second group	23	-17.02 ± 2.71	8.21 ± 1.29	4.90 ± 0.76	14.02 ± 1.70	2.81 ± 0.39	9.04 ± 1.68
t	-	0.822	0.533	0.086	0.608	0.671	0.365
P	-	0.415	0.597	0.932	0.546	0.505	0.717

3.3. Comparison of the range of motion of the wrist joint between the two groups

Before the operation, there was no difference in the range of motion of the wrist joint between the groups ($P > 0.05$). 3 months after the operation, the range of motion of the wrist joint in the first group was greater than that in the second group ($P < 0.05$), as presented in **Table 3**.

Table 3. Comparison of the range of motion of the wrist joint between the two groups (mean ± standard deviation, °)

Group	Number of cases	Ulnar deviation		Wrist extension		Pronation		Wrist flexion		Supination		Radial deviation	
		Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative	Preoperative	Postoperative
The first group	26	12.36 ± 1.84	24.15 ± 2.32	31.53 ± 2.88	45.18 ± 4.32	35.81 ± 2.83	62.59 ± 4.98	18.59 ± 2.73	47.36 ± 3.75	35.91 ± 3.08	67.28 ± 6.59	7.26 ± 1.53	17.82 ± 1.66
The second group	23	12.41 ± 1.77	22.01 ± 2.17	31.42 ± 2.71	40.18 ± 4.29	36.01 ± 2.71	58.02 ± 4.75	18.45 ± 2.69	42.05 ± 3.61	35.44 ± 3.06	63.02 ± 6.55	7.44 ± 1.50	15.02 ± 1.60
t	-	0.097	3.321	0.137	4.056	0.252	3.276	0.180	5.034	0.535	2.265	0.415	5.993
P	-	0.923	0.002	0.891	0.000	0.802	0.002	0.858	0.000	0.595	0.028	0.680	0.000

4. Discussion

Open reduction combined with volar plate internal fixation is a common treatment for distal radius fractures. Through incision of the surgical wound, volar Henry approach was performed followed by reduction treatment, and internal fixation with a bone plate was used to stabilize the fracture site [4]. Specifically, most distal radius

fractures are accompanied by disease features such as articular surface misalignment and fracture fragment instability. Open reduction combined with volar plate internal fixation can effectively stabilize the fracture site and promote fracture healing and joint function recovery. Open reduction allows direct observation and handling of the broken ends of the fracture, ensuring accurate reduction, so that the broken ends can be correctly connected [5,6]. Open reduction combined with internal fixation can prevent fracture displacement or re-dislocation. The volar plate has strong rigidity offering stable support to the fracture end, ensuring early and mid-term joint stability after surgery, and providing a favorable environment for fracture healing. In addition, this treatment option can shorten the recovery time of hand function, and improve the range of motion of the wrist and the flexibility of fingers, thereby enhancing the postoperative quality of life [7].

The ulnar styloid is an important structure that maintains a stable connection between the distal radius and the metacarpal. When the ulnar styloid process is fractured, its anatomical integrity and physiological function are significantly damaged, resulting in a serious decline in the stability of the wrist joint, which will directly affect the treatment and healing process of distal radius fractures [8]. Firstly, an ulnar styloid fracture increases the instability of the distal radius fracture, making it difficult to maintain the correct anatomical position of the fracture. Unstable fractures can delay the healing process and affect the treatment of distal radius fractures. Secondly, ulnar styloid fractures can damage the related vascular supply, resulting in a disturbance of blood circulation at the fracture site of the distal radius [9]. Adequate blood supply is particularly important for fracture healing, thus impaired vascular supply will impact the effect of postoperative fracture treatment. Lastly, most ulnar styloid fractures necessitate surgical treatment, and the postoperative recovery time is longer, which will delay the fracture healing speed and affect the functional recovery of the patient's wrist joint [10].

Previous studies have pointed out that different types of ulnar styloid fractures have distinct effects on the treatment of distal radius fractures. Therefore, this study divided patients with distal radius fractures into type I fracture (the first group) and type II fracture (the second group). The results showed that the total effective rate of the first group was higher than that of the second group ($P < 0.05$). The reason is that type I ulnar styloid fractures are mostly simple transverse fractures, while type II ulnar styloid fractures are accompanied by lateral fragmentation of the articular surface of the ulnar styloid process or dorsal cortical rupture. Since type II fractures involve multiple fracture lines, the fracture segments are more complex and unstable. Compared with type I fractures, type II fractures are more prone to dislocation, which affects the postoperative treatment effect [11]. In addition, type I ulnar styloid fractures have better fracture stability, thus a fixed steel plate is usually placed below the surgical incision as an internal fixation. The internal fixation method maintains joint function and is conducive to fracture fusion. Type II ulnar styloid fractures are variable and require more complicated internal fixation methods, thus posing higher risks of postoperative complications that affect the prognosis of the fracture [12]. There was no difference in the anatomical indicators before the operation and 3 months after the operation between the first group and the second group ($P > 0.05$). The reason is that although type I and type II ulnar styloid fractures are different in terms of position and degree of fracture line, the fracture sites are relatively concentrated in the area of the ulnar styloid process. The recovery process of distal radius fractures does not only depend on the type of ulnar styloid process fracture, the improvement of palmar tilt, ulnar inclination, and radial height depends on the accuracy of reduction, stability of internal fixation, and the rehabilitation of the patient [13]. In addition, palmar tilt, ulnar inclination, and radial height are also affected by other factors, such as surgical technique, internal fixation materials and methods, surgical incision, and postoperative management. These factors may have a partial impact on the improvement of measurement parameters, and weaken the difference in the impact of various types of ulnar styloid process fractures on anatomical indicators [14]. The range of motion of the wrist joint in the first group was greater than that in the

second group 3 months after operation ($P < 0.05$). This is because type I ulnar styloid fractures are more stable than type II fractures. After surgery and internal fixation, the fracture ends of type I fractures are stable, with rare displacement and dislocation of the fracture site, which helps to maintain the normal range of motion of the wrist joint, so that patients can perform wrist joint exercise training as soon as possible during postoperative recovery period. Type II ulnar styloid fractures can lead to severe soft tissue damage, including articular cartilage damage, joint meniscus tear, etc. [15]. Soft tissue injury may exert a negative impact on the range of motion of the wrist joint, resulting in a more limited wrist range of motion in type II ulnar styloid fractures than in type I fractures.

5. Conclusion

In summary, the difference in the type of ulnar styloid fracture will affect the rehabilitation effect of distal radius fracture, and type II fracture exerts a greater impact on the total effective rate of treatment and the range of motion of the wrist joint. It is necessary to comprehensively evaluate the fractures of the ulnar styloid process and distal radius, and rationally formulate the surgical plan to ensure the treatment effectiveness of the surgery.

Disclosure statement

The author declares no conflict of interest.

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Effects of Heat Fumigation with Hai Tong Pi Decoction and Chinese Bone-Setting Manipulation on Patients with Lumbar Disk Herniation

Xiaofei Wang*

Xuyi Hospital of Traditional Chinese Medicine, Huai'an 211700, Jiangsu Province, China

***Corresponding author:** Xiaofei Wang, huaianwxf@163.com

Abstract: *Objective:* To investigate the effects of heat fumigation with Hai Tong Pi decoction and Chinese bone-setting manipulation on patients with lumbar disk herniation. *Methods:* 126 patients with lumbar disk herniation who visited the orthopedic department of our hospital from January 2022 to May 2023 were included and divided into two groups of 63 cases each according to the method of randomized numerical table. Conventional lumbar traction treatment was applied in the control group, while in the study group, heat fumigation with Hai Tong Pi decoction and traditional Chinese bone-setting manipulation were adopted in addition to conventional lumbar traction treatment. The total effective rate was compared between the groups, and the lumbar spine mobility, lumbar spine function scores, and symptom scores were compared between and within the groups. *Results:* After treatment, the total effective rate in the study group was higher than that in the control group ($P < 0.05$). The lumbar spine mobility and lumbar spine function scores after treatment were significantly higher in both groups compared with those before treatment, while lumbar spine mobility and lumbar spine function scores were higher in the study group than in the control group ($P < 0.05$). After treatment, the scores of symptoms such as lumbar back pain, radiating pain in the lower limbs, and urinary and defecation disorders were significantly lower in both groups compared with those before treatment, while the scores of each symptom in the study group were lower than those in the control group ($P < 0.05$). *Conclusion:* In the treatment of patients with lumbar disk herniation, the combined application of heat fumigation of Hai Tong Pi decoction and Chinese bone-setting manipulation can enhance the treatment effectiveness, improve the lumbar spine function, lumbar spine mobility, and lumbar back pain.

Keywords: Orthopedics and traumatology; Lumbar disk herniation; Lumbar traction; Hai Tong Pi decoction; Traditional Chinese medicine heat fumigation; Chinese bone-setting manipulation

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1. Introduction

Lumbar disk herniation is a common chronic degenerative spinal lesion in orthopedics, with a high incidence in the elderly and a high morbidity rate [1]. After the onset of lumbar disk herniation, patients experience low back pain, lumbar dysfunction, limited lumbar spine activities, and recurrent episodes during the long course of the disease,

causing serious interference in the patient's daily life and declined quality of life [2]. Clinical practices advocate for an active approach to treating lumbar disk herniation. The treatment of lumbar disk herniation in Western medicine typically involves lumbar traction, utilizing negative gravity to apply traction to the lumbar spine, which can correct vertebral body alignment to a certain extent [3], but some patients may not achieve optimal results with this single lumbar traction treatment. In recent years, clinical research reports on the application of traditional Chinese medicine techniques in the treatment of lumbar disk herniation have increased, and traditional Chinese medicine techniques such as heat fumigation of traditional Chinese medicines and bone-setting manipulation have achieved certain effects in the treatment of lumbar disk herniation. This study investigated the effects of heat fumigation with Hai Tong Pi decoction and Chinese bone-setting manipulation treatment on lumbar disk herniation patients.

2. Materials and methods

2.1. General information

126 cases of patients with lumbar disk herniation who visited the orthopedic department of the hospital from January 2022 to May 2023 were included and divided into two groups of 63 cases each according to the method of randomized numerical table. There were 41 males and 22 females in the control group, with a minimum age of 60 years and a maximum age of 84 years, with a mean of 71.35 ± 6.02 years; there were 43 males and 20 females in the study group, with ages ranging from 60 to 86 years, with a mean of 71.68 ± 5.94 years. The data on gender and age were compared between the groups, and it was found that the difference between the data was not statistically significant ($P > 0.05$), which indicated that the general information of the two groups was comparable. This study was approved by the hospital ethics committee. The patients and their families were given an explanation of this study and their consent was obtained.

Inclusion criteria included lumbar disk herniation diagnosed by symptom observation and imaging examination; elderly not less than 60 years old; patients awake and conscious during the treatment period, who did not have consciousness disorder.

Exclusion criteria were patients with lumbar disk herniation combined with spinal fracture, spinal tuberculosis, or spinal tumor; patients with cardiovascular and cerebrovascular diseases; patients with cognitive impairment; the presence of systemic infection.

2.2. Methods

In the control group, conventional lumbar traction was implemented. The patients received traction therapy in a prone position on the traction bed, with the initial traction load value set at 35 kg. The subsequent load value was adjusted according to the patient's specific conditions. Lumbar spine traction was performed once per day for 30 minutes each time, continuously for 2 weeks.

In the study group, in addition to conventional lumbar traction treatment, heat fumigation with Hai Tong Pi decoction and Chinese bone-setting manipulation were adopted, and the specific steps were as follows.

(1) Heat fumigation with Hai Tong Pi decoction: 30g safflower, 30g rhizoma *Ligusticum chuanxiong*, 30g Cortex Eucommiae, 30g parasitic *Loranthus*, 30g *Clematis chinensis*, 30g *Turbinaria*, 30g *Lycopodium clavatum*, 30g Hai Tong Pi, 30g *Gentiana macrophylla*, 30g *Ramulus mori*, 30g *Notopterygium* root, 30g cinnamon twig, 30g Cortex Acanthopanacis, 20g *Radix sileris*, 30g *Spatholobi caulis*, 15g *Boswellia*, and 15g myrrh were crushed to coarse material using a pulverizer, which was then placed on pillows and put in a steam pot for 60 minutes of continuous heat fumigation. During the treatment, a thick towel was placed on the affected area, pillows were placed onto the towel for heat fumigation treatment for 30 minutes, once a day, and continued for 2 weeks.

(2) Chinese bone-setting manipulation: The patient was instructed to lie down on the treatment bed, placing one pillow below the chest, specifically in the iliac front part of the patient, ensuring that the lumbar region maintained an over-extension position. The physician stood on the patient's right side and pushed downward with both thumbs from 2–3cm beside the patient's spinous process with even force for 8–12 times, and then the physician continued to press the patient's spinous process and high protruding parts with his right elbow with the help of his body weight for about 2 minutes, followed by pressing and kneading the patient's dorsal acupuncture acupoint, pincer spine acupoint, Changqiang acupoint, Feiyang acupoint, Jinmen acupoint, and Tao Dao acupoint until the localized area became warm. Bone-setting manipulation was performed once a day for 2 weeks, with each session lasting about 1 hour.

2.3. Observation indicators

The total effective rate was compared between the groups; the lumbar spine mobility, lumbar spine function score, and symptom scores were compared between and within the groups.

Efficacy: Evaluation of the treatment efficacy was carried out according to the relief of symptoms and the improvement of lumbar spine function after treatment, such as the disappearance of symptoms and full recovery of lumbar spine function, i.e., cured; the relief of symptoms and partial improvement of lumbar spine function, i.e., improved; the symptoms were not relieved and no improvement of lumbar spine function, i.e., ineffective. The cured and improved cases were categorized as effective, and the sum of the percentages of these two classes of cases was counted, i.e. the total effective rate.

Lumbar spine function score: The lumbar spine function of the patients was evaluated using the Japanese Orthopaedic Association (JOA) scale as an assessment tool, with a maximum score of 29 and a minimum score of 0. The final score obtained was proportional to the lumbar spine function.

Symptom scores: Regarding the assessment of the severity of symptoms after the onset of lumbar disk herniation, Likert's 4-grade scoring method was applied to score the severity of symptoms such as lumbar back pain, radiating pain in the lower extremities, and urinary and defecation disorders. The score range was set to be 0–3, and the higher the score obtained, the higher the severity of the symptom.

2.4. Statistical methods

The data obtained in this study were analyzed statistically using SPSS22.0 software. The count data were compared with the χ^2 test, and the measured data were normally distributed, and the *t*-test was used for comparison, with $P < 0.05$ indicating a statistically significant difference.

3. Results

3.1. Comparison of total effective rate between two groups

After treatment, the total effective rate in the study group was higher than that in the control group ($P < 0.05$), as shown in **Table 1**.

Table 1. Comparison of total effective rate between the two groups [n (%)]

Group	Cases	Cured	Improved	Ineffective	Total effective rate
Control group	63	32 (50.79%)	23 (36.51%)	8 (12.70%)	55 (87.30%)
Study group	63	38 (60.32%)	24 (38.10%)	1 (1.59%)	62 (98.41%)*

*$P < 0.05$ vs. control group

3.2. Comparison of lumbar spine mobility and lumbar spine function scores between the two groups

After treatment, lumbar spine mobility and lumbar spine function scores in both groups were significantly higher compared with those before treatment, while lumbar spine mobility and lumbar spine function scores in the study group were higher than those in the control group, both $P < 0.05$. The results are presented in **Table 2**.

Table 2. Comparison of lumbar spine mobility and lumbar spine function scores between the two groups (mean ± standard deviation)

Group	Time	Lumbar spine mobility (°)				Lumbar spine function score (points)
		Forward bend	Posterior extension	Lateral flexion	Rotation	
Control group (n = 63)	Before treatment	47.29 ± 4.16	12.51 ± 1.14	14.19 ± 1.06	13.29 ± 1.17	16.58 ± 2.19
	After treatment	52.37 ± 4.94#	14.69 ± 1.58#	16.43 ± 1.87#	15.07 ± 1.46#	19.37 ± 2.65#
Study group (n = 63)	Before treatment	47.53 ± 4.08	12.63 ± 1.06	14.30 ± 1.03	13.39 ± 1.12	16.74 ± 2.03
	After treatment	60.46 ± 5.32#*	17.05 ± 1.97#*	18.97 ± 2.14#*	17.12 ± 1.85#*	22.09 ± 2.71#*

#$P < 0.05$ vs. before treatment, *$P < 0.05$ vs. control group

3.3. Comparison of symptom scores between the two groups

After the treatment, the scores for the symptoms of low back pain, radiating pain of lower limbs, and urinary and defecation disorders were significantly reduced in both groups compared to the pre-treatment period, while the scores of each symptom in the study group were lower than those in the control group, all $P < 0.05$. The data are shown in **Table 3**.

Table 3. Comparison of symptom scores between the two groups (mean ± standard deviation, points)

Group	Time	Low back pain	Radiating pain in the lower extremities	Urinary and fecal problems
Control group (n = 63)	Before treatment	2.13 ± 0.42	2.05 ± 0.40	2.19 ± 0.47
	After treatment	1.58 ± 0.43#	1.52 ± 0.48#	1.61 ± 0.45#
Study group (n = 63)	Before treatment	2.15 ± 0.45	2.03 ± 0.44	2.21 ± 0.54
	After treatment	1.17 ± 0.39#*	1.06 ± 0.31#*	1.16 ± 0.40#*

#$P < 0.05$ vs. before treatment, *$P < 0.05$ vs. control group

4. Discussion

For lumbar disk herniation, clinical practices advocate the implementation of active treatment after the onset of the disease. Western medicine typically recommends lumbar traction therapy, utilizing traction beds in weight-bearing traction mode. Gravity is used to complete the traction for the lumbar vertebrae and disks, promoting the recovery of the patient's lumbar disk position and alleviating compression on the cauda equina nerve. This helps achieve relief from lumbar and sciatic nerve pain. Lumbar spine exercise is considered beneficial not only for strengthening but also for expanding the range of motion in the lumbar spine [4]. Conventional lumbar traction therapy can play a certain therapeutic role for patients with lumbar disk herniation, but some patients fail to achieve the optimal therapeutic effect with single lumbar traction therapy, and its therapeutic efficacy requires improvement.

In recent years, the application of Chinese medicine in the treatment of lumbar disk herniation has increased. Lumbar disk herniation belongs to the category of "paralysis" in Chinese medicine, the pathogenesis of which

is the insufficiency of kidney qi, the invasion of wind, cold, and dampness, damage to yang qi, paralysis of the tendons and veins, and impaired circulation of qi and blood in the meridians and channels, and the resulting pain from the poor circulation. Therefore, the principle of Chinese medicine for lumbar disk herniation is to warm channel and disperse cold, dispel wind and dampness, enhance blood circulation and remove blood stasis, and activate qi circulation to relieve pain [5,6]. Chinese medicine heat fumigation and Chinese bone-setting manipulation are two Chinese medicine techniques that are commonly used in the treatment of lumbar disk herniation. Among these, Chinese bone-setting manipulation belongs to Chinese medicine physiotherapy, which is mainly guided by the theory of Chinese medicine meridians and collaterals and bone-setting manipulation as a means to remove the blood stasis through bone-setting manipulation of the patient's lumbar spine, thereby prompting the qi, balancing yin and yang qi in the body, and effectively improving the local blood circulation to reduce the pain caused by the poor local blood circulation. It can effectively improve local blood circulation, reduce nerve edema and adhesion caused by poor local blood circulation, and loosen the muscles of the lumbar spine to further reduce pain [7,8]. Heat fumigation of traditional Chinese medicine is a kind of traditional Chinese medicine treatment method in addition to the internal treatment of traditional Chinese medicine, and this approach allows drugs to act directly on the affected area through steam without metabolizing through the liver and kidney, which can improve the safety of treatment [9,10]. The prescription of heat fumigation of traditional Chinese medicine in this study is Hai Tong Pi decoction, in which safflower can invigorate blood circulation and remove blood stasis, *Ligusticum chuanxiong* can invigorate blood circulation and promote qi, dispel wind, and relieve pain. Cortex Eucommiae and parasitic *Loranthus* can replenish the liver and kidney, and strengthen the tendons and bones, and *Clematis chinensis* can dispel wind-dampness, and improve the channels and meridians. *Turbinaria*, *Lycopodium clavatum*, and Hai Tong Pi can dispel wind and dampness, soothe the tendons and enhance blood circulation, dissipate blood stasis, reduce swelling, and relieve pain. *Gentiana macrophylla* can dispel wind-dampness, remove dampness and heat, and relieve paralysis and pain. *Ramulus mori* can dispel wind-dampness and improve the joints, while *Notopterygium* root can dissipate cold and relieve pain, and dispel wind-dampness. Cinnamon branches can warm the channels, *Radix sileris* can dispel paralysis and cold, and wind-dampness. Cortex Acanthopanacis can dispel wind-dampness, tonify liver and kidneys, and strengthen the muscles and bones, while *Spatholobi caulis* can invigorate blood circulation and remove blood stasis, and invigorate the channels. *Boswellia* and myrrh can dissipate blood stasis and relieve pain, eliminate swelling, and regenerate muscle. The combination of these herbs can enhance blood circulation and eliminate blood stasis, move qi and relieve pain, remove paralysis and dissipate cold, and dispel wind and dampness.

In this study, it was found that the total effective rate of the study group was higher than that of the control group, the lumbar spine mobility and lumbar spine function scores of the study group were higher than that of the control group, and the scores on each symptom of the study group were lower than that of the control group, all of which were statistically significant ($P < 0.05$). These indicated that heat fumigation of Hai Tong Pi decoction combined with bone-setting manipulation of traditional Chinese medicine can better improve the lumbar spine function and lumbar spine mobility of lumbar disk herniation patients and alleviate lumbar back pain, lower limb radiating pain, and other symptoms with remarkable efficacy.

5. Conclusion

To summarize, in the treatment of patients with lumbar disk herniation, the combined application of heat fumigation of Hai Tong Pi decoction and bone-setting manipulation can enhance the therapeutic effect, improve the lumbar spine function and lumbar spine mobility, and reduce lumbar back pain.

Disclosure statement

The author declares no conflict of interest.

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Evaluation of the Clinical Effect of Modified *Dipsacus* Decoction in the Treatment of Osteoporotic Fractures

Chunyang Bi*

Department of Orthopedics III, Changping District Hospital of Integrated Traditional Chinese and Western Medicine, Beijing 102208, China

***Corresponding author:** Chunyang Bi, yuhang050625@163.com

Abstract: *Objective:* To observe the clinical effect of modified and subtracted *Dipsacus* Decoction in the treatment of osteoporotic fractures (OPF). *Methods:* 60 OPF cases were divided into two groups based on the double-blind method. Both groups underwent fracture reduction under X-ray guidance and took calcitriol soft capsules simultaneously, while *Dipsacus* Decoction was added to the observation group. The clinical treatment effectiveness, fracture healing time, bone density, laboratory indicators, and incidence of adverse reactions of the two groups were compared. *Results:* The total effective rate of clinical treatment in the observation group was higher than that in the control group, the fracture healing time was shorter than that of the control group, and the bone density and laboratory indicators after treatment were better than those of the control group ($P < 0.05$). There were no severe adverse reactions in either group. *Conclusion:* The addition and subtraction of *Dipsacus* Decoction based on conventional Western medicine treatment for OPF can further improve the effectiveness of clinical treatment and speed up fracture healing, which is worthy of promotion.

Keywords: *Dipsacus* Decoction; Osteoporotic fracture; Effective rate

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1. Introduction

Osteoporotic fracture (OPF) is one of the common clinical orthopedic trauma events. Its occurrence is primarily based on decreased individual bone density and bone quality and increased bone fragility caused by menopause, advanced age, or related diseases [1]. In recent years, integrated traditional Chinese and Western medicine treatment has gradually become a mainstream clinical trend. Compared with the symptomatic treatment of Western medicine, traditional Chinese medicine (TCM) puts more emphasis on "syndrome differentiation and treatment" and considers the relationship between the disease and the body's meridians and the movement of qi and blood, thus allowing a more targeted and comprehensive treatment, addressing both the symptoms and the root causes [2]. *Dipsacus* Decoction is a traditional Chinese medicine prescription that mainly treats orthopedic diseases. It has profound effects of strengthening muscles and bones, consolidating the body and supporting

yang, activating blood circulation, and removing blood stasis. Relevant practice has proven that it has relatively ideal application advantages in promoting fracture healing [3]. This study aims to explore the clinical benefits of the modified *Dipsacus* Decoction on OPF patients.

2. Materials and methods

1.1. Materials

A total of 60 OPF cases admitted from March 2019 to March 2022 were selected as the study samples. Using the double-blind method, the cases were grouped into two groups. The control group had 30 cases with 12 male patients and 18 female patients; age ranged from 52 to 86 years old, with a mean of 69.35 ± 4.87 years old; based on their educational background, 4 completed primary school and below, 12 completed junior high school, 9 with a junior college education, and 5 with a bachelor's degree and above. The observation group had 30 cases with 15 male patients and 15 female patients; age ranged from 53 to 88 years old, with an average of 69.41 ± 4.92 years; according to their educational background, 5 completed primary school and below, 10 completed junior high school, 11 with a junior college education, and 4 with a bachelor's degree and above. After a normalized comparison of the data shown between the groups, there was no significant difference ($P > 0.05$).

Inclusion criteria included patients who are consistent with the relevant diagnostic criteria of the "Chinese Guidelines for the Diagnosis and Treatment of Osteoporotic Fractures - Principles of Diagnosis and Treatment of Osteoporotic Fractures" [4]; the disease has been confirmed by imaging, bone density, and other examinations; patients who have no missing information in their medical records; patients who have no history of mental, cognitive, or psychological diseases; patients who are conscious and can communicate normally; patients who are informed with documented information about the patient; patients who have demonstrated their independent will. Exclusion criteria were patients with malignant tumors; patients with severe dysfunction of vital organs; patients with coagulation disorders and immune system diseases; patients who have received systemic treatment for osteoporosis 2 months before enrollment; patients with severe fractures and life-threatening conditions; patients with extremely poor medical compliance; patients who leave before the completion of the study.

2.2. Methods

After both groups were admitted to the hospital, fracture reduction was performed under X-ray guidance, and external fixation and braking intervention were performed at the same time. Subsequently, the patient was provided with calcitriol soft capsules (National Drug Approval Number: H20213963, Manufacturer: Henan Taifeng Biotechnology Co., Ltd.) for treatment, and was instructed to continuously take 0.25 **μg** each time with warm water, 3 times a day. There were 5 courses of medication, and one course of treatment lasted for 10 days. For the 30 cases enrolled in the observation group, based on the above treatment, modified and subtracted *Dipsacus* Decoction was used. The basic prescription is 15g each of *Dipsacus* spp., psoralen, and *Drynariae*, 10g each of *Astragalus membranaceus*, *Salvia miltiorrhiza*, and natural copper. 1 dose was taken every day, and 400ml of water was added and boiled until there was approximately 200ml juice left, in which 100ml was taken warmly in the morning and evening. It was taken continuously for 5 courses, with 10 days as a course of treatment.

2.3. Observation indicators

(1) Clinical treatment effectiveness

Based on "Guiding Principles for Clinical Research of New Traditional Chinese Medicines" [5], the

symptoms of dizziness, tinnitus, soreness, and weakness of waist and knees, and lumbar spine pain in the two groups were treated with points. The reduction rate of TCM syndrome points (Reduction rate = [points before treatment - points after treatment] / points before treatment × 100%), along with the results of physical examination, X-ray, and other examination were used to evaluate the clinical treatment effectiveness. Basically recovered: TCM syndrome point reduction rate ≥ 95%, no vertical axis percussion pain or abnormal movement, no tenderness, X-ray film shows blurred fracture line, and continuous callus formation; Markedly effective: TCM syndrome point reduction rate is between 70% and 94%, painless percussion, slight local tenderness, X-ray shows sound reduction with relatively blurred fracture line; Effective: TCM syndrome point reduction rate is between 30% and 69%, slight percussion pain and tenderness, X-ray shows basic reduction, with less than 1mm displacement and less than 2mm crack; Ineffective: the relevant content does not meet the above standards.

(2) Fracture healing time

(3) Bone density and laboratory parameters

Bone density of the two groups before and after treatment was accurately measured through X-ray examination. At the same time, 5ml of fasting venous blood was drawn from two groups of patients to determine the specific concentrations of serum vascular endothelial growth factor (VEGF) and osteocalcin (BGP), which were compared between the groups.

(4) Adverse reactions

2.4. Statistical analysis

Using SPSS25.0 software for Windows as the statistical basis, all the obtained data were divided by nature. Measurement data were displayed as mean ± standard deviation (SD), and a parallel *t* test was performed. Count data were displayed as %. At the same time, the chi-square test was performed. $P < 0.05$ indicated that there was a statistically significant difference.

3. Results

3.1. Comparison of clinical treatment effectiveness between the two groups

As shown in **Table 1**, the total effective rate of clinical treatment in the observation group was significantly higher than that in the control group, $P < 0.05$.

Table 1. Comparison of clinical treatment effectiveness [n (%)]

Group	Number of cases	Basically recovered	Markedly effective	Effective	Ineffective	Total effective rate
Control group	30	4 (13.33)	6 (20.00)	12 (40.00)	8 (26.67)	22 (73.33)
Observation group	30	6 (20.00)	9 (30.00)	14 (46.67)	1 (3.33)	29 (96.67)
χ^2	-	-	-	-	-	6.405
P	-	-	-	-	-	0.011

3.2. Comparison of fracture healing time between the two groups

Observation showed that the fracture healing time of the control and observation groups were 13.72 ± 5.14 weeks and 11.11 ± 3.95 weeks, respectively, $t = 2.205$, $P = 0.031$, and the difference between the groups was statistically significant.

3.3. Comparison of bone density and laboratory indicators between the two groups

In **Table 2**, there was no statistically significant difference between the groups in bone density, VEGF, and BGP before treatment, $P > 0.05$. After treatment, the levels of various indicators in the observation group were higher than those in the control group, $P < 0.05$.

Table 2. Comparison of bone density and laboratory indicators (mean ± SD)

Group	Time	Bone density (g/cm^2)	VEGF (μg/L)	BGP (ng/mL)
Control group (n = 30)	Before treatment	0.52 ± 0.19	12.41 ± 5.62	2.37 ± 1.05
	After treatment	0.61 ± 0.24	16.58 ± 6.74	4.88 ± 2.12
Observation group (n = 30)	Before treatment	0.54 ± 0.20	12.39 ± 5.58	2.39 ± 1.06
	After treatment	0.78 ± 0.31	23.72 ± 9.87	8.35 ± 3.69
t	Before treatment	0.397	0.014	0.073
	After treatment	2.375	3.272	4.466
P	Before treatment	0.693	0.989	0.942
	After treatment	0.021	0.002	0.001

3.4. Comparison of adverse reactions between the two groups

After observation, no severe adverse reactions such as liver and kidney damage, occurred in both groups. Only one case of nausea and skin itching occurred in the control group, but these symptoms subsided spontaneously after discontinuing the drug.

4. Discussion

It is widely known that healing after a fracture is a relatively lengthy process. During this period, fracture healing may be affected by factors such as biomechanics, histology, biochemical factors, hormones, etc., leading to slow or even stagnant healing process. In severe cases, healing deformities may even occur and significantly hinder the patient's motor function [6]. Since OPF is not just a simple fracture event, the clinical treatment of this disease goes beyond mere fracture management. In addition to prompt fracture reduction and active use of medication to promote bone healing, it also necessitates targeted treatment of the primary disease, osteoporosis. This comprehensively enhances bone strength and stimulates bone formation [7]. In the past, clinical treatments for OPF were mainly based on Western medicine treatment concepts. Although they did exert a certain degree of therapeutic benefit, they were prone to failure due to long medication cycles and individuals' different tolerance levels to Western medicines. Western medicine treatment causes more adverse reactions, and the overall treatment cost is relatively high, which reduces the patient's treatment compliance and directly affects the overall treatment effect [8,9].

In recent years, due to the long-term accumulation of toxic and side effects of Western medicine and the continuous development of traditional Chinese medicine, most patients have gradually favored conventional Chinese medicine for its advantages of greenness, safety, and significant efficacy. From the perspective of traditional Chinese medicine, osteoporosis can be classified as "bone dryness," "bone paralysis," and "bone fistula." It is mainly affected by individual kidney yang deficiency, spleen weakness, blood deficiency, and blood stasis blocking the meridians. When fractures occur, they will further aggravate the disorder of qi and blood circulation, resulting in bone malnutrition and difficulty in effectively producing marrow. In other words, the basic pathology of OPF is multiple deficiency and blood stasis, so the treatment should be include

nourishing the kidney and strengthening the yang, removing blood stasis and stagnation, with emphasis on promoting blood circulation, dredging collaterals, strengthening bones, and regenerating marrow [10,11]. In the *Dipsacus* Decoction used in this article, Radix Dipsaci exhibit the effects of strengthening muscles and bones and replenishing the liver and kidneys. When used in medium and high doses, it can accelerate the proliferation of bone cells and further increase the expression of osteocalcin and other substances. Psoralen has the effects of strengthening essence, supporting yang, warming the spleen, and absorbing qi, and its extract has high application value in promoting bone formation. *Drynariae* can activate blood circulation, remove blood stasis, strengthen bones, and nourish the kidneys, and its extract also exhibit high application value in promoting bone formation. The total flavonoids in the extraction can speed up the absorption of calcium and phosphorus at the fracture site and further enhance bone density; *Astragalus* has the effect of strengthening the spleen and raising yang, assisting qi and deficiencies, and *Salvia miltiorrhiza* can remove blood stasis, relieve pain, activate and nourish the blood. All of them increase the levels of blood calcium, blood phosphorus, osteocalcin, etc.; natural copper can replenish trace elements such as copper, iron, zinc, manganese, etc., which can further increase collagen content and promote the formation of callus [12-15]. Based on the results of this article, the total clinical treatment effectiveness of the observation group was 96.67%, the fracture healing time was significantly shorter than that of the control group, and bone density and laboratory indicators were significantly improved, suggesting that combined Chinese and Western medicine treatment has higher application advantages, exerting a synergistic effect to further improve the efficiency of clinical treatment and speed up fracture healing.

5. Conclusion

In summary, the addition and subtraction of *Dipsacus* Decoction based on conventional Western medicine treatment for OPF patients can further improve the clinical treatment efficiency without causing severe adverse reactions, and it has high application and promotion values.

Disclosure statement

The author declares no conflict of interest.

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Efficacy of Open Reduction and Internal Fixation Versus Conservative Treatment for Rib Fractures

Yiqing Zhang*

Taishun County People's Hospital, Wenzhou 325500, Zhejiang Province, China

***Corresponding author:** Yiqing Zhang, kobozyq@126.com

Abstract: *Objective:* To investigate the efficacy of open reduction and internal fixation versus conservative treatment for rib fractures. *Methods:* The study period was from June 2022 to June 2023, during which 70 patients with rib fractures were grouped by randomized numerical table method, with 30 cases in the observation group and 40 cases in the control group. The observation group implemented open reduction internal fixation treatment and the control group adopted conservative treatment. After treatment, the results of each index in the two groups were compared. *Results:* Treatment-related indexes, lung function indexes, and treatment effects between the two groups were compared ($P < 0.05$). The Visual Analogue Scale (VAS) score and complication rate of the observation group after treatment were lower than those of the control group ($P < 0.05$). *Conclusion:* In the comparison of the efficacy of open reduction internal fixation and conservative treatment for rib fractures, the former exerts a more significant effect and can improve the lung function of the patients, which is worthy of research and promotion.

Keywords: Rib fracture; Open reduction internal fixation; Conservative treatment; Efficacy

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1. Introduction

Rib fractures are common thoracic injuries with various causes, including falls from height, falls, traffic accidents, or direct impact of external forces on the chest. Severe thoracic injury is often accompanied by multiple rib fractures, which can affect respiratory function and easily lead to fluttering of the mediastinum, abnormal respiration, and pose a threat to the patient's life and safety [1]. Therefore, prompt and effective treatment is essential, but conservative treatment has a longer healing time that is unfavorable to the patient's prognosis [2]. The purpose of this paper is to investigate the efficacy of open reduction internal fixation for rib fractures compared to conservative treatment.

2. General information and methods

2.1. General information

Patients with rib fractures admitted in the period from June 2022 to June 2023 were selected and divided into

two groups, with 30 cases in the observation group and 40 cases in the control group. In the observation group, there were 18 male and 12 female patients, ranging from 21 to 72 years old, with an average age of 46.52 ± 2.71 years. Their causes of injuries included 12 cases of fall from height, 10 cases of car accident injuries, 2 cases of crush injuries, 2 cases of fall injuries, and 4 cases of blunt injuries. The types of fractures were 16 cases of single fracture and 14 cases of multiple fractures. The complications were 10 cases of spinal injuries, 12 cases of limb fractures, 5 cases of brain injuries, and 3 cases of abdominal distension and organ injury. In the control group, there were 20 male and 20 female patients, ranging from 22 to 72 years old, with an average age of 46.96 ± 2.09 years. Their causes of injuries were 20 cases of fall from height, 15 cases of car accident injuries, 2 cases of crush injuries, 2 cases of fall injuries, and 1 case of blunt injuries. The types of fracture included 20 cases of single fracture and 20 cases of multiple fractures. The complications were 15 cases of spinal injuries, 15 cases of limb fractures, 5 cases of brain injuries, and 5 cases of abdominal distension and organ injury. The general information of the two groups was not statistically significant ($P > 0.05$).

The criteria for inclusion in this study were patients meeting the diagnostic criteria for rib fracture [3], patients with an AIS-ISS (Abbreviated Injury Scale-Injury Severity Score) score of 9 to 20, and the patients and their families signing an informed consent form, and the study being approved by the Medical Ethics Committee.

The existence of serious chronic diseases, the presence of communication barriers, and a combination of other severe fractures were taken as the criteria for exclusion from this study.

2.2. Methods

Conservative treatment was chosen as the treatment mode for the control group, with the following specific contents: instructing patients to ensure bed rest and encouraging patients to cough up sputum on their own in order to prevent the occurrence of lung infection and sputum accumulation. Based on the degree of inflammation and lung damage of the patients, expectorant and antibiotic medication was given to the patients. For the patients who had pleural effusion, closed drainage of thoracic cavity was required, and the patients' conditions were reviewed once a week. If the patients had hypoxemia and respiratory insufficiency, non-invasive mechanical ventilation was required. For those with pleural effusion, closed pleural drainage was needed, and the patients were reviewed once a week to observe the changes in their conditions.

As for the observation group, open reduction internal fixation treatment was adopted: general anesthesia with single-lumen tracheal intubation was performed, and double-lumen tracheal intubation was given to those who have serious lung injury, increased airway secretion, and aggravated lung infection. First of all, the fracture site of the patient was cleared and a curved incision was made at the fracture site; if the fracture was located in the lateral wall of the patient's chest, a longitudinal incision was made. The patient was instructed to stay in the supine position. The fractured end of the patient's ribs was fully exposed, an appropriate size of the rib bone plate was selected and its angle was adjusted with a special instrument to match the fractured end of the ribs, and then a special instrument was used to clamp and fix the rib bone plate.

2.3. Observation indexes

The treatment-related indexes, complications, Visual Analogue Scale (VAS) scores before and after treatment, lung function indexes, and treatment effects of the two groups were compared.

The visual analogue scoring method was used to assess the pain intensity of patients, using a straightedge as an assessment tool, with a scale of 0 to 10, of which 0 = no pain, and 10 = the most severe pain. Patients were instructed to mark the corresponding numbers according to their feelings of pain.

The efficacy of treatment was also measured [4]. After the treatment, the patient's pain disappeared and the

fractured part recovered intact, indicating that the treatment was very effective; while the patient's pain was significantly reduced after the treatment and the fractured part recovered, which was regarded as effective; the patient's pain still existed after the treatment and the fracture had not healed, which was regarded as ineffective. Total effective rate included very effective rate plus effective rate.

2.4. Statistical analysis

The statistical software used in this study was SPSS25.00, and the measurement data were expressed in the form of mean ± standard deviation (SD) and tested by *t*-test, and the count data were expressed in the form of % and tested by χ^2, and for the data with $P < 0.05$, the difference was statistically significant.

3. Result

3.1. Comparison of treatment-related indexes between the two groups

The treatment-related indexes of the two groups were statistically significant ($P < 0.05$), as shown in **Table 1**.

Table 1. Comparison of treatment-related indexes

Group	Cases (n)	Duration of hospitalization (days)	Fracture healing time (weeks)	Time out of bed for functional exercise (days)
Observation group	30	15.22 ± 1.52	10.78 ± 2.41	4.22 ± 1.12
Control group	40	25.85 ± 1.79	13.96 ± 2.71	7.88 ± 1.78
t	-	26.195	5.091	9.881
P	-	0.000	0.000	0.000

3.2. Comparison of complications between the two groups

Compared with the control group, the complication rate of the observation group was lower ($P < 0.05$), as presented in **Table 2**.

Table 2. Comparison of complication rates in the two groups (n, %)

Group	Cases (n)	Lung infection	Thoracic deformity	Pulmonary hypotension	Total
Observation group	30	0	1	0	3.33
Control group	40	2	8	1	27.50
χ^2	-	-	-	-	7.049
P	-	-	-	-	0.008

3.3. Comparison of VAS scores before and after treatment

Based on **Table 3**, the VAS scores of the observation group were lower than those of the control group in 1 day, 7 days, and 14 days after treatment ($P < 0.05$).

Table 3. Comparison of VAS scores before and after treatment (points)

Group	Cases (n)	Before treatment	1 day after treatment	7 days after treatment	14 days after treatment
Observation group	30	8.22 ± 2.41	6.22 ± 1.41	4.22 ± 1.41	3.02 ± 0.41
Control group	40	8.23 ± 2.45	7.52 ± 1.97	5.88 ± 1.69	4.22 ± 1.79
t	-	0.017	3.070	4.359	3.596
P	-	0.987	0.003	0.000	0.001

3.4. Comparison of lung function indexes between the two groups

According to **Table 4**, the lung function indexes of the observation group, including the forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), and maximum voluntary ventilation (MVV) were better than those of the control group ($P < 0.05$).

Table 4. Comparison of lung function indexes (%)

Group	Cases (n)	FVC	FEV1	MVV
Observation group	30	92.52 ± 2.74	103.96 ± 5.11	88.82 ± 2.45
Control group	40	86.33 ± 2.01	94.25 ± 2.76	79.32 ± 2.01
t	-	10.910	10.210	17.811
P	-	0.000	0.000	0.000

3.5. Comparison of the treatment effects of the two groups

The treatment effect of the observation group was better compared with the control group ($P < 0.05$), as shown in **Table 5**.

Table 5. Comparison of the treatment effects of the two groups (n, %)

Group	Cases (n)	Very effective	Effective	Ineffective	Total effective rate
Observation group	30	19	10	1	96.67
Control group	40	20	5	15	62.50
χ^2	-	-	-	-	11.349
P	-	-	-	-	0.001

4. Discussion

In thoracic trauma, rib fracture is a common injury that causes patients to experience severe pain, accompanied by coughing, dyspnea, movement difficulty, and other adverse conditions. Mediastinal swing can also occur in patients with serious symptoms, not only on the patient's effective ventilation to a certain extent but also on the body's blood reflux, resulting in a series of pathophysiological performance, such as reduced blood pressure, shortness of breath, hypoxemia, etc., thus it is crucial to provide effective treatment at an early stage [5]. Pressure bandage fixation is the chosen traditional treatment, but this method is likely to result in increased compression of the lungs and thorax by external forces, thus causing thoracic deformity, and may also cause different degrees of impact on pulmonary function; while traction requires patients to remain bedridden for an extended period, which is ineffective for the stabilization of the thorax. In the traditional surgery, commonly selected internal fixation materials are Kirschner's needle, silk thread, and so on, but these materials are prone to issues such as instability, easy detachment, and looseness, limiting their overall effectiveness and application. With the continuous development of internal fixation technology, open reduction internal fixation has remarkable efficacy and firm fixation, which can ensure that the patient's thoracic shape is well restored. This is a relatively simple operation that can make up for the shortcomings of external fixation and promote the improvement of the patient's respiratory function [6,7].

In this study, the treatment indexes of the observation group were better compared with the control group, indicating that the open reduction internal fixation treatment is more conducive to shortening hospitalization time and time to get out of bed, so as to restore various functions at an early stage compared with the traditional

treatment. This may be because internal fixation surgery can provide a good fixation of the patient's chest, avoid causing damage to the fracture end of the patient's lung tissue, and produce a better repairing effect of the damaged lung tissue [8]. Comparing between the two groups, the observation group had a lower incidence rate of complications, thus indicating that internal fixation surgery is safer compared with conservative treatment. The reason for this is that this procedure can effectively remove the pneumoperitoneum and blood in the chest cavity of the patient, restore the patient's thoracic volume, facilitate the discharge of sputum to reduce the risk of lung infection, prevent the occurrence of thoracic deformities and other complications, and accelerate the process of recovery of the patient's lung function. The indications for this surgery include: obvious fracture malposition; thoracic deformity caused by fracture, the intercostal nerve is compressed by the fracture, which causes intractable chest pain; other injuries in the thoracic cavity; the conditions of mechanical respiration are not met and accompanied by severe respiratory distress; accompanied by the collapse of the chest wall, and the presence of paradoxical respiration. In these cases, surgical treatment is preferred. Research shows that the human lung function mainly depends on the stability of the patient's lung tissue function and the integrity of the thoracic structure. In this study, various lung function indexes in the observation group were better than those of the control group, which shows that the internal fixation surgery can play a corrective role for the patient's damaged thorax and repair the diseased lung tissues, so as to avoid the impact of the fracture on the patient's lung function and enable recovery of the normal pulmonary function as soon as possible.

In an article by Yang *et al.* [9], patients with severe thoracic trauma were taken as the research object and grouped into the observation group and the control group by the randomized numerical table method with 62 cases each. The former group was treated by open reduction internal fixation and the latter group was treated by conservative treatment. In the comparison of treatment-related indexes, the observation group's time to get out of bed (3.14 ± 1.36 days), hospitalization time (8.25 ± 1.45 days), and fracture healing time (49.66 ± 8.04 days) were shorter than that of the control group (6.15 ± 1.75 days for the time to get out of bed, 11.26 ± 1.84 days for hospitalization time, and 60.32 ± 8.39 days for fracture healing time). In addition, in the comparison of complication rate between the two groups, the complication rate of the observation group (3.23%) was lower than that of the control group (16.16%), which is similar to the results of this paper. These suggest that compared with the conservative treatment, open reduction internal fixation has a better treatment effect and higher safety, accelerates fracture healing, and shortens the hospitalization time, thus reducing economic pressure.

5. Conclusion

In summary, this study concluded that in patients with multiple rib fractures, open reduction and internal fixation is an effective and safe treatment that is worthy of further promotion and application.

Disclosure statement

The author declares no conflict of interest.

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Evaluation of Platelet-Rich Plasma Combined with Minimally Invasive Arthroscopic Surgery for the Treatment of Degenerative Knee Joints

Xinglei Xiao*, Shanglun Liu, Guoqing Chen, Chen Cao

Huai'an Hospital of Traditional Chinese Medicine, Huai'an 223001, Jiangsu Province, China

***Corresponding author:** Xinglei Xiao, xxl13382332889@163.com

Abstract: *Objective:* To evaluate the effect of platelet-rich plasma and arthroscopic minimally invasive surgery treatment in patients with degenerative knee joint lesions. *Methods:* From July 2015 to July 2022, 80 patients with degenerative knee joint lesions were selected and randomly divided into two groups. Group A received platelet-rich plasma and minimally invasive arthroscopic surgery treatment while group B received only minimally invasive arthroscopic surgery treatment. The treatment efficacy, visual analog scores (VAS), knee osteoarthritis severity index (ISOA), knee function scores (KSS), and Lysholm knee scores were compared. *Results:* The treatment efficacy in group A was higher than that in group B ($P < 0.05$); at 3 and 6 months after surgery, the VAS and ISOA scores of group A were lower than those of group B ($P < 0.05$), while the KSS and Lysholm scores of group A were higher than those of group B ($P < 0.05$); the treatment satisfaction in group A was higher than that in group B ($P < 0.05$). *Conclusion:* Patients with knee joint degeneration receiving platelet-rich plasma and minimally invasive arthroscopic surgery treatment can restore knee joint function and reduce local pain, which is efficient and feasible for clinical application.

Keywords: Knee joint degeneration; Minimally invasive arthroscopic surgery; Platelet-rich plasma; Efficacy

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1. Introduction

The risk of knee joint degeneration is higher in the senior population, and arthroscopic examination is performed to observe synovial membrane hyperplasia in the knee joint. There are common problems in knee joint degeneration such as fiber bundle adhesion, osteophytes, and cartilage surface exfoliation. Blind selection of hormonal drug treatment can lead to the aggravation of degenerative lesions [1]. At present, the clinical treatment of this disease is mostly minimally invasive arthroscopy, which has the characteristics of small incision, less secondary damage to the knee joint cavity, and low intraoperative bleeding. This approach can shorten the recovery time of postoperative knee function. However, it is still an invasive operation with a high risk of postoperative complications, thus some scholars suggest the addition of platelet-rich plasma treatment to restore the physiological function of the knee joint [2]. In this paper, 80 patients with degenerative knee joints

admitted from July 2015 to July 2022 were taken as samples to explore the efficacy of platelet-rich plasma and minimally invasive arthroscopic surgery.

2. General information and methods

2.1. General information

From July 2015 to July 2022, 80 patients with degenerative knee joint lesions were selected and randomly divided into two groups. The information of patients in group A is comparable to group B, $P > 0.05$ (**Table 1**).

Table 1. Analysis of patient data

Group	n	Gender		Age (years)		Disease duration (years)	
		Male	Female	Interval	Average value	Interval	Average value
Group A	40	27 (67.50)	13 (32.50)	60–84	63.25 ± 1.14	1–9	39.81 ± 1.25
Group B	40	28 (70.00)	12 (30.00)	61–85	63.27 ± 1.12	1–10	39.82 ± 1.27
χ^2/t	-	0.1623		0.0270			
P	-	0.6870		0.9785			

Inclusion criteria included no history of knee joint pathology or operation history; platelet count >150 × 10^9/L; informed consent; hemoglobin count > 100g/L.

Exclusion criteria were knee deformity; injection of sodium citrate and glucocorticoids before enrollment; immunosuppressants use before enrollment.

2.2. Treatment method

Group A was treated with platelet-rich plasma:

(1) The preparation tool used in this paper was platelet-rich plasma (PRP) preparation set (Weihai Lian Sheng Medical Instrument Co., Ltd.), and the preparation process was as follows. 45 ml of venous blood was obtained and placed into the preparation set, and then 5 ml of anticoagulant sodium citrate solution was added for anticoagulation. After completion, another cannula was removed to complete the leveling operation. The centrifugation process was set at 2500 rpm/min for 15 minutes. After centrifugation, the red blood cell layer was removed, retaining white blood cells and platelet layers. After the second leveling process, centrifugation was performed at 3200 rpm/min for 12 minutes. The platelet-poor plasma in the upper layer was removed and then the remaining platelet-rich layer was prepared for use.

(2) Injection: The patients with degenerative knee joints were instructed to maintain the sitting position, with the knee joint partially receding. The knee joint was punctured and 5 ml of platelet-rich plasma was injected, followed by local anesthesia under the C-arm, and then injected in the joint cavity, the stopping point of the tendon of the goosefoot, and the medial-lateral femoral muscle near the patella and other areas, with 1.5 ml injection at each point. After injection, the patients were instructed to avoid weight-bearing for 24 hours.

Group B received minimally invasive arthroscopic surgery treatment. Patients with degenerative knee joint disease were given epidural anesthesia to carry out arthroscopic surgery to clean up the damaged meniscus, free bodies, inflammatory tissues, and synovial tissues, and simultaneously polish the local defective cartilage. Patellar support release surgery was carried out for patients with limited patellar movement; while expanding intercondylar notchplasty was carried out for patients with narrow intercondylar notch. After the operation, the patients were encouraged to carry out exercise early.

2.3. Observation index

(1) Treatment efficacy: Normal knee joint structure, restored physiological function, and no remaining complications were recorded as highly effective; improved knee joint structure and physiological function, and occurrence of slight complications after the operation were recorded as effective; severe knee joint pain and abnormal physiological function were recorded as ineffective [3].

(2) Visual analog scores (VAS) and knee osteoarthritis severity index (ISOA) scores: VAS (0–10 points) and ISOA (0–14 points) scores were positively correlated with the degree of knee joint pain and the severity of knee joint conditions.

(3) Knee function scores (KSS) and Lysholm knee scores: KSS (0–100 points) and Lysholm (0–100 points) scores were positively correlated with knee function.

(4) Treatment satisfaction: Treatment satisfaction was assessed by a self-constructed knee degenerative disease scale.

2.4. Statistical analysis

The data of those with degenerative knee joints were processed by SPSS21.0, % was recorded (χ^2 test) for the count data and mean ± standard deviation (SD) was recorded (*t* test) for the measure data. There was statistical differences if $P < 0.05$.

3. Results

3.1. Comparison of treatment efficacy in those with degenerative knee joint lesions

The treatment efficacy of those with degenerative knee joint lesions in group A (97.50%) was higher than that in group B (82.50%), $P < 0.05$. The results are shown in **Table 2**.

Table 2. Comparison of the efficacy of those with degenerative knee joint lesions (n, %)

Group	Highly effective	Effective	Ineffective	Total effective rate
Group A (n = 40)	34 (85.00)	5 (12.50)	1 (2.50)	97.50
Group B (n = 40)	23 (57.50)	10 (25.00)	7 (17.50)	82.50
χ^2	-	-	-	5.0000
P	-	-	-	0.0253

3.2. VAS and ISOA scores

At 3 and 6 months after surgery, VAS and ISOA scores were lower in group A than in group B, $P < 0.05$, as shown in **Table 3**.

Table 3. Comparison of VAS and ISOA scores in those with degenerative knee joints (points, mean ± SD)

Group	VAS score				ISOA score			
	Pre-operative	1 month after surgery	3 months after surgery	6 months after surgery	Pre-operative	1 month after surgery	3 months after surgery	6 months after surgery
Group A (n = 40)	6.58 ± 0.74	4.81 ± 0.65	2.17 ± 0.42	2.52 ± 0.51	12.18 ± 1.25	10.29 ± 1.02	8.05 ± 0.73	7.48 ± 0.51
Group B (n = 40)	6.59 ± 0.76	4.02 ± 0.62	3.08 ± 0.51	3.31 ± 0.57	12.19 ± 1.27	9.04 ± 0.83	8.49 ± 0.79	8.21 ± 0.64
t	0.0596	5.5622	8.7112	6.5325	0.0355	6.0118	2.5871	5.6417
P	0.9526	0.0000	0.0000	0.0000	0.9718	0.0000	0.0115	0.0000

3.3. KSS and Lysholm scores

At 3 and 6 months after surgery, the KSS and Lysholm scores of group A were higher than those of group B, $P < 0.05$, as presented in **Table 4**.

Table 4. Comparison of KSS and Lysholm scores in those with degenerative knee joints (points, mean ± SD)

Group	KSS score				Lysholm score			
	Pre-operative	1 month after surgery	3 months after surgery	6 months after surgery	Pre-operative	1 month after surgery	3 months after surgery	6 months after surgery
Group A (n = 40)	40.18 ± 2.11	50.69 ± 2.44	71.85 ± 2.82	88.42 ± 3.52	52.81 ± 3.85	53.51 ± 3.91	73.58 ± 4.15	85.36 ± 4.48
Group B (n = 40)	40.19 ± 2.13	58.43 ± 2.59	65.25 ± 2.73	69.87 ± 3.15	52.79 ± 3.83	58.16 ± 4.03	67.18 ± 4.11	79.64 ± 4.32
t	0.0211	13.7570	10.6350	24.8368	0.0233	5.2375	6.9301	5.8128
P	0.9832	0.0000	0.0000	0.0000	0.9815	0.0000	0.0000	0.0000

3.4. Treatment satisfaction of patients with degenerative knee joints

The treatment satisfaction of those with degenerative knee joint lesions in group A (97.50%) was higher than that in group B (85.00%), $P < 0.05$. The results are displayed in **Table 5**.

Table 5. Comparison of treatment satisfaction of patients with degenerative knee joint lesions (n, %)

Group	Very satisfied	Satisfied	Unsatisfied	Satisfaction rate
Group A (n = 40)	31 (77.50)	8 (20.00)	1 (2.50)	97.50
Group B (n = 40)	24 (60.00)	10 (25.00)	6 (15.00)	85.00
χ^2	-	-	-	3.9139
P	-	-	-	0.0479

4. Discussion

Knee degenerative joint disease, also known as osteoarthropathy, is related to continuous wear and tear of the joints and can be aggravated in wet and cold environments [4]. Patients with knee degenerative joint disease may suffer from pain, stiffness, swelling, weakness, impaired mobility, etc. If it is not diagnosed and treated as soon as possible, it may aggravate meniscus damage, increase knee pain, and even lead to knee deformation and restriction of joint activities [5]. At present, the clinical treatment of degenerative knee joints mostly involves arthroscopic surgery. Under arthroscopic guidance, free bodies and synovium are cleaned up and menisci are trimmed, thus optimizing the environment of the knee joint cavity and reducing inflammatory factors in the joint cavity, which is conducive to the reduction of swelling and pain and facilitates knee joint activities [6]. However, minimally invasive arthroscopic surgical treatment can reduce joint secretion, nutrients, and lubricants in the joint cavity, resulting in swelling and pain in the knee joint that is difficult to relieve. Coupled with the impact of postoperative trauma exudation, it can result in an increase in the degree of edema in the joint cavity, which affects the patient's prognosis [7]. In this paper, in addition to minimally invasive arthroscopic surgery, platelet-rich plasma therapy is carried out, which contains rich growth factors and promotes local tissue repair of the knee joint. Furthermore, intra-articular injection of platelet-rich plasma can stimulate cartilage differentiation and promote cartilage metabolism, which in turn can shorten the regeneration time of knee joint tissues. In recent years, some scholars have found that healthy cartilage and subchondral bone are intercommunicating, so the "intraosseous infiltration" treatment program is gradually used in the treatment of degenerative joint disease. During the treatment period, platelet-rich plasma is injected into the cancellous bone of the knee joint

by puncture method, and under the infiltration of the bone, it can enter into the deeper cartilage of the joint and restore the function of the cartilage of the knee joint [8].

Based on the results, the treatment efficacy of 97.50% in group A was higher than that of 82.50% in group B, with $P < 0.05$. It suggests that the addition of platelet-rich plasma has a better therapeutic effect. During the treatment of minimally invasive arthroscopic surgery, the local cartilage and ligament of the knee joint were freshly processed, and then platelet-rich plasma was injected, which could maximize the role of growth factors within the plasma. This was conducive to the repair and regeneration of the local tissues of the knee joint, and therefore the efficacy was higher than that without platelet-rich plasma [9]. Additionally, at 3 and 6 months after surgery, the VAS and ISOA scores of group A were lower than those of group B, with $P < 0.05$; at 3 and 6 months after surgery, the KSS and Lysholm scores of group A were higher than those of group B, with $P < 0.05$. It is suggested that platelet-rich plasma treatment can reduce knee joint pain and restore knee joint function. This may be due to that minimally invasive arthroscopic surgery is an invasive operation, in which oozing and swelling problems can easily occur after the operation. The long recovery cycle of the knee joint cartilage can be improved through promotion of the recovery of joint function by the injection of platelet-rich plasma [10]. However, it should be noted that there are inflammatory factors in platelet-rich plasma, thus the pain is aggravated in the early stage of injection and the recovery index is slightly worse, while the pain gradually decreases in 3 months and 6 months after the operation. Furthermore, the treatment satisfaction of patients with degenerative knee joints in group A (97.50%) was higher than that of group B (85.00%), with $P < 0.05$. This suggests that platelet-rich plasma treatment has a higher level of patient satisfaction. The reason for this is that as an invasive operation, the 5 mm-diameter arthroscope used in arthroscopic surgery can cause ligament and nerve damage. Therefore, platelet-rich plasma treatment can promote cartilage repair, hence the satisfaction of patients receiving this treatment is higher. However, it should be noted that the cartilage repair cycle is long and minimally invasive arthroscopic surgery can only delay joint degeneration, so it is necessary to increase the number of samples of knee degenerative joint lesions, extend the follow-up period, and deeply explore the effect of platelet-rich plasma treatment after minimally invasive arthroscopic surgery.

5. Conclusion

In conclusion, platelet-rich plasma therapy after minimally invasive arthroscopic surgery in patients with degenerative knee joints can reduce knee pain, restore knee function, and promote the regression of knee joint lesions. Therefore, it can be widely used in clinical practice.

Disclosure statement

The authors declare no conflict of interest.

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Meta-Analysis of the Clinical Efficacy of Taohong Siwu Decoction in the Treatment of Knee Osteoarthritis

Haoran Li[1], Xinyu Mai[1], Jie Mei[2]*

[1]Hubei University of Chinese Medicine, Wuhan 430060, Hubei Province, China
[2]Wuhan Hospital of Traditional Chinese Medicine, Wuhan 430010, China

***Corresponding author:** Jie Mei, 17771806785@163.com

Abstract: *Objective:* To conduct a meta-analysis to systematically evaluate the clinical efficacy of Taohong Siwu Decoction in treating knee osteoarthritis (KOA) and to provide data for the clinical application of Taohong Siwu Decoction in the treatment of KOA. *Methods:* The five major databases of HowNet (CKNI), Wanfang, VIP, PubMed, and Chinese Biomedical Database (CBM) were used to search for relevant papers, the search time was from the establishment of the database to April 15, 2023. The relevant data were extracted from randomized controlled trials (RCT) of the treatment of KOA with modified Taohong Siwu Decoction that met the inclusion and exclusion criteria. The risk of bias was assessed using the Cochrane tool, and the data were imported into RevMan5.3 software for statistical analysis. *Results:* The search included 11 RCT literature involving 951 cases. Among them, there were 487 cases in the observation group (modified Taohong Siwu Decoction or modified Taohong Siwu Decoction + control group) and 464 cases in the control group (traditional Chinese medicine or conventional Western medicine). According to meta-analysis: (1) The effective rates of modified Taohong Siwu Decoction ($P = 0.03$) and modified Taohong Siwu Decoction + control group ($P < 0.0001$) in the treatment of KOA were significantly higher than that of the control group. (2) The VAS score of the observation group was significantly lower than the control group ($P < 0.00001$). (3) The Lysholm knee function score of the observation group was significantly higher than the control group ($P < 0.00001$). *Conclusion:* Compared with conventional Western medicine or simple traditional Chinese medicine, modified Taohong Siwu Decoction or its combination with conventional Western medicine or traditional Chinese medicine in treating KOA can improve the treatment effective rate and Lysholm knee function score, and reduce VAS score.

Keywords: Taohong Siwu Decoction; Knee osteoarthritis

Online publication: December 30, 2023

1. Introduction

Osteoarthritis of the knee is a common degenerative disease of articular cartilage, the risk of which increases with age. There are several clinical treatment options, but the main focus remains to relieve symptoms. With

the advanced development of traditional Chinese medicine research in recent years, the research on the pathogenesis of knee osteoarthritis (KOA) has also made significant progress [1]. Non-surgical treatment is the first treatment option clinically for KOA, including traditional Chinese and Western medicine treatments. Taohong Siwu Decoction promotes blood circulation, removes blood stasis, and nourishes qi and blood [2]. There are many literature reports on the treatment of KOA with Taohong Siwu Decoction, but the sample size of each literature is small and lacks credibility. Therefore, this study evaluates the clinical efficacy of Taohong Siwu Decoction in treating KOA by conducting a meta-analysis to provide an evidence-based basis for clinical practice [3].

2. Material and methods

2.1. Inclusion and exclusion criteria

2.1.1. Inclusion criteria

(1) Research type: Taohong Siwu Decoction was the leading research object in randomized controlled trials (RCT) limited to Chinese and English papers.

(2) Research objects: The research objects were patients with knee osteoarthritis, which were diagnosed according to the diagnostic criteria of the American College of Rheumatology (ACR):

(i) Pain in the knee joint occurred within one month before seeing the doctor.

(ii) X-ray films showed bone spurs or hyperosteogeny.

(iii) There was an abnormal friction sound when the knee joint moved.

(iv) Knee joint swelling, floating patella test (+).

(v) Aged over 40 years old.

(vi) Morning stiffness occurred for less than 30 minutes.

The diagnosis can be made if one of the two diagnoses of (i), (ii) or (i), (iii), (iv), (v), (vi) is met. Race, gender, age, region, and other conditions are not limited.

(3) Intervention measures: The control group was treated with conventional Western medicine or traditional Chinese medicine; the observation group was treated with modified Taohong Siwu Decoction alone, or Taohong Siwu Decoction combined with the primary treatment of the control group; when it comes to primary treatment, the two groups must be consistent.

(4) Outcome indicators: The indicators included effective rate, visual analog scale (VAS) for pain score, and Lysholm knee function score.

2.1.2. Exclusion criteria

(1) Article that does not belong to randomized controlled trials (RCT).

(2) Article that belongs to non-randomized clinical trials such as experience, review, and individual cases.

(3) The literature information is incomplete or has errors.

(4) Duplicate publications.

(5) Intervention measures do not meet the standards.

(6) Non-Chinese and English papers [4].

2.2. Data screening

The online databases such as CNKI (Chinese National Knowledge Infrastructure), CBM (China Biomedical Database), VIP, Wanfang Medical Journal Database, and PubMed were used to search for relevant papers and the search time was limited from the establishment of the database to April 15, 2023. After excluding

duplicative publications in each database, two researchers independently read and screened the literature according to the inclusion and exclusion criteria. Subsequently, the two researchers checked the literature. If there was any disagreement, a third researcher discussed whether to include it. The extracted content included first author, year of publication, sample size, intervention measures, outcome indicators, and Jadad score [5].

2.3. Quality evaluation

Two researchers used the evaluation manual provided by the Cochrane Collaboration Network system and the Jadad scoring scale [5] to evaluate the risk of bias in the included literature. The evaluation contents of the former include:

(1) Random allocation: According to the different allocation methods, they are classified as low risk (such as lottery, random number table method) and high risk (such as grouping by admission order or admission date).
(2) Allocation concealment.
(3) Whether to choose blind method: It is divided into single-blind, double-blind, and triple-blind.
(4) Completeness of result data.
(5) Selective publication.
(6) Other biases.

According to the standard, the researchers made judgments such as yes (low risk), no (high risk), and unclear for the above six items, expressed in the risk of bias map.

The Jadad scoring scale includes the following content:

(1) Generation of random number sequence: 2 points for appropriate, 1 point for unclear, 0 point for inappropriate [6].
(2) Concealment of randomization: 2 points for appropriate, 1 point for unclear, 0 point for inappropriate and non-use.
(3) Blinding: 2 points for appropriate, 1 point for unclear, and 0 point for inappropriate.
(4) Withdrawal: 1 point for those with descriptions, 0 point for those without descriptions.

A Jadad score of 1–3 is considered low-quality research, 4–7 is regarded as high-quality research, and the total score is 7 points. After completing the evaluation, the two researchers compared the data. If there was any disagreement, it was discussed and decided by a third researcher [7].

2.4. Statistical methods

The collected data were processed with RevMan5.3 software. The heterogeneity test was carried out on the included research results. If $P > 0.1$, $I^2 \leq 50\%$, there was homogeneity, and the fixed effects model was used to analyze it; if $P < 0.1$, $I^2 > 50\%$, there was heterogeneity that was analyzed using a random effects model. Binary variables were represented by odds ratio (OR) and its 95% confidence interval (CI). Continuous variables were defined by mean difference (MD) if the outcome data units were consistent. Otherwise, the standard deviation (SD) and its 95% CI were used.

3. Results

3.1. Literature search results

624 papers were obtained using the mentioned databases in the initial inspection. After eliminating 447 duplicate records, two researchers screened 177 RCT papers based on the titles and abstracts and then read the entire text of the 90 papers. According to the above exclusion criteria, 79 articles were excluded, and 11 were

finally included. In the included literature, there were 951 patients, including 487 cases in the observation group and 464 cases in the control group. The flow chart of the literature screening is shown in **Figure 1**.

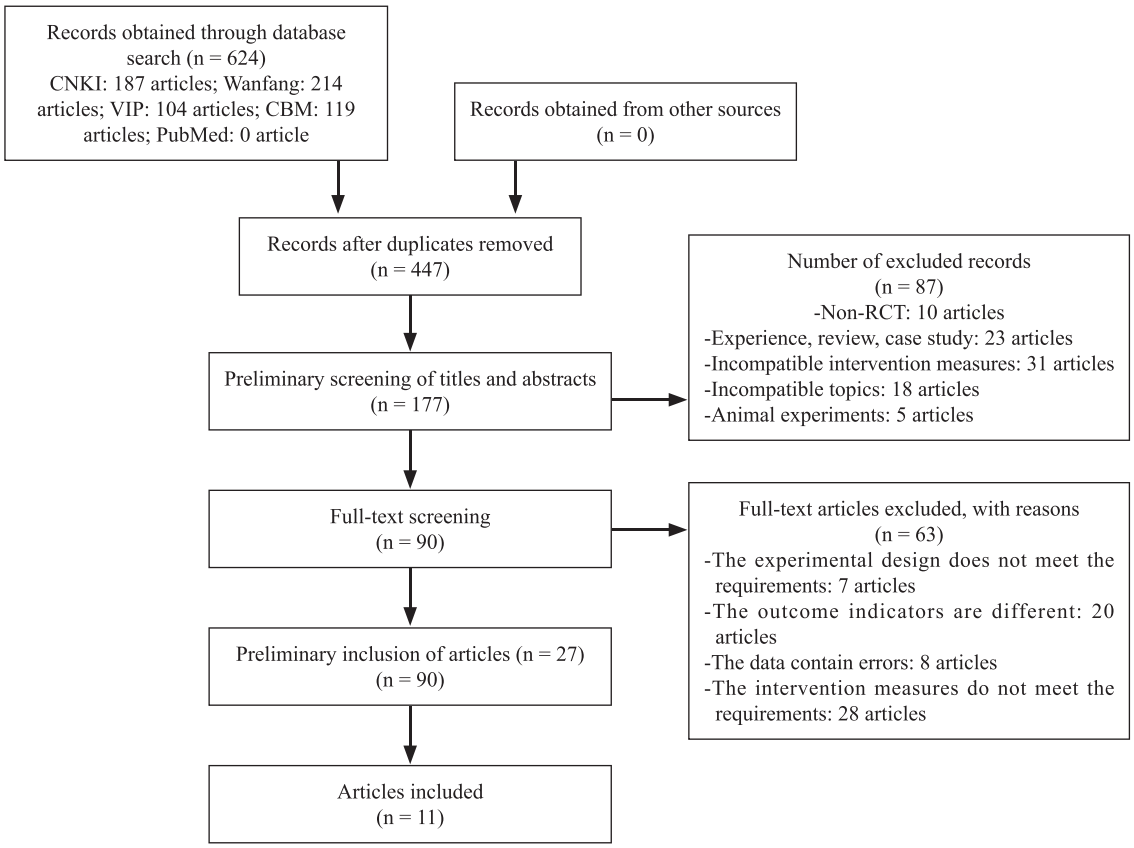

Figure 1. Flow chart of literature screening

3.2. Basic characteristics of the included literature

Among the 11 included literature, a total of 10 literature [4,6-14] conducted a comparative analysis of the effective rates of the two groups, five literature [7,8,11-13] compared and analyzed the VAS scores of the two groups, and three literature [7,8,15] compared the Lysholm knee function scores between the two groups. Among them, the outcome indicators of the VAS score reported in one article [11] did not meet the inclusion requirements, and only the effective outcome indicators were extracted. The essential characteristics of the included literature are shown in **Table 1**.

Table 1. Essential characteristics of the included literature

First author	Year	Sample size (cases)		Interventions		Outcome indicators	Jadad score
		Observation group	Control group	Observation group	Control group		
Wu Di	2022	35	35	Taohong Siwu Decoction	Western medicine treatment	Effectiveness rate	1
Fang Xiaolin	2016	48	48	Taohong Siwu Decoction + control group	Ozone	Effectiveness rate + VAS score + Lysholm knee function score	2
Xing Peng	2021	40	40	Taohong Siwu Decoction + control group	External application of traditional Chinese medicine + physiotherapy	Effectiveness rate + VAS score + Lysholm knee function score	4

Table 1. (Continue)

First author	Year	Sample size (cases)		Interventions		Outcome indicators	Jadad score
		Observation group	Control group	Observation group	Control group		
Guo Zhanying	2020	41	41	Taohong Siwu Decoction	Physiotherapy	Effectiveness rate	1
Lu Na	2018	51	49	Taohong Siwu Decoction + control group	Warm acupuncture	Effectiveness rate	1
Wang Xiang-peng	2015	70	50	Taohong Siwu Decoction + control group	Warm acupuncture	Effectiveness rate	2
Zhao Wanliang	2015	40	40	Taohong Siwu Decoction	Glucosamine hydrochloride capsules	Effectiveness rate + VAS score	3
Qin Hong	2013	52	52	Taohong Siwu Decoction + control group	Rehabilitation training + traditional Chinese medicine fumigation	Effectiveness rate + VAS score	1
Liu Min	2018	30	29	Taohong Siwu Decoction	Mannitol	Effectiveness rate + VAS score	2
Zhu Lanfei	2013	30	30	Taohong Siwu Decoction	Basic treatment	Lysholm knee function score	2
Deng Yong	2019	50	50	Taohong Siwu Decoction	Ibuprofen	Effectiveness rate	1

3.3. Methodological quality evaluation of included literature

The 11 included studies were all RCTs, four of which were grouped by random number table method, two by lottery method, and the remaining five did not specify the specific random method for grouping. Only one study explained allocation concealment. Four studies clarified that blinding was not used, the remaining seven did not mention the use of blinding, and four studies mentioned and explained case dropout. One of the studies had incomplete information, and the other 10 had complete baseline information. None of the 11 included studies reported selectively included literature [12]. There was one paper with modified Jadad score of 4 points indicating a high-quality study, and the scores of other literatures were all 1–3 points, which represented a low-quality study. The methodological quality evaluation of the included literature is shown in **Figures 2** and **3**.

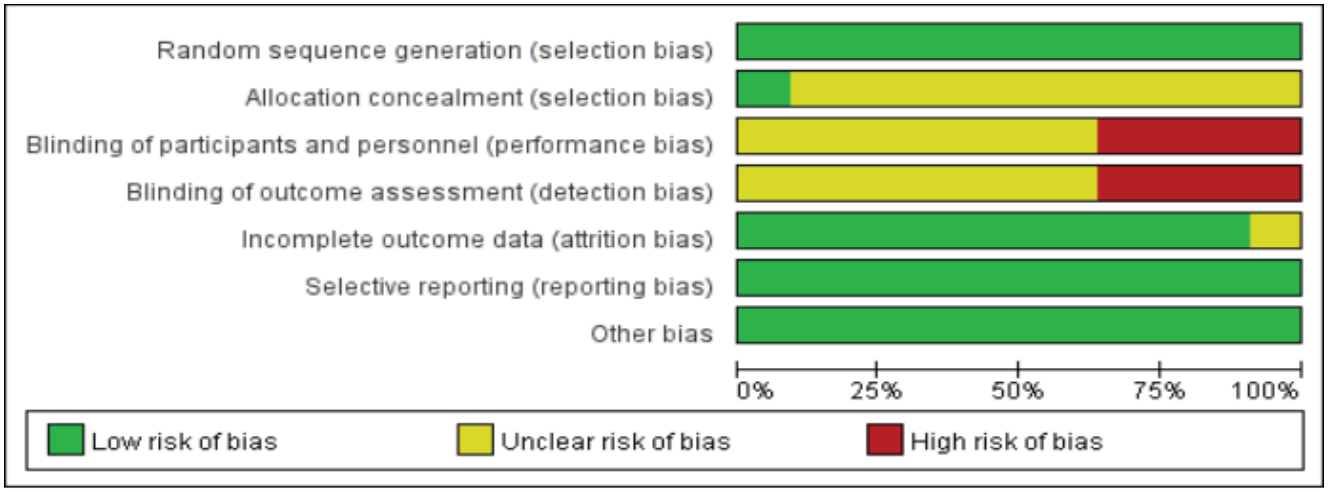

Figure 2. Risk of bias assessment

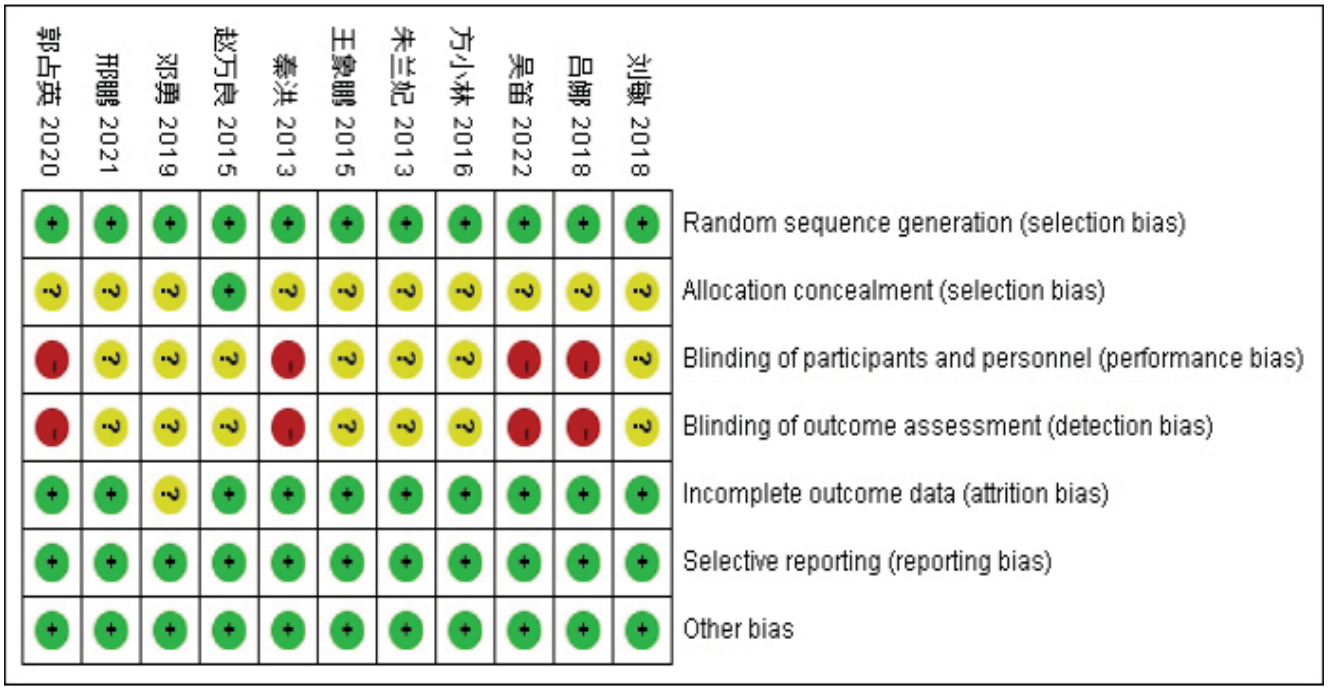

Figure 3. Risk of bias summary

3.4. Meta-analysis results

3.4.1. Treatment effectiveness

The ten studies were subgroup-analyzed according to different intervention measures, among which the intervention measures of 5 studies were modified Taohong Siwu Decoction versus conventional treatment in control group. The heterogeneity test results revealed $P = 0.22$ and $I^2 = 30\%$, which shows that the homogeneity among the five studies was good, and the fixed effects model can be used. The calculated MD = 2.39, 95% CI [1.10, 5.19], Z = 2.20, $P < 0.03$, which shows that the difference in treatment effectiveness between the two groups is statistically significant, that is, the effective rate of modified Taohong Siwu Decoction in the treatment of KOA is significantly higher than that of conventional therapy alone. The intervention measures of the five studies were modified Taohong Siwu Decoction + control group versus control group. The heterogeneity test obtained $P < 0.0001$ and $I^2 = 0\%$, showing that the homogeneity among the five studies was good. The fixed effects model was used, obtaining MD = 4.29, 95% CI [2.18, 8.44], Z = 4.22, $P < 0.0001$, indicating that the difference in the effective rate of KOA treatment between the two groups was statistically significant. The differences among the subgroups were not statistically significant ($P = 0.47$, $I^2 = 0\%$), indicating that the subgroup factors were not the source of heterogeneity (**Figure 4**) [13].

3.4.2. VAS scores

Five studies reported VAS scores, and the heterogeneity test results showed $P < 0.00001$ and $I^2 = 96\%$, indicating heterogeneity among the studies, thus the random effects model was used for analysis. The results of the meta-analysis showed that compared with the control group, the VAS score of the observation group was significantly lower, [MD = -0.77, 95% CI (-0.87, -0.66), $P < 0.00001$], as shown in **Figure 5** [15].

3.4.3. Lysholm knee function score

Three clinical trials reported Lysholm knee function score and heterogeneity test ($P = 0.10$, $I^2 = 57\%$). The results of the meta-analysis showed that compared with the control group, the knee joint function score of the observation group was significantly higher, [MD = 6.87, 95% CI (6.23, 7.52), $P < 0.0001$], as shown in **Figure 6**.

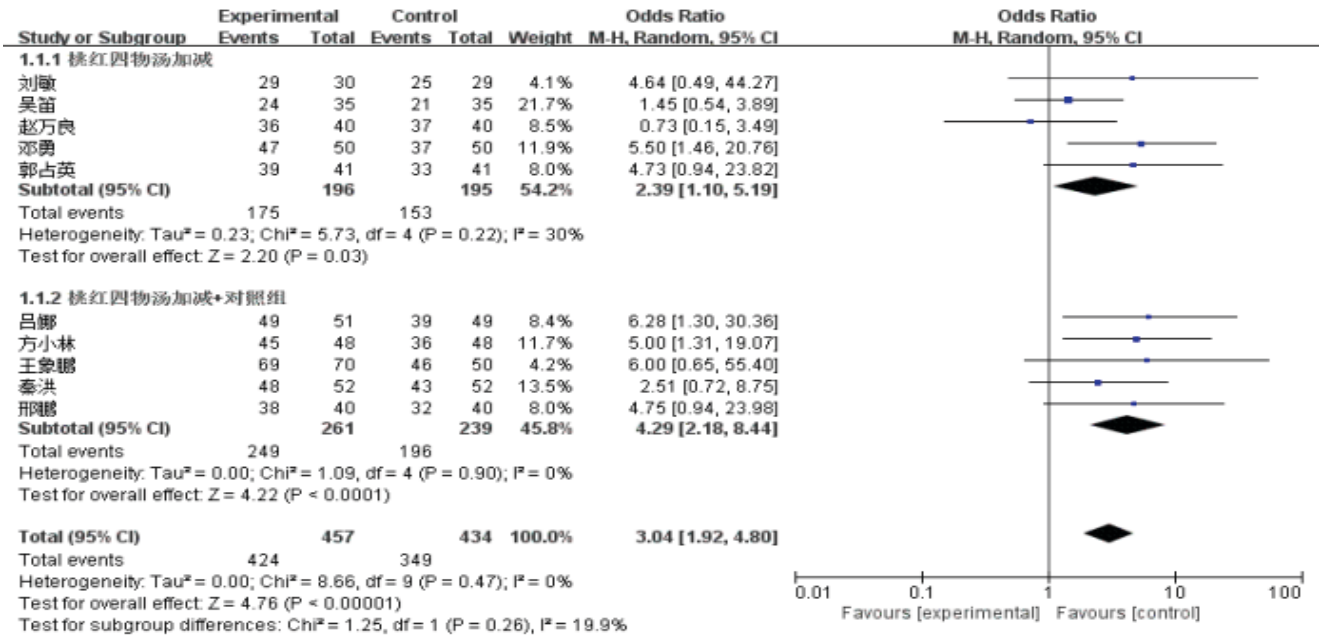

Figure 4. Forest plot of the effective rate of modified Taohong Siwu Decoction in the treatment of KOA

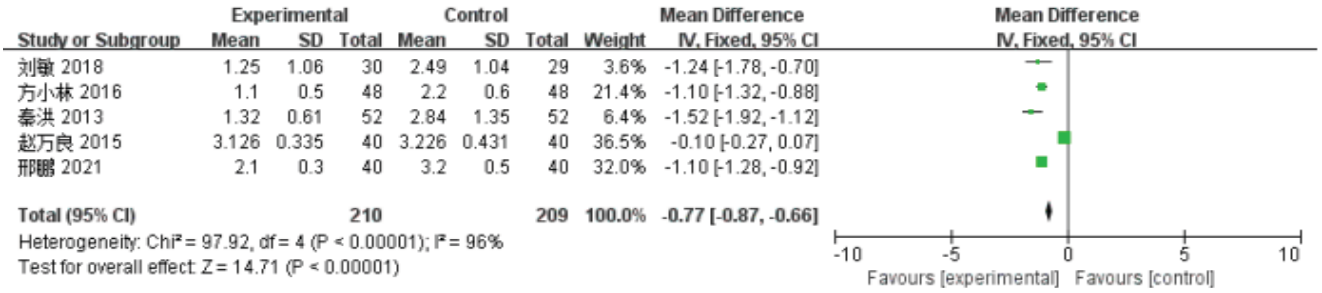

Figure 5. Forest plot of the VAS score of modified Taohong Siwu Decoction in the treatment of KOA

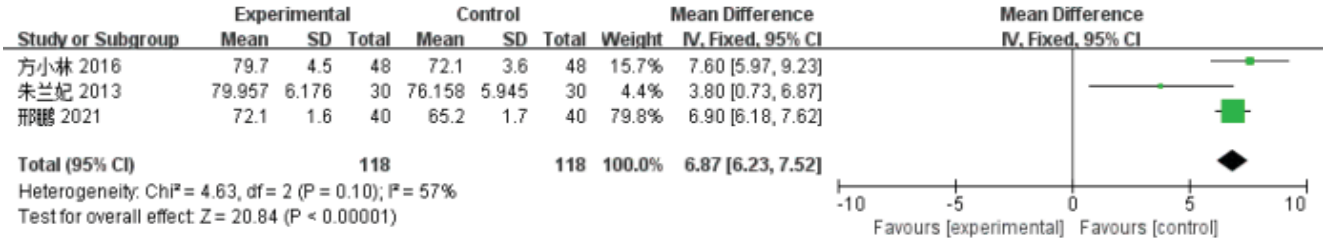

Figure 6. Forest plot of the knee joint function scores in the treatment of KOA with modified Taohong Siwu Decoction

4. Discussion

4.1. KOA in Chinese medicine

KOA is a prevalent clinical disease affecting older adults with persistent strain and knee inflammation. According to Chinese medical philosophy, KOA is classified as arthralgia and tendon injury related to old age, fatigue, and exogenous pathogenic factors. Taohong Siwu Decoction contains peach kernel, *Angelica sinensis*, red peony, Chuanxiong, myrrh, safflower, rhubarb, licorice, and other medicinal materials, which have the therapeutic effect of promoting blood circulation, removing blood stasis, and relieving pain. The formula is

adjusted according to the patient's condition to ensure the therapeutic effect. According to the results of this study, the modified Taohong Siwu Decoction was significantly better than the treatment used in the control group in terms of clinical treatment effect and knee function score, indicating that the drug has an excellent clinical curative effect in the treatment of knee osteoarthritis and can effectively relieve the clinical symptoms of patients. The main advantage of the decoction is that it can restore the function of the knee joint and improve the prognosis of patients, which is worthy of clinical application and promotion in the future.

4.2. Limitations

The following are the main limitations of this study:

(1) The quality of the included studies is generally poor, there was no description of case drop-out and follow-up, some studies introduced the randomization procedure and allocation concealment inaccurately, and all studies did not explain the use of blinding.

(2) The included studies have a significant degree of heterogeneity, which somewhat weakens the validity of the meta-analysis results.

(3) Some studies did not state whether patients with other comorbidities should stop taking the drug, which may impact the research results.

(4) This study only retrieved Chinese and English literature, so there may be omissions.

4.3. Future work

Taohong Siwu Decoction has a definite curative effect in treating KOA. It can effectively cure patients' clinical symptoms and has few side effects, so it is worthy of clinical promotion. To assist the development of various clinical studies in the future, we should pay more attention to the use of objective and standardized diagnostic criteria, avoid observations being affected by different drug additions and doses, improve the use of random methods, allocation concealment, and blinding procedures, in order to benefit various clinical research work in the future [14].

Disclosure statement

The author declares no conflicts of interest.

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Effects of Total Hip Replacement and Femoral Head Replacement in the Treatment of Femoral Neck Fractures in Elderly Patients and Their Impacts on Hip Joint Function

Jie Yang*

Changshu Meili People's Hospital, Changshu 215500, Jiangsu Province, China

***Corresponding author:** Jie Yang, bluesky-1986913@163.com

Abstract: *Objective:* To explore the therapeutic value of total hip replacement and femoral head replacement in elderly patients with femoral neck fractures. *Methods:* 30 elderly patients with femoral neck fractures were sampled from January 2019 to August 2023 and randomly divided into two groups. Total hip replacement was adopted in the research group, and femoral head replacement was performed in the control group. The surgical indicators, quality of life, hip replacement, Harris hip score, and surgical complications were compared between the groups. *Results:* The operation time of the research group was longer than that of the control group, and the intraoperative blood loss and postoperative drainage volume were higher than those of the control group, $P < 0.05$; the SF-36 (36-Item Short Form Health Survey) score of the research group was higher than that of the control group, $P < 0.05$; the Harris scores of various hip joints of the research group were higher than those in the control group, $P < 0.05$; the femoral neck fracture complication rate in the research group was lower than that in the control group, $P < 0.05$. *Conclusion:* Both total hip replacement and femoral head replacement can improve hip joint function in treating femoral neck fractures in elderly people. However, total hip replacement has better long-term efficacy and can enhance patients' quality of life and reduce postoperative complications.

Keywords: Femoral neck fracture in the elderly; Femoral head replacement; Total hip replacement; Efficacy

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1. Introduction

Femoral neck fractures are more common in older people and are related to osteoporosis and abnormal hip muscle function. Older people are prone to falls, increasing femoral neck fracture incidence. In addition, femoral neck fracture can cause damage to the blood vessels and affect the blood supply of the affected limb, thereby increasing the risk of femoral head necrosis, nonunion of the fracture, and even secondary traumatic infection, which can reduce the patient's quality of life, so surgical treatment should be performed as soon as possible. Currently, the main clinical treatments for femoral neck fractures are total hip replacement and

femoral head replacement, which can improve patients' hip joint function. However, the long-term effects of the two surgeries are different [1]. This article selects 30 elderly patients with femoral neck fractures treated from January 2019 to August 2023 as samples to explore the value of total hip replacement and femoral head replacement.

2. Materials and methods

2.1. Materials

A sample of 30 elderly patients with femoral neck fractures treated from January 2019 to August 2023 were randomly divided into two groups. There was no difference in the data of the patients in the research group and the control group, $P > 0.05$, as shown in **Table 1**.

Table 1. Analysis of femoral neck fracture data in the elderly patients

Group	n	Gender [n (%)]		Age (years)		Garden classification of fracture type [n (%)]		Cause of fracture	
		Male	Female	Range	Mean	Type III	Type IV	Car accident	Injured by fall
Research group	15	9 (60.00)	6 (40.00)	62–82	70.36 ± 3.25	9 (60.00)	6 (40.00)	10 (66.67)	5 (33.33)
Control group	15	10 (66.67)	5 (33.33)	63–84	70.39 ± 3.27	8 (53.33)	7 (46.67)	11 (73.33)	4 (26.67)
χ^2/t	-	0.1435		0.0252		0.1357		0.1587	
P	-	0.7048		0.9801		0.7125		0.6903	

2.2. Inclusion and exclusion criteria

Inclusion criteria included patients with normal walking function of the affected limb before fracture; hip X-ray showing femoral neck fracture; patients aged over 60 years old; patients with informed consent; and patients with no history of diseases affecting bone metabolism.

Exclusion criteria were patients with abnormal coagulation; patients with abnormal organ function; and patients with femoral neck fracture caused by metabolic diseases.

2.3. Treatment methods

Preoperative hip X-ray and CT diagnosis were performed. Active treatment of the original disease, apparent fracture displacement, and acetabular lesions were carried out. A surgical plan based on the examination results was formulated.

In the control group, femoral head replacement was adopted. Combined spinal and epidural anesthesia was performed, ensuring that the limb on the side of the femoral neck fracture was on top. The pelvis was fixed, and a posterolateral approach was used to incise the skin, subcutaneous tissue, superficial and deep fascia, and gluteus maximus fascia lata in sequence. At the muscle attachment point, the gluteus maximus was bluntly separated, exposing and cutting off the attachment points of the piriformis muscle, superior and inferior medullary muscles, and other external rotator muscles at the insertion point of the greater trochanter. Part of the quadratus femoris muscle was cut off, making a T-shaped incision for the joint capsule. The femoral torque was kept at about 1 cm, and the neck-shaft angle at 135°, an oscillating saw was used to flatten the end of the femoral neck, and the femoral head and residual bone fragments were removed. This was followed by internal rotation, hip flexion, and knee flexion of the left lower limb to expose the femoral neck section. A box-type opener was used to open the medullary cavity of the proximal femur. The medullary cavity expander gradually expanded the medullary cavity. Then, a femoral stem was used to maintain the anteversion angle of about 15°

to expand the medullary cavity. Bone debris was flushed and absorbed, the trial prosthesis was driven in and installed, externally rotating and abducting, flexing and resetting the knees and hips, checking that there was no dislocation during movement in all directions and that the length was appropriate. The trial prosthesis was taken out, the corresponding artificial femoral stem was inserted, and the anteversion angle was kept at 15° for hammering. It was fastened tightly, the artificial femoral head was installed and hammered tightly, and the joint was reset, checking that the joint movement was normal and the stability was good. It was also checked that the head socket was well contained, the tightness was appropriate, with 90° flexion and 30° adduction, and it was stable without dislocation, and that both lower limbs were the same length. The surgical field was flushed, and the bleeding area around the femoral stem was covered with bone wax to stop the bleeding. The instruments and gauze were checked to see if they were correct in number. Part of the joint capsule was repaired and the external rotator muscles were repaired and reconstructed. The incision was sutured layer by layer, negative pressure drainage was placed, and moderate pressure was applied to the dressing.

Total hip replacement was performed in the research group. Combined spinal and epidural anesthesia was performed, ensuring that the limb on the side of the femoral neck fracture was on top. The pelvis was fixed, and a posterolateral approach was used to sequentially incise the skin, subcutaneous tissue, superficial and deep fascia, and gluteus maximus fascia lata. At the attachment point of the tensor muscle, the gluteus maximus was bluntly separated, exposing and cutting off the attachment points of the piriformis muscle, superior and inferior medullary muscles, and other external rotator muscles at the insertion point of the greater trochanter. Part of the quadratus femoris muscle was cut off, making a T-shaped incision for the posterior joint capsule. The femoral torque was kept at about 1 cm, and the neck-shaft angle at 135°, an oscillating saw was used to flatten the end of the femoral neck, the femoral head and residual bone fragments were removed, and the diameter of the femoral head was measured. The hyperplastic joint capsule and synovial tissue along the edge of the acetabulum were removed. An acetabular file with a suitable diameter was used to maintain an angle of about 45° and tilted forward at an angle of 15°. The acetabulum was gradually expanded and deepened until blood oozed evenly. After the acetabular mold was tested suitable, the bone chips were vacuumed and dried, a press-fit artificial acetabular cup of appropriate size was inserted. An orientater was used to keep it outward at about 45°, it was tilted forward at an angle of about 15° and hammered. The corresponding lining was installed and hammered tightly. This was followed by internal rotation, hip flexion, and knee flexion of the left lower limb to expose the femoral neck section. A box-type opener was used to open the medullary cavity of the proximal femur. The medullary cavity expander was used to gradually expand the medullary cavity, and then the femoral stem was used to expand the medullary cavity with an inclination angle of about 15°. Bone debris was flushed and absorbed, the trial prosthesis was inserted and the trial cast was installed, externally rotating and abducting, flexing and resetting the knees and hips, checking that there was no dislocation during movement in all directions and that the length was appropriate, and the trial cast was taken out. The prosthesis was inserted into the corresponding artificial femoral stem, and the anteversion angle was kept at 15°, hammering to tighten it. The artificial femoral head was installed and hammered tightly, and the joint was reset, checking that the joint movement was normal and the stability was good. It was also checked that the head socket was well contained, the tightness was appropriate, with 90° flexion and 30° adduction, and it was stable without dislocation, and that both lower limbs were the same length. The surgical field was flushed, and the bleeding area around the femoral stem was covered with bone wax to stop the bleeding. The instruments and gauze were checked to see if they were correct in number. Part of the joint capsule was repaired and the external rotator muscles were repaired and reconstructed. The incision was sutured layer by layer, negative pressure drainage was placed, and moderate pressure was applied to the dressing.

2.4. Statistical methods

The data of patients with femoral neck fractures were processed with SPSS21.0. % recorded (χ^2 test) the count data of patients with femoral neck fractures, and mean ± standard deviation (SD) recorded (*t* test) the measurement data of patients with femoral neck fractures. There was a statistically significant difference if $P < 0.05$.

3. Results

3.1. Surgical indicators

The operation time, time to get out of bed for the first time after surgery, and hospitalization time in the research group were all longer than those in the control group, and the intraoperative blood loss and postoperative drainage volume were higher than those in the control group, $P < 0.05$. The results are shown in **Table 2**.

Table 2. Comparison of surgical indicators in patients with femoral neck fractures (mean ± SD)

Group	Operation time (minutes)	Intraoperative blood loss (ml)	Postoperative drainage volume (ml)	Time to get out of bed for the first time after surgery (days)	Hospitalization time (days)
Research group (n = 15)	99.14 ± 2.63	369.48 ± 6.36	206.11 ± 4.36	15.01 ± 2.43	25.64 ± 1.89
Control group (n = 15)	78.31 ± 1.89	318.44 ± 4.18	184.36 ± 2.45	11.43 ± 1.86	20.47 ± 1.63
t	24.9097	25.9737	16.8434	4.5309	8.0228
P	0.0000	0.0000	0.0000	0.0001	0.0000

3.2. Quality of life

After nursing, the SF-36 (36-Item Short Form Health Survey) score of the research group was higher than that of the control group, $P < 0.05$, as shown in **Table 3**.

Table 3. Comparison of quality of life in patients with femoral neck fractures (mean ± SD)

Group	Good health (points)		Mental health (points)		Physiological functions (points)		Social functions (points)	
	Before nursing	After nursing	Before nursing	After nursing	Before nursing	After nursing	Before nursing	After nursing
Research group (n = 15)	62.25 ± 2.43	87.36 ± 3.21	63.42 ± 2.38	88.41 ± 3.18	62.41 ± 2.36	88.41 ± 3.52	63.25 ± 2.39	88.43 ± 3.48
Control group (n = 15)	62.31 ± 2.41	74.21 ± 3.15	63.39 ± 2.39	75.25 ± 3.06	62.39 ± 2.39	73.09 ± 3.13	63.27 ± 2.41	72.43 ± 3.25
t	0.0679	11.3243	0.0344	11.5492	0.0231	12.5966	0.0228	13.0140
P	0.9463	0.0000	0.9728	0.0000	0.9818	0.0000	0.9820	0.0000

3.3. Harris hip scores

The Harris scores of all hip joints in the research group were higher than those in the control group, $P < 0.05$, as shown in **Table 4**.

Table 4. Harris hip scores analysis (mean ± SD)

Group	Joint movement	Joint deformity	Joint function	Pain level
Research group (n = 15)	3.78 ± 0.25	4.39 ± 0.21	29.21 ± 1.36	42.81 ± 3.25
Control group (n = 15)	3.21 ± 0.21	4.04 ± 0.18	20.18 ± 1.21	36.82 ± 2.87
t	6.7615	4.9010	19.2122	5.3506
P	0.0000	0.0000	0.0000	0.0000

3.4. Comparison of fracture complications

Based on **Table 5**, the fracture complication rate of the research group was lower than that of the control group, $P < 0.05$.

Table 5. Analysis of fracture complications [n, (%)]

Group	Periprosthetic fracture	Heterotopic ossification	Deep vein thrombosis of lower limbs	Incidence
Research group (n = 15)	0 (0.00)	0 (0.00)	0 (0.00)	0.00
Control group (n = 15)	1 (6.67)	2 (13.33)	1 (6.67)	26.67
χ^2	-	-	-	4.6154
P	-	-	-	0.0317

4. Discussion

Femoral neck fractures are common in older people. This disease is mainly treated with surgery. However, postoperative complications such as avascular necrosis of the femoral head and nonunion of the fracture are prone to occur. Femoral neck fractures in older people are mainly related to the following factors:

(1) Reduced bone strength, occurrence of osteoporosis, changes in the biomechanical structure of the femoral neck region, and increased fragility of the femoral neck all increase the risk of fractures.

(2) The hip muscles of older people have degenerated, and the hip joints are unresponsive, thus unable to weaken the harmful stress on the hip. Local fractures may occur under the action of external forces such as falls and car accidents.

Elderly patients with femoral neck fracture may develop the following symptoms:

(1) Deformity: External rotation deformity of the affected limb or hip flexion deformity.

(2) Pain: The pain is more severe, especially when moving the affected limb. Tapping the affected limb's greater trochanter area and heel area can aggravate the hip pain. Pressing the inguinal ligament will cause tenderness.

(3) Swelling: Most femoral neck fractures are intracapsular fractures. The amount of bleeding after the onset is small, and the extra-articular muscles are affected, thus local swelling symptoms are more likely to occur.

(4) Functional impairment: The patient's activities can be restricted, causing the patient to be unable to stand or sit up independently. However, some patients with impacted fractures and linear fractures can still walk after the injury.

Relevant literature reports that the efficacy of surgical treatment for patients with femoral neck fractures is slightly worse than that of fractures in other locations, and there is a higher nonunion rate after surgery. In addition, the elderly population has a low overall physical fitness and underlying severe diseases, which may aggravate bedsores, urinary tract infections, and other risks [2]. Therefore, choosing which surgical methods to treat femoral neck fractures in older people, improving the prognosis of patients, and reducing surgical complications are still popular topics in clinical research.

When clinically treating elderly patients with femoral neck fractures, internal fixation, artificial hip replacement, and other options are often chosen, which have the advantages of high solidity, easy operation, and fast recovery. However, various surgical methods have different indications. Some orthopedic surgeons recommend artificial joint replacement to treat patients with Garden III to IV types to restore hip joint function and improve the quality of life [3]. Relevant literature reports that compared with conventional internal fixation

treatment, choosing an artificial joint replacement to treat femoral neck fractures in older people can reduce postoperative nonunion, bone necrosis, and other symptoms. It can also reduce the fracture nonunion rate and shorten the time for patients to get out of bed after surgery [4]. Summary analysis shows that artificial hip replacement has the following advantages in treating patients with femoral neck fractures:

(1) Safe and efficient: After hip replacement, it can reduce joint pain caused by femoral head necrosis, restore joint movement function, and correct limping, enabling the patient to stand and walk normally.
(2) Mature technology: Hip replacement has been developed for decades, and the current technology in replacement operation is relatively mature.
(3) Short cycle: Conventional femoral neck fracture patients can complete the hip replacement operation in about 1 hour, and the affected limb can be moved typically about one month after surgery [5].

When total hip replacement is used to treat elderly patients with femoral neck fractures, it can quickly reduce postoperative complications, restore the patient's essential joint functions, and significantly reduce or eliminate the patient's pain symptoms. It is suitable for patients with good physical fitness; elderly patients with high hip joint activity after surgery are being treated with this approach [6]. However, before total hip replacement surgery, it is necessary to strictly control the indications for prosthetic replacement, make preoperative preparations, and regulate the range of intraoperative operations. In addition, although total hip replacement has excellent long-term effects, as the patient ages, complications such as aseptic loosening may occur, and remediation is complex. A femoral head replacement has the characteristics of minor trauma and low blood loss and is suitable for treating comminuted fractures in patients with poor physical fitness [7]. However, it should be noted that the artificial femoral head prosthesis cannot fully match the bony acetabulum, and concentrated stress is prone to occur in the bony acetabulum load-bearing area, which may lead to thigh pain and acetabular wear during postoperative activities [8]. Total hip replacement and femoral head replacement have both advantages and disadvantages, and the surgical plan must be scientifically selected based on the specific conditions of patients with femoral neck fractures.

Based on the data analysis in this article, the operation time, time to get out of bed for the first time after surgery, and hospitalization time in the research group were all longer than those in the control group, and the intraoperative blood loss and postoperative drainage volume were higher than those in the control group, $P < 0.05$. It shows that total hip replacement operation is relatively complicated and slightly more invasive. Another set of data showed that the SF-36 score of the research group was higher than that of the control group, $P < 0.05$; the Harris hip score of each hip joint in the research group was higher than that of the control group, $P < 0.05$. It indicates that total hip replacement has significant long-term effects, and the physiological function of the hip joint recovers well after surgery. This may be due to that the trauma of hemiarthroplasty is relatively mild, but the acetabulum continues to wear after surgery, and there is a risk of hip pain and limited joint movement, hence the quality of life after surgery is relatively low [9]. The results also showed that the fracture complication rate in the research group was lower than in the control group, $P < 0.05$. Analyzing intraocular pressure, total hip replacement treatment can avoid acetabular cartilage wear and facilitate postoperative functional exercise, reducing the risk of complications. However, this article reported no postoperative complications, which may be related to the small number of patients with femoral neck fractures included in this study [10].

5. Conclusion

In summary, total hip replacement and femoral head replacement can improve hip joint function in elderly patients with femoral neck fractures. However, total hip replacement has better long-term effects.

Disclosure statement

The author declares no conflict of interest.

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Evaluation of the Therapeutic Efficacy of the Bone Transport Technique in the Treatment of Patients with Infected Tibial Nonunion

Weihong Jin, Jianfei Jin*, Guoliang Ye, Zhixiong Tao, Jian Liu

Orthopedic Department, Fuliang County Orthopedic Hospital (Jingdong Hospital), Fuliang 333403, Jiangxi Province, China

***Corresponding author:** Jianfei Jin, jinjianfei1968@163.com

Abstract: *Objective:* To evaluate the therapeutic effect of bone transport technique in patients with infected tibial nonunion. *Methods:* 30 patients with infected tibial nonunion admitted to our hospital from January 2021 to January 2023 were selected as the subjects of this study, and were divided into two groups according to the different treatment methods. 15 patients in the control group were subjected to conventional surgical treatments, and another 15 patients in the observation group were treated with bone transport techniques. The operation time, intraoperative bleeding, hospitalization time, incidence of postoperative complications, and the total effective rate of treatment were compared between the two groups. *Results:* The operation time and the hospitalization time of the observation group were shorter than that of the control group, and the intraoperative bleeding of the observation group was less than that of the control group ($P < 0.05$); the observation group had a lower incidence of postoperative complications than the control group ($P < 0.05$); the observation group had a higher total effective rate of treatment than the control group ($P < 0.05$). *Conclusion:* In the treatment of infected tibial nonunion, the application of bone transport technique can achieve better therapeutic effects, shorten the operation time, reduce intraoperative bleeding, lower postoperative complications, and promote the early recovery of patients.

Keywords: Infected bone defect of tibia; Tibial nonunion; Bone transport technique; Treatment effect

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1. Introduction

Severe traumatic injuries to the lower leg caused by falling from height, traffic accidents, or heavy objects need to be treated promptly, or else serious complications such as infected bone defects and bone nonunion may occur. Infected bone nonunion is caused by persistent bacterial infections at the location of the fracture and the subsequent failure of the fracture to heal properly [1]. It usually occurs after severe trauma is not treated properly and prolongs the overall course of the disease, requiring multiple surgeries and causing great pain to the patient. Currently, the clinical recommendation for infected bone defects and nonunions in the tibia is to implement the

bone transport technique, which involves adjusting an external fixator according to the predicted rate of bone growth so that the bone fragments are slowly docked with each other to achieve the therapeutic goal [2]. In this study, we analyze the therapeutic effect of the bone transport technique in patients with infected tibial nonunion.

2. General information and methods

2.1. General information

A total of 30 cases of patients suffering from infected bone defects and bone nonunion in the tibia admitted to our hospital from January 2021 to January 2023 were selected as the subjects of this study, and were divided into 15 cases in the control group and 15 cases in the observation group according to the different treatment methods.

In the control group, there were 10 males and 5 females, age ranged from 28 to 81 (43.63 ± 5.26) years old; the duration of disease ranged from 1 to 7 (2.30 ± 0.30) years; in terms of the cause of injury, there were 10 cases of traffic accidents, 3 cases of fall from height, 1 case of heavy object injury, and 1 case of machine strangulation; according to the Gustilo classification, there were 1 case of type I, 3 cases of type II, 3 cases of type IIIA, 6 cases of type IIIB, and 2 cases of type IIIC. The observation group had 9 males and 6 females, age ranged from 26 to 80 (43.50 ± 5.14) years old; the duration of disease ranged from 1 to 6 (2.41 ± 0.25) years; for the cause of injury, there were 11 cases of traffic accidents, 2 cases of fall from height, 1 case of heavy object injury, and 1 case of machine strangulation; according to the Gustilo classification, there were 1 case of type I, 3 cases of type II, 2 cases of type IIIA, 6 cases of type IIIB, and 3 cases of type IIIC. The data of the two groups were statistically analyzed, and it was concluded that $P > 0.05$.

Inclusion criteria included patients meeting the diagnostic criteria of the disease; patients without other serious diseases, such as organ failure, malignant tumors, etc.; patients meeting the indications for treatment; patients having basic communication, understanding, and cognitive expression ability; patients with complete clinical data and informed consent.

Exclusion criteria were the presence of comorbid mental illness or serious psychological illness; patients with previous major surgery; patients with a history of taking special drugs; and patients who dropped out in the middle of the study.

2.2. Methods

After the admission of the two groups of patients, all of them received routine examinations, such as X-ray examination, cardiopulmonary function examination, etc. They underwent preoperative preparations, such as clarifying the defective condition of the fracture end and the traumatic infection, and patients with acute infection received targeted anti-infection treatment.

The control group received conventional surgical treatment. The lesion was first removed, a thorough debridement treatment was given, and the infection was controlled. An autologous free bone grafting was performed, if there was a large segmental bone defect, it was filled with vascularized bone flap transplantation.

The observation group adopted treatment using the bone transport technique. For patients with internal fixation, the internal fixation was taken out before treatment. If there was a severe infection, debridement was first carried out to remove all necrotic tissues as well as bone, and they were sent for bacterial culture and drug sensitivity test to select antibiotic treatment. After which, the severed end of the bone defect was cut off, and the wound was rinsed with saline and hydrogen peroxide repeatedly and then bandaged. The Orthofix external fixator was installed in the proximal tibial osteotomy position. After fixation, most of the skin defects were sutured. If there was a severe infection in the wound that could not be closed, an open dressing was performed,

along with a direct suture of the drainage tube.

2.3. Observation indexes

(1) The operation time, intraoperative bleeding, and hospitalization time of the two groups were compared.

(2) The postoperative complications of the two groups were compared.

(3) The treatment effects of the two groups were compared [3]. The final results were evaluated by referring to the Johner-Wruhs criteria. If the fracture healing time did not exceed five months, and the knee and ankle joints can move normally, with normal gait and no pain, and can walking freely, it was evaluated as "excellent." If the fracture healing time did not exceed 8 months, and the functions of knee and ankle joints partially recovered, with a slight limp and limited self-care, it was evaluated as "good." The fracture healing time of not more than one year, and the knee and ankle joint functions improved compared with that before the operation was assessed as "moderate." If the fracture had not healed, with relatively poor ankle joint function, and the limb was shortened by more than 1 cm and the angular deformity was more than 10 degrees, it was considered "poor." Total effective rate of treatment = [(number of excellent cases + number of good cases + number of moderate cases)/ total number of cases in the group] × 100

2.4. Statistical methods

The data were entered into the SPSS25.0 statistical software for analysis. Mean ± standard deviation (SD) was used to indicate the measurement data (conforming to normal distribution), and [n (%)] was used to indicate the count data, and independent sample *t*-tests and χ^2 test were carried out respectively. $P < 0.05$ indicated that the compared data were statistically significant.

3. Results

3.1. Surgery-related indexes

As shown in **Table 1**, the observation group had shorter operation time and hospitalization time, and less intraoperative bleeding than the control group, $P < 0.05$.

Table 1. Surgery-related indicators (mean ± SD)

Group	Number of cases (n)	Operation time (minutes)	Intraoperative bleeding (ml)	Duration of hospitalization (days)
Control group	15	93.52 ± 5.34	218.52 ± 10.17	16.31 ± 3.12
Observation group	15	67.17 ± 6.13	102.45 ± 9.31	11.81 ± 2.26
t	-	12.553	32.604	4.524
P	-	0.000	0.000	0.000

3.2. Postoperative complications

As presented in **Table 2**, the incidence of postoperative complications in the observation group was lower than that in the control group, $P < 0.05$.

Table 2. Postoperative complications [n (%)]

Group	Number of cases (n)	Neurological symptoms	Pain	Pin tract infection	Total
Control group	15	2 (13.33)	2 (13.33)	2 (13.33)	6 (40.00)
Observation group	15	1 (6.67)	0 (0.00)	0 (0.00)	1 (6.67)
χ^2	-	-	-	-	4.658
P	-	-	-	-	0.031

3.3. Treatment effects

Based on **Table 3**, the observation group had a higher total effective rate of treatment than the control group, $P < 0.05$.

Table 3. Treatment effects [n (%)]

Group	Number of cases (n)	Excellent	Good	Moderate	Poor	Total effective rate
Control group	15	3 (20.00)	4 (26.67)	2 (13.33)	6 (40.00)	9 (60.00)
Observation group	15	8 (53.33)	5 (33.33)	1 (6.67)	1 (6.67)	14 (93.33)
χ^2	-	-	-	-	-	4.658
P	-	-	-	-	-	0.031

4. Discussion

With the development of the transportation industry and the construction industry in recent years, there are increased incidences of traffic accidents, falling from height, and other accidents. These accidents can lead to multiple injuries throughout the body, of which fractures are more common. Among the injuries, tibial trauma and post-traumatic infections need to be dealt with in a timely manner, otherwise soft tissue defects and necrosis may occur. In severe cases, the trauma may occur in the exposed bone [4], bone and soft tissue infections can slowly evolve into skin defects, as well as chronic osteomyelitis, sinus tract formation, and later infected bone nonunion [5], increasing the treatment difficulty.

Bone transport technique is a novel treatment technique, which uses external fixator and tensile force in the Ilizarov system to treat bone defects. In bone transport, the length of the limb is maintained by the external fixator, and the bone is amputated in the epiphysis of the long bone that has rich blood supply. Simultaneously, the broken end of the bone defect is repaired [6], and the amputated bone segments are moved at a certain speed, so that the normal living bone is slowly delivered to the defect site. The treatment principle lies in that, firstly, after the lesion is removed during the operation, the affected limb is kept in a stable framework [7]. Secondly, the bone end is pulled every day to facilitate tissue repair and regeneration, and to promote the formation and regeneration of soft tissues, such as muscle, skin, as well as bone tissues. Lastly, a sustained elastic pressure is formed between the osteotomy extension area and the bone end as well as the confluent end of the bone block [8], which is conducive to the accelerated regeneration of osteogenic area. The bone at the confluence of defects is regenerated through a form of guided bone regeneration, and the bone in the lengthening zone is regenerated through the formation of distraction bone regeneration [9].

Conventional surgical treatment involves repeated removal of the lesion, thorough debridement, control of infection, and vascularized bone flap transplantation or autologous free bone grafting to fill up the bone defect. In this therapy for large bone defects, a high level of microsurgical skill is required, and the soft tissue and

blood supply should be ideal and adequate. In addition, conventional surgical treatment is prone to reinfection and requires a relatively long treatment period. The repeated surgeries will worsen the soft tissue condition [10], increasing the treatment difficulty, and may even lead to amputation. The bone transport technique can shorten the treatment time with ideal outcomes. Especially when dealing with cases of severe infected bone nonunion combined with soft tissue defects, the limb can be preserved and limb function can be actively restored [11,12]. Additionally, complications such as pain and pin tract infection can be prevented through timely follow-up and early intervention. The Orthofix unilateral lengthener is simple to operate and does not affect functional exercise in the later stage, but the stability is not as good as the ring external fixation (Ilizarov frame) [13]. At the same time, it is susceptible to offset during movement, so it is necessary to carry out the moving operation under the monitoring of the X-ray imaging, and timely adjust the offset position [14,15]. When dealing with infected wounds at the end of the bone, it is necessary to thoroughly remove the necrotized bone and inflammatory tissues, as well as the original internal fixation, and it will possibly lead to the recurrence of bone infection if there is any residual lesion [16]. The data from the results of this paper showed that the observation group had a shorter operation time, less intraoperative bleeding, and a reduced hospitalization time than the control group; moreover, the incidence of postoperative complications in the observation group was lower than that in the control group; and the total effective rate of treatment in the observation group was higher than that in the control group, so it is evident that the overall therapeutic effect of the bone transport technique is more satisfactory.

5. Conclusion

In conclusion, infected tibial nonunions are difficult to treat. This study found that the effect of adopting the bone transport technique for the treatment of infected tibial nonunion is more satisfactory and it is worth adopting.

Disclosure statement

The authors declare no conflict of interest.

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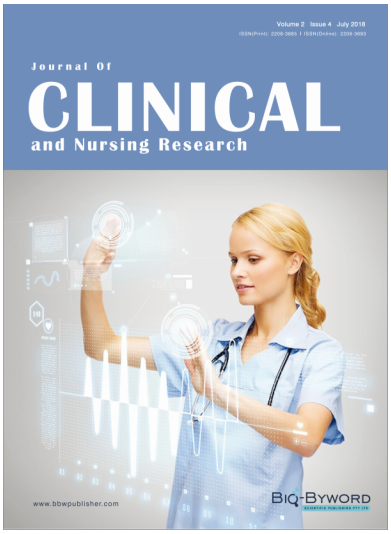

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