META-ANALYSIS

Application of TCM Rehabilitation in Joint Function Recovery After Treatment of Distal Radius Fractures: A Meta-Analysis

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ABSTRACT

Objective • To evaluate the effect of traditional Chinese medicine (TCM) rehabilitation on the postoperative function of patients with distal radius fractures by Meta-analysis.

Methods • PubMed, Embase, CNKI, Wanfang, and other databases were searched for retrospective controlled trials and prospective randomized controlled trials on the effect of traditional Chinese medicine rehabilitation on the function of patients with distal radius fractures after surgery from the establishment of the database to May 2023. Revman version 5.3 software was used to analyze the extracted and screened index data.

Results • Eight studies involving 455 patients were included. Meta-analysis results showed Overall analysis showed that there was a significant difference in wrist function between the TCM rehabilitation group and the control group (MD = -12.16, 95%CI:-17.21 to -7.11, $P <$ .00001), low heterogeneity (I^2=40%, P = .17), the difference in dorsiflexion function between the TCM rehabilitation group and the control group was statistically significant (MD = -1.16, 95%CI:-2.24 to -0.08, P = .04), with high heterogeneity (I^2=79%, P = .003), that there was a significant difference in grip strength between the TCM rehabilitation group and the control group at 6 weeks (MD= 0.48, 95%CI: 0.24 to 0.71, $P <$ .0001) with low heterogeneity (I^2=45%, P = .12), there was no significant difference between the TCM rehabilitation group and the control group (OR= -0.00, 95%CI: -0.08 to 0.08, P = .99), and there was no heterogeneity (I^2=0%, P = .66).

Conclusion • Traditional Chinese medicine rehabilitation treatment of distal radius fractures can increase the range of motion of wrist joints, reduce pain, shorten the rehabilitation time of patients, improve the quality of life, and is conducive to the standardized treatment of patients. (*Altern Ther Health Med.* [E-pub ahead of print.])

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INTRODUCTION

Distal radius fracture is one of the most common fracture types in clinic.[1] It refers to the fracture less than 3cm from the articular surface of the distal radius. It is a prevalent type of fracture in the elderly. Fractures of the distal radius due to traumatic, senile osteoporosis also occur frequently. In 1814, surgeon Colles first reported a prolonged fracture of the distal radius, also known as Colles fracture.[2] Simth fracture of the distal radius was first reported in 1847.[3] The treatment effect of distal radius fractures seriously affects the quality of life of patients, and its long-term complications will seriously affect the wrist function. There are many complications caused by distal radius fractures, such as carpal tunnel syndrome and traumatic arthritis. The incidence of carpal tunnel syndrome after surgical treatment of distal radius fractures has been reported to range from 0.5% to 2.2%. The pathogenesis of carpal tunnel syndrome may be related to a new callus and increased carpal tunnel pressure caused by internal fixation implantation. Traumatic arthritis can lead to long-term chronic pain and partial loss of function of the wrist. There are many treatments for distal radius fractures, including conservative treatment: closed reduction, cast fixation, or small splint fixation: Manual reduction techniques require external force applied in the opposite direction of the injury. After reduction, the fracture was fixed at ulnar deviation of 5° -15°. Flexion fractures of the distal radius (Smith fractures) should be fixed

in wrist extension and forearm supination, with casts and other external fixators outside the elbow joint. The external fixator of Barton's fracture is prone to instability. Surgical treatment: open reduction and internal fixation (the principle of the plate and screw internal fixation in open reduction is the purpose of intra-articular fracture treatment is to reconstruct the joint, and the best way is to complete reduction and reconstruction through anatomical relationship), external fixation, wrist arthroscopy. Wrist arthroscopy, as an emerging treatment method, can directly evaluate the separation and dislocation of the articular surface under a microscope and examine the wrist ligaments. Wrist arthroscopy has many advantages: the incision is small, will not affect the appearance of the patient's injury, the degree of injury to the patient's injury is less, not only observe the articular surface but also observe the degree of articular cartilage damage but also can judge the prognosis. Wrist joint dysfunction caused by fracture can be well judged at an early stage. However, arthroscopic internal fixation has great limitations and can only be used as an auxiliary treatment for surgery. The choice of treatment modality depends not only on the type of fracture and the degree of fracture displacement, but also on the age of the patient, the degree of functional requirements, and even the level of local medical technology.[4]

Most patients with distal radius fractures are treated conservatively. For simple distal radius fractures without articular surface involvement, manual reduction and external fixation combined with wrist training and anti-osteoporosis treatment can obtain satisfactory results without surgery. For elderly patients with complex intra-articular fractures, reduction, and fixation may be more demanding. Because elderly patients cannot tolerate surgery and often have different degrees of osteoporosis, surgery may not achieve the stable effect of internal fixation. In addition, the elderly do not have high requirements for functional recovery, do not pursue anatomical reduction, and the treatment methods are simple, and there is no need to worry about carrying excessive costs. Therefore, manual reduction and external fixation may be a better choice for the elderly with poor economic status or who are willing to be treated conservatively and do not have high requirements for curative effect. In a study of fracture severity, sex, age, and energy of injury, complication rates were much higher in elderly patients with distal radius fractures treated surgically than in those treated conservatively. The ultimate goal of the treatment of distal radius fractures is good bone reduction, rapid prognosis, and rapid recovery of wrist function. For the conservative treatment of distal radius fractures, manual reduction should be performed according to the type of fracture, followed by the choice of strong external fixation materials. At present, the external fixation materials are mostly plaster and splint. With the continuous in-depth study of materials, gypsies and splints are constantly progressing and upgrading. Casts and splints are widely used in clinical practice and have shown promising results in many studies. Both plaster and splint fixation have advantages and disadvantages. Splint external fixation can adjust the fixation tightness in time, perform functional exercises early, and prevent joint stiffness. The cast can be shaped according to the affected limb for a more stable fixation. Of course, they also have some disadvantages. Tension blisters, pressure sores, swelling, and obvious pain occurred in the early stage of external fixation, and fracture malunion and radius shortening occurred in the late stage of external fixation. Which treatment method can better avoid various complications during the treatment and recovery period of external fixation, and promote the recovery of wrist function, these clinicians have their treatment plan.[5]

The wrist joint is a very important joint of the human body, which plays a pivotal role in people's daily lives and work. Karnezis et al. also conducted a follow-up study of patients with unstable fractures of the distal radius and reached a similar conclusion. The degree of displacement of articular surface fracture and the degree of articular surface smoothness are closely related to the prognosis of patients. The loss of articular surface smoothness will directly reduce the range of motion of the wrist. Some biomechanical experiments by Fraser et al. showed that changes in the normal anatomy of the distal radius in imaging result in excessive load concentrated on the dorsal articular surface of the radius, which easily causes wrist ligament injury and eventually leads to wrist instability. Kumar et al. conducted a follow-up study in a group of patients with extra-articular fractures of the distal radius. The patients were divided into a middle-aged group and an elderly group. The wrist function of the two groups was evaluated during follow-up. The results showed that there was no correlation between wrist function and the recovery of palmar tilt in the elderly group, but there was a significant correlation between wrist function and the recovery of palmar tilt in the middle-aged group.

The purpose of this study is that distal radius fractures are closely related to wrist function, and there are many influencing factors. Although the imaging follow-up after treatment showed satisfactory reduction, some patients did not achieve the expected functional recovery. Satisfaction with imaging indicators cannot represent functional satisfaction. It is necessary to be familiar with wrist anatomy, injury mechanism, fracture classification, etc., and treat to maximize the recovery of wrist function and to reduce the occurrence of traumatic arthritis and other complications.

MATERIALS AND METHODS

Inclusion criteria

The object of this study was to the literature on joint function recovery after the treatment of distal radius fractures with traditional Chinese medicine rehabilitation methods. All the literature on joint function recovery after the treatment of distal radius fractures by traditional Chinese medicine rehabilitation methods included in the database from the establishment of the database to 2023 was searched.

Inclusion criteria: patients with joint function recovery after treatment of distal radius fractures; Traditional Chinese medicine (TCM) rehabilitation methods were used to restore wrist joint function.

Exclusion criteria

Patients with other fractures; The patient had severe physical disability, low mobility, and could not carry out normal rehabilitation. The patient was complicated with other mental disorders. Severe complications occurred after treatment. Patients were unable to complete the study due to poor compliance. Data were missing or duplicated published.

Literature retrieval methods

This literature search was mainly conducted in Chinese and English, and the databases included CNKI (website: https://www.cnki.net/), Wanfang (website:https://www.wanfangdata.com.cn/index.html), VIP (website:https://wwwv3.cqvip.com/), PubMed (website: PubMed https://pubmed.ncbi.nlm.nih.gov/) and Springer(https://link.springer.com/). "distal radius fracture", "rehabilitation", "Joint function" and other keywords were used as search terms for literature retrieval, and "acupuncture and moxibustion", "smoke and wash" were used as search terms for literature retrieval. The abstracts, keywords, and conclusions of the retrieved literature were read, and the literature with appropriate content, detailed data, and complete data were selected for inclusion in the study.

Quality Assurance

The inclusion of the literature was mainly carried out by the criteria, and the research was conducted by professional scholars, who read in detail where there was doubt or dispute to further determine whether the literature met the inclusion criteria.

Quality evaluation

This study used methodological quality evaluation, and the evaluation was carried out with the standardized scale involved by Thomas et al. The standardized scale contains 13 questions, namely, whether the purpose of the study is clearly stated; The study involved a prospective/randomized controlled study. Whether the double-blind method was used in the study; Whether the inclusion criteria of the study population were clear; Whether the exclusion criteria of research objects were clear and reasonable; Whether the treatment method was clear, perfect, and scientific; Whether patients were lost to follow-up; Whether the indicators are closely related to the research subjects; Whether the research data were statistically different; Whether the sample size of the study meets the research needs; Whether the findings have any implications for clinical research.

The quality of prospective studies was evaluated according to the number of studies meeting the above criteria, and 8 or more prospective studies were considered as excellent. Retrospective studies that met more than 6 criteria were considered as excellent, others as poor quality. The sixth and eighth items in the study were not relevant to retrospective studies and were not used to evaluate the literature quality of retrospective studies.

Statistical analysis

RevMan version 5.0 provided by Cochrane Collaboration was used for statistical analysis. According to the P value and I^2 to judge the degree of heterogeneity, the $P < .05$ was the homogeneity test level. A fixed-effects model was used to combine groups without heterogeneity, and a random-effects model was used if there was heterogeneity between groups. OR values and 95%CI were used for dichotomous variables.

Figure 1. Literature screening flow chart

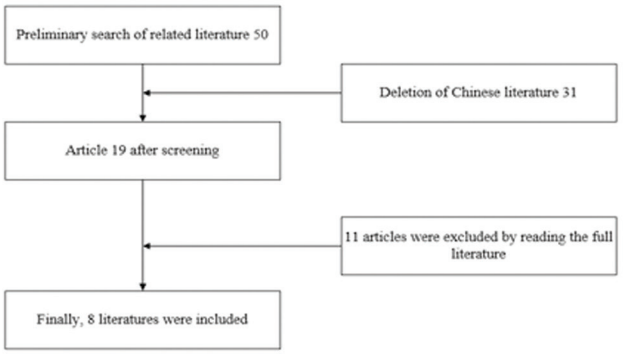


Table 1. Basic data of the included literature

author	Year	A case (case)		Male/female (example)		Age years, mean (range).	
		Experimental Group	Control group	Experimental Group	Control group	Experimental Group	Control group
Calderón	2008	30	30	11/19	10/20	55	51
Brehmer	2014	36	42	16/20	15/21	49.8	55.3
Iitsuka	2016	27	18	7/20	8/10	57±13 (33~78)	49±19 (19~81)
Quadlbauer	2017	15	13	2/13	2/11	49.13±15.41	58.77±12.06
Dennison	2018	18	15	1/17	1/14	54.9	53.1
Clementsen	2019	57	62	4/53	7/55	55 (12.4)	55 (11.9)
Tomruk	2020	15	17	8/7	6/1	45.25±9.84	57.00±15.84

RESULTS

Literature search results

A total of 50 domestic and foreign articles related to the keywords and consistent with the title and abstract were retrieved, of which 31 were in Chinese. After reading the full text of the literature, 8 articles were finally adopted.[6-13] There were 455 patients, including 228 in the TCM rehabilitation group and 227 in the control group. Complications were mentioned in 6 literature, See Figure 1.

Basic characteristics

The details of the included literature are shown in Table 1.

Wrist function

Overall analysis showed that there was a significant difference in wrist function between the TCM rehabilitation group and the control group (MD=-12.16, 95%CI: -17.21 - 7.11, $P < .00001$), low heterogeneity (I^2=40%, $P = .17$), see Figure 2. early rehabilitation is more beneficial to the recovery of the wrist joint of patients.

Pain

A visual analog scale (VAS) was used to obtain pain data. After overall analysis, the difference in dorsiflexion function between the TCM rehabilitation group and the control group was statistically significant (MD=-1.16, 95%CI: -2.24 to -0.08, $P = .04$), with high heterogeneity (I^2=79%, $P = .003$), as shown in Figure 3. Chinese medicine can improve patients' dorsiflexion function.

Figure 2. Comparison of wrist function between the two groups

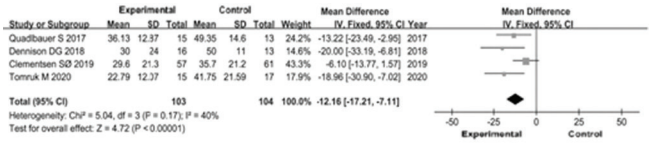


Figure 3. Comparison of pain between the two groups

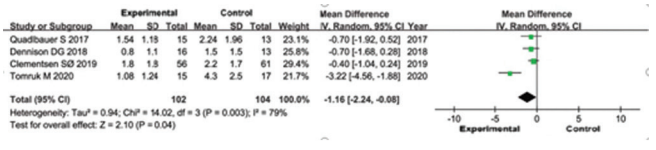


Figure 4. Comparison of grip strength (kg) between the two groups

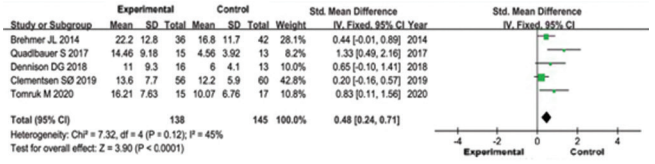
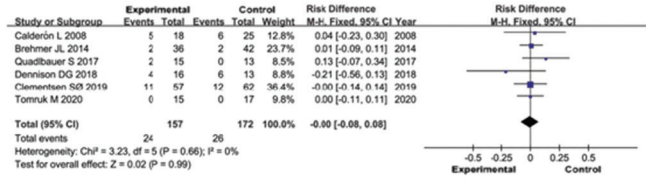


Figure 5. Comparison of complications between the two groups



Grip Strength (kg)

Grip strength was measured by a handgrip dynamometer. Overall analysis showed that there was a significant difference in grip strength between the TCM rehabilitation group and the control group at 6 weeks (MD=0.48, 95%CI: 0.24 to 0.71, $P < .0001$) with low heterogeneity (I^2=45%, $P = .12$), as shown in Figure Traditional Chinese medicine can improve the grip strength of patients and promote faster recovery.

Complications

Six studies were used for the meta-analysis of complications.[6-7,9,11-13] After overall analysis, there was no significant difference between the TCM rehabilitation group and the control group (OR=-0.00, 95%CI: -0.08 to 0.08, $P = .99$), and there was no heterogeneity (I^2=0%, $P = .66$), as shown in Figure 5. Chinese medicine can improve the joint function of patients and promote their rehabilitation.

DISCUSSION

Distal radius fracture is a very common type of fracture. In clinical practice, there are various treatment methods and perfect treatment.[14] However, due to the high incidence of distal radius fractures, it is easy to have serious complications such as impaired wrist function after treatment, which will affect the normal life of patients.[15] Therefore, how to give scientific and efficient nursing after treatment to ensure the recovery of wrist function of patients has been an important issue in the clinical treatment and related research of distal radius fractures.[16] At present, the treatment of distal radius fractures is mainly based on Western medicine surgery, but surgery has a certain degree of trauma. After treatment, patients may have inflammation or other conditions that affect the recovery of wrist joint function.[17-18]

In recent years, with the deepening of the research on distal radius fractures, it has been found that the clinical effect of traditional Chinese medicine bone setting manipulation and traditional Chinese medicine decoction in the treatment of distal radius fractures is significant, which has incomparable advantages to western medicine.[19-20] The distal radius is located at the junction of dense and cancellous bone, and the bone structure is relatively weak. When the distal radius is impacted by external force or its bone mineral density is too low to withstand normal activity pressure, it is easy to occur distal radius fractures.[21-22] Distal radius fractures are often associated with joint damage and muscle traction, which are difficult to reduce during treatment. If the distal radius fracture is not reduced in time during the treatment, the wrist pain will be aggravated, the elbow and shoulder joints will also be affected, the patient's activity will be limited, and the mood may be depressed. In addition, in the late treatment of distal radius fractures, patients may not form a correct concept of fracture rehabilitation because of various factors and do not pay attention to rehabilitation training in the later period, resulting in difficult recovery of wrist joint function.[23] Functional exercise after the treatment of distal radius fractures is a very important part of the later stage of fracture, which will directly affect the prognosis of distal radius fractures and the occurrence of complications, and has a direct impact on the daily activities of patients. Compared with Western medicine rehabilitation, TCM rehabilitation is more similar to "treatment", which represents a higher mandatory meaning and importance for patients and can better ensure patients' attention to the later rehabilitation process.[24] However, some nurses and patients did not realize the importance of functional exercise in the later stage of fracture, or were in a hurry to succeed, and the exercise methods were not scientific and reasonable. Therefore, we should strengthen the rehabilitation education for nursing staff, strengthen the knowledge of science popularization for patients, and scientifically guide the correct functional exercise method.

Rehabilitation in the late stage of fracture is an important process, and there are many related influencing factors.

Traditional Chinese medicine has always paid attention to the importance of functional rehabilitation exercises after fracture reduction and fixation. In Lu shi, Chun Qiu, Ji Chun Ji, it is advocated to treat the froggy of the foot by practicing kung therapy, which laid a solid foundation for the formation of rehabilitation exercises. In Lu Shi Spring and Autumn Ancient Music, it is mentioned that the ancient people would use the form of dance practice to exercise and promote the recovery of limb function. Silk painting Daoyuan Tu recorded notes on the treatment of bone injuries and diseases and also

painted images of Daoyuan practice, reflecting that there was a certain connection between the treatment of bone injuries and the rehabilitation of practice at that time. One of the four basic principles of fracture treatment, "dynamic and static combination, equal emphasis on muscle and bone, internal and external treatment, and doctor-patient cooperation", proposed by the famous modern doctors Fang Xianzhi and Shang Tianyu,[25] emphasizes the importance of the combination of fracture fixation and functional rehabilitation training after fixation so that the fracture healing can be synchronized with the recovery of the affected limb function. "Internal and external treatment" is one of the four principles of traditional Chinese medicine (TCM) in the treatment of fracture diseases. The so-called "internal treatment" refers to the treatment of stasis in the body, bone fracture and tendon off, and blood overflow outside the pulse, blocking the circulation of the qi machine. In addition to manual reduction and external fixation, "Yi" also includes comprehensive rehabilitation treatment of traditional Chinese medicine (TCM fumigation and washing, tendon manipulation, joint mobilization, etc.).[26] Bone injury in traditional Chinese medicine divides the process of fracture healing into three stages: accumulation, regeneration, and bone healing, and three treatment methods are adopted accordingly. In the early stage of fracture, due to the separation of bone and tendon, blood from the meridians, stagnation of qi and blood, and obstruction of meridians, it is necessary to promote blood circulation to remove blood stasis, relieve swelling, and relieve pain. The representative prescriptions included Fuyuan Huoxue decoction, Heying Zhutong decoction, etc.[27-28] In the middle stage of the fracture, the swelling gradually subsided and the pain was relieved, but the blood stasis was not completely removed and the muscle and bone were not yet joined. The treatment is mainly based on invigorating the heart and regulating bone and blood, and the representative prescriptions are Taohong Siwu decoction and Xugu-Huoxue decoction. The treatment should strengthen the muscles and bones, nourish qi and blood, and supplement the liver and kidney, representing internal treatment and external treatment.[29] It is one of the four principles of traditional Chinese medicine in the treatment of fracture diseases. The so-called "inside", is the treatment of blood stasis in the body, fractured tendons, and blood overflow in the vein, blocking the circulation of qi and blood.[30] In addition to manual reduction and external fixation, "Yi" also includes comprehensive rehabilitation treatment of traditional Chinese medicine (TCM fumigation, tendon massage, joint mobilization, etc.).[31] Bone injury in traditional Chinese medicine divides the process of fracture healing into three stages: accumulation, regeneration, and bone healing, and three treatment methods are adopted accordingly. In the early stage of fracture, due to the separation of bone and tendon, blood from the meridians, stagnation of qi and blood, and obstruction of meridians, it is appropriate to promote blood circulation to remove blood stasis, relieve swelling, and relieve pain. The representative prescriptions included Fuyuan Huoxue decoction, Heying Zhutong decoction, etc.[32-33] In the middle stage of the fracture, the swelling gradually subsided and the pain was relieved, but the blood stasis was not completely removed and the muscle and bone were not yet joined.[34] The treatment is mainly based on invigorating the heart and regulating bone and blood, and the representative prescriptions are Taohong Siwu decoction and Xugu-Huoxue decoction. There was callus growth and qi and blood loss in the later stage of fracture.[35] Treatment should be based on strengthening muscles and bones, nourishing qi and blood, and nourishing the liver and kidneys.

Zhao Yong [20] et al. grouped 72 patients with distal radius fractures and performed postoperative comprehensive rehabilitation of traditional Chinese medicine and concluded that comprehensive rehabilitation of traditional Chinese medicine can effectively reduce the occurrence of postoperative joint dysfunction.[36] Distal radius fractures are multiple fractures, mostly involving the wrist joint. The wrist joint is the most complex in the human body.[37] How to perform wrist operation on the premise of reducing surgical trauma and obtaining better alignment of fracture ends, and how to achieve better functional rehabilitation after wrist surgery should avoid the thinking of every clinician involved in wrist surgery.[38] With the continuous improvement of modern science and technology, the continuous update of medical equipment, and the continuous proposal of new concepts and new surgical methods, the surgical methods and postoperative functional rehabilitation of distal radius fractures will have better development.[39] However, the effect of traditional Chinese medicine rehabilitation on Chinese patients with distal radius fractures in addition to joint pain remains to be further studied, and this study only included 8 articles, which still have certain limitations. Affected by the quality and quantity of included studies, high-quality, multi-center RCT studies are still needed.

To sum up, traditional Chinese medicine rehabilitation methods can effectively promote the recovery of wrist joint function in patients with distal radius fractures, help to reduce the pain of patients, and can effectively reduce the risk of complications and improve the prognosis of patients. It is an effective clinical rehabilitation method.

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DECLARATION OF INTEREST

The author states that there is no conflict of interest.

AUTHOR CONTRIBUTIONS

Weiheng Chen designed the study, Sainan Liu and Shuwen Li wrote the manuscript, Zeli Li and Juan Wang collected and analyzed data, Xiaobo Xie revised the manuscript, and Sainan Liu and Shuwen Li made equal contributions to this work. All authors read and approved the final submitted manuscript.

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