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Research Progress on Conservative Traditional Chinese Medicine Treatment of Colles' Fracture in the Elderly

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Abstract: ***Fracture of the distal radius is one of the common fractures in clinical practice, mostly occurring in middle - aged and elderly patients. This paper aims to study the progress of traditional Chinese medicine (TCM) conservative treatment for Colles fracture. The traditional TCM conservative treatment involves reducing the fracture of the radial stump through the manipulation of traditional Chinese medicine, then performing external fixation with small splints or plaster, and at the same time, carrying out rehabilitation training and functional exercises as prescribed by the doctor, and coordinating with treatments such as internal administration and external application of traditional Chinese medicine. It has a long - standing history and rich experience. According to the type of the fracture of the affected limb, selecting an appropriate treatment plan, reducing complications, and maximizing the recovery of the wrist joint function of the affected limb are the difficulties and key points faced by our clinical physicians. Compared with surgical treatment, TCM conservative treatment has the advantages of no surgery, less trauma, low cost, and good clinical efficacy. This paper reviews the research progress of TCM conservative treatment for distal radius fractures.***

Keywords: TCM conservative treatment, Distal radius fracture, External fixation of fracture, Research progress**.**

1. Introduction

Distal Radius Fractures refer to fractures within the range of 2 - 3 cm above the articular surface of the distal radius. It is a common type of fracture, among which intra - articular fractures account for 25% of distal radius fractures [1]. The injury mechanism is as follows: when a person falls, with the elbow extended, the forearm pronated, the wrist in the dorsiflexion position, and the palm supporting the ground, the violence causes a fracture of the distal radius, also known as the Colles' fracture. It is particularly common in the middle - aged and elderly, and the incidence in women is higher than that in men [2]. Traditional Chinese medicine conservative treatment has advantages such as no surgery, good curative effect, and simple treatment methods. For some elderly patients who do not strongly pursue better recovery of wrist function, traditional Chinese medicine conservative treatment often has good clinical efficacy compared with surgical treatment, and clinicians also tend to choose traditional Chinese medicine conservative treatment. By reading a large number of relevant literatures, the author noticed that the eight - character core of "separate first and then reunite" is indispensable in the fracture manipulation. Moreover, in the direction of external fixation, based on the principle of "combining movement and immobility" in fracture fixation and the traditional Chinese medicine theory of "bones and muscles are connected, and tendons can bind bones", bold innovation and the combination of Chinese and Western medicine have been carried out. Distal radius fractures are one of the common diseases in the field of orthopedics. This paper aims to review the research progress in this field.

2. Oral Administration of Traditional Chinese Medicine

Traditional Chinese medicine believes that fractures are a disease with deficiency in the root and excess in the symptoms. The healing process of fractures is divided into three stages: the early, middle, and late stages, which is a process of "removing stasis, generating new tissues, and uniting bones". In the early stage, the main treatment principles are promoting blood circulation to remove blood stasis and reducing swelling and pain; in the middle stage, the focus is on reconnecting tendons and bones and promoting blood circulation to remove blood stasis; in the late stage, the emphasis is on tonifying the liver and kidneys and strengthening the bones. Chen Jiangge [3] and others analyzed the medication rules of oral administration of traditional Chinese medicine in the treatment of distal radius fractures through data mining technology. They found that the meridians associated with the medications for fracture healing are mainly the liver, spleen, heart, and kidney meridians. The flavors of the medications are a combination of sweet, bitter, and pungent, and most of the medications are warm - natured. The main treatment principles are nourishing blood, promoting blood circulation, removing blood stasis, and reconnecting tendons and bones. The core composition of the medications is in good agreement with the results of modern pharmacological research.

Clinically, most patients with distal radius fractures are middle - aged and elderly people, and there are more women. At this time, the essence and qi gradually decline, the foundation is unstable, and the warming and transforming function is weak. Since the kidney governs the bones, deficiency of kidney yang leads to a lack of the source for bone marrow production, and the bones lose nourishment, making fractures more likely to occur. Therefore, Li Hongbo [4] believes that distal radius fractures belong to the syndrome of yang deficiency, cold coagulation, and a mixture of

deficiency and excess of blood stasis, which requires treatment mainly by warming yang to strengthen the bones and tonifying the kidneys to nourish the bones. A clinical study using the Yang - warming bone - strengthening decoction found that it can increase the biomechanics of bones, reduce collagen synthesis, inhibit bone resorption, delay bone dissolution and loss, promote bone formation, shorten the fracture healing time, and accelerate the recovery of wrist joint function.

The Wumen medical school in Suzhou skillfully uses the "purgative method" to remove stasis and dredge the intestines. The drugs for promoting blood circulation to remove blood stasis are combined with rhubarb, achyranthes root, lycopus lucidus, and alisma orientale to remove stasis and promote diuresis, which have good clinical effects both before and after fracture surgery.

Traditional Chinese medicine has a long - standing cultural heritage and profound historical background. Each traditional Chinese medicine school has its own theoretical guidance for medication. Some advocate the theory of the "kidney", and some emphasize the "purgative method". In fact, they basically follow the medication rules for the three stages of fractures.

3. Manual Reduction

Manual reduction of fractures is the most crucial part in traditional Chinese conservative treatment. The longer the time passes, the greater the difficulty of reduction. The earlier the manual reduction is performed, the more comprehensive the recovery of joint function will be. During the Tang Dynasty, Lin Daoren pointed out in his book "Xian Shou Li Shang Xu Duan Mi Fang" that appropriate methods of traction and manipulation should be selected according to the direction and angle of fracture displacement. The treatment of reduction and fixation of distal radius fractures can be traced back to the book "Shang Ke Hui Zuan" written by Hu Tingguang in the Qing Dynasty. Relevant manual reduction methods are also recorded in "Shi Yi De Xiao Fang" by Wei Yilin in the Yuan Dynasty: For patients with distal radius fractures, if the fractures are interlocked, the bone should be manipulated at the lower fossa; if it is displaced outward, it should be manipulated inward. These theories are generally consistent with the current reduction methods of "traction, squeezing, and shaking" for distal radius fractures. At the same time, with the development of the times, various orthopedic schools have formed unique bone - setting techniques based on their respective academic ideas. For example, the "reverse injury mechanism" [5] technique of the Ge's orthopedics in the Wu Gate of Suzhou, the traction - lifting and manipulation method of the Tianchi orthopedic school in the north [6], the pushing - dispersing, traction and extension reduction method of the Wei's orthopedics [7], the traction, lifting, pressing and shaking method of the Zheng's orthopedics [8], the traction, pressing and pushing method of the Li's [9], and the bone - setting technique of the Qing Palace orthopedic school [10]. The core mechanisms can be summarized as "traction and extension", "folding and lateral pressing", and "separating first and then reuniting".

4. External Fixation for Fractures

External fixation is the key in the entire treatment stage of distal radius fractures. It ensures the alignment of the fractured ends after reduction. It has the advantages of convenient material sourcing, simple operation, non - invasive fixation, and is beneficial for the functional exercise of adjacent joints. However, there are also possibilities such as unreliable fixation, the need for regular adjustment of the external fixation, and even the occurrence of some serious complications. Therefore, more improvements are needed in external fixation. Through literature retrieval, the author makes the following report:

The earliest form of external fixation can be traced back to small splints. In the Han Dynasty, the book "Zhong Cang Shu" recorded that "for severe fractures, bamboo slices should be used to clamp the fracture". In the Jin Dynasty, Ge Hong's "Zhou Hou Jiu Zu Fang" stated that "wrap it with bamboo slices to keep it in place and tie it tightly to prevent rotation". Small splints are simple in style, inexpensive, easy to operate, and have a long history. Although small splints are widely used, there are still some deficiencies such as fracture displacement and poor fit with the human body. In recent years, many clinical doctors have made their own unique external fixations to address the shortcomings of small splints. Traditional small splints have many components and complex operations, and these shortcomings are particularly prominent when patients under conservative treatment need to have their splints adjusted during regular outpatient follow - up. Meng Xianyu [11] et al. designed an integrated splint with straps and pressure pads. The pressure pad and four splints are connected by straps. This external fixation is indeed more convenient to operate and more reliable in fixation compared with traditional small splints. Some scholars, based on the concept of "elastic fixation", have given full play to the advantages of Chinese fir bark splints [12], such as elastic fixation, easy adjustment, rapid swelling reduction, and early functional exercise, and achieved good clinical results: it can effectively reduce complications such as re - displacement and early wrist joint stiffness; Li Guanghui [13] made an improved elastic plastic splint on the basis of traditional small splints, which is composed of a latex pad, a polymer splint, a cotton pad, and an elastic band. Due to the change in the arc angle, the distal fracture is pressed towards the palm side. With the plastic effect of the ulnar splint and the suspension fixation, radial deviation and displacement can be avoided to the greatest extent, and satisfactory clinical results have been achieved in the treatment of extended distal radius fractures, which can improve biomechanical indicators and promote fracture healing and wrist joint function recovery.

However, the former all have the drawback of individual differences. In response, an improved ultra-wrist splint was developed on the basis of the traditional small splint, based on the theory of "tailoring the device according to the shape" and the principles of modern medical limb kinematics [14]. Compared with the traditional small splint and plaster fixation, it is closer to the physiological curve of the forearm and has the advantages of facilitating early functional exercise. With the rise and development of 3D printing technology, 3D-printed external fixation braces have emerged. They are orthopedic external fixation braces made by 3D printing

technology based on the imaging data of the affected limb and a three-dimensional external fixation model generated by digital design means. They have the functions of correcting body deformities, stabilizing joints, and fixing the fractured bones after reduction. Many scholars have used 3D printing technology to customize external fixation braces according to the affected limb and anatomical contours. This kind of external fixation brace provides great convenience for patients to change dressings, and the re-fixation effect is also stable. A large number of clinical case studies have also demonstrated that 3D-printed small splints are more conducive to early fixation and functional exercise than traditional small splints, thus achieving better wrist joint function [15, 16, 17]. The author believes that this kind of "customized" external fixation brace better fits the human contour, matches the human bones, and has the advantages of being personalized, lightweight, firmly fixed, and more comfortable to wear. It provides an innovative idea for the external fixation treatment of distal radius fractures and is also a future trend.

Of course, during outpatient follow - up and X - ray re - examination, clinical doctors will find that a small number of patients show loss of radial height on imaging, and in severe cases, there is shortening deformity of the affected wrist joint. Some scholars believe that external fixation lacks a longitudinal traction force to counteract fracture shortening. However, both plaster and small splint fixation lack longitudinal traction force, and it is easy for displacement such as shortening to occur after fixing unstable distal radius fractures in the elderly, those with osteoporosis, or comminuted fractures. Li Xin [18] and others developed a traction splint, which has a continuous longitudinal traction force compared with the traditional small splint. Through a clinical study of treating displaced distal radius fractures with plaster fixation, it was found that satisfactory reduction could be achieved through longitudinal traction and local extrusion reduction.

During the fracture fixation period, patients may develop metacarpophalangeal joint complications due to lack of functional exercises such as fist - clenching. Yang Gang [19] designed an M - splint, which not only prevents adhesion and contracture of the collateral ligaments of the metacarpophalangeal joints but also avoids hand function disorders caused by tendon adhesion, scar contracture, and joint stiffness. Clinical studies have found that this M - splint can promote the improvement of wrist joint function through large - range movement of the metacarpophalangeal joints during the middle and late stages of fracture treatment. The Department of Orthopedics of Suzhou Hospital of Traditional Chinese Medicine [20, 21] used horse - dung paper combined with wooden splints to treat Colles' fractures. The moistened horse - dung paper can better fit the gradually swollen affected limb, achieving relatively ideal treatment results. Some clinical doctors also choose to alternate between plaster fixation and splint fixation [22, 23, 24]. The author believes that this combination of "rigidity" and "elasticity" in external fixation not only has a firm fixation effect in the early stage of fracture but also has the advantage of correcting residual displacement in the middle and late stages. The combination of "rigidity" and "elasticity" well reflects the traditional Chinese medicine theory of "combining movement and stillness".

Some clinical doctors will place pressure pads during fixation after reduction according to the patient's imaging examination to correct residual displacement or fix small bone fragments. The pressure pad is placed between the splint and the skin, and the pressure or leverage it generates acts on the fracture end to maintain the good position of the fracture end after reduction [25, 26]. However, traditional pressure pads have the drawback of instability, and as the swelling of the affected limb subsides, the straps become loose, resulting in loss of reduction and poor fixation efficacy. The intelligent dynamic airbag regulates the pressure through a pressure monitoring system to maintain the position of the fracture end after reduction and correct residual displacement. Wei Chengjian [27] and Tao Baochen [28] and others successively found through finite element analysis that this new - type pressure pad can not only correct the residual displacement after manual reduction but also solve the problems of poor fixation of some unstable fractures by ordinary small splints, loss of reduction during the fixation process, and residual displacement after reduction, and it conforms to the traditional Chinese medicine theory of "combining movement and stillness" in fracture fixation. This intelligent pressure pad is like an invisible big hand that is constantly performing manual reduction and fixation on the fracture end, providing a "static" force during the patient's "dynamic" activities such as exercise and functional training.

In addition to splint fixation, external plaster immobilization is also a good choice. However, the sequelae of plaster application are often criticized. For Colles' fracture, the affected limb is fixed with a plaster splint in the wrist flexion position. Plaster fixation is cost - effective, easy to operate, highly malleable, can fully conform to the affected limb, and provides firm fixation, which is a kind of "rigid fixation". However, in the later stage, there are problems such as shortening and other re - displacements of the fracture, poor radiographic recovery, and lack of longitudinal traction [29].

Compared with traditional external plaster fixation, Nie Weizhi [30] and others innovated and invented the traction - flexion reduction semi - tubular plaster fixation technique based on the traditional plaster splint technique to address the lack of longitudinal traction in the later stage of plaster application. Through a large number of clinical studies, it was found that this technique can achieve non - invasive reduction and reliable fixation of Colles' fracture, avoid serious adverse consequences such as loss of fracture reduction, skin pressure sores, and even compartment syndrome. The cost of the fixation materials is low, the operation is simple, and it will not cause secondary trauma to the affected limb. Some scholars have invented a Y - shaped plaster. The main axis of the plaster is placed on the radial side of the forearm of the affected limb, and the two sides of the main axis are placed on the palmar and dorsal sides of the forearm. This "crab - foot" plaster [31] can provide better grasping force on the affected limb. The intersection of the plaster is located on the radial side of the forearm, and by combining local thickened padding, radial displacement can be corrected, which makes up for the defect of the traditional plaster splint.

External fixation is a key step in the treatment of distal radius fractures and a guarantee after manual reduction. External fixation can be divided into "rigid fixation", which is strong

and reliable, and “elastic fixation”, which conforms to biomechanics. Plaster fixation can provide absolute immobilization and good stability, but it cannot be adjusted according to the swelling degree of the affected limb. Prolonged use can cause complications such as pressure sores, folliculitis, and even compartment syndrome. Traditional small splints are more convenient to operate than plaster and can be adjusted according to the swelling of the affected limb. However, it is difficult to maintain the fixation during rest, sleep, or elbow and wrist flexion and extension activities. The fixation effect is relatively weak, and it is easy to cause angulation or displacement of the fracture ends. Therefore, orthopedic scholars have made innovative splints or pressure pads with their own characteristics to address the drawbacks of splints and pressure pads. Some scholars have considered the loss of radial length in external fracture fixation and invented a traction splint with innovative longitudinal traction, which can effectively maintain the radial length after manual reduction to a certain extent.

With the development and application of 3D printing technology, the splints produced by it have good clinical effects in both fixation and functional exercise. Secondly, functional exercise is also important. If effective functional exercise cannot be carried out, complications such as traumatic arthritis and wrist joint stiffness may occur. Zhang Jing [32] and others designed a new rehabilitation device for wrist fractures based on the concepts of “combining movement and stillness” and “elastic fixation”, which consists of upper and lower splints and a functional module. Its advantages are that staged functional exercise can promote better recovery of the patient’s wrist joint, and the range of slight movement of the wrist joint is no longer limited to palmar, dorsal, ulnar, and radial displacements.

In the early stage of the fracture, the affected limb is swollen, the tension of soft tissues and muscles increases, and the fracture ends are pulled. The special traction splint mentioned above provides additional longitudinal traction. However, the author believes that its clinical efficacy is not significant in the middle and late stages of the fracture. As the swelling of the affected limb improves, the traction interference of soft tissues and muscles on the fracture ends is minimal. Only palmar - dorsal and ulnar - radial fixation needs to be maintained. At this time, the external fixation does not fit the affected limb well, resulting in loose fixation and poor fixation effect. Therefore, re - examination at a certain time interval is necessary, and the external fixation should be adjusted according to the condition of the affected limb. In this regard, the author believes that the external fixation of horse - dung paper combined with wooden splints self - made by the Wumen Orthopedic School of Suzhou Hospital of Traditional Chinese Medicine [22, 21] has good clinical efficacy. The horse - dung paper can be shaped after being soaked in water, which can better fit the affected limb, is conducive to maintaining the reduction state of the fracture, and is very convenient for re - fixation after re - examination. After the horse - dung paper dries slowly, it maintains a proper distance from the skin of the affected limb. The upper (long) wooden splint fixes beyond the wrist - metacarpal joint, and the lower (short) wooden splint does not fix beyond the wrist - metacarpal joint, which conforms to the principle of “combining movement and stillness” in traditional Chinese orthopedics.

In terms of the efficacy evaluation of traditional Chinese conservative treatment of Colles fractures in the elderly, in terms of imaging, the radial length, ulnar inclination angle, and palmar tilt angle are compared at a certain time after manual reduction. Compared with internal fixation surgery, the recovery of the palmar tilt angle after manual reduction is often not ideal. However, for elderly patients, there is no need to be overly critical. In terms of wrist joint function recovery, it is sufficient to actively restore the wrist joint function without causing significant impact on daily life. Of course, it is also very important to choose the appropriate time for functional exercise. Exercising too early may cause re - displacement of the fracture ends, while exercising too late may cause complications such as traumatic arthritis, increasing the patient’s pain.

5. Therapeutic Exercises

Therapeutic exercises, also known as functional training, were called “Daoyin” in ancient times. It is a therapy that prevents and treats diseases, improves health, and promotes the recovery of limb function through self - exercise. Therapeutic exercises can accelerate the recovery of joint function. Timely and effective exercise activities not only have the effect of promoting blood circulation and removing blood stasis. As the saying goes, “when the channels are unblocked, there is no pain”, achieving the effect of reducing swelling and relieving pain; they also have the function of promoting the growth of new bone. Moreover, functional training under splint fixation can not only maintain the good alignment of the original fracture but also correct mild residual displacement; it also promotes the smooth flow of qi and blood, avoiding joint adhesion, stiffness, osteoporosis, and muscle atrophy.

During the three - stage healing process of fractures, therapeutic exercises should be carried out step by step. One should not be over - eager for quick results. Starting from passive activities to active activities and then to resistance training, the training time, range of motion, and frequency should be gradually increased, with the principle that the affected limb feels no pain or only slight pain. Violent exercise is strictly prohibited [22].

In the case of Colles fractures, in the early stage of the fracture, patients are advised to hold the affected limb above the head and perform finger grasping exercises to promote blood circulation in the affected limb and eliminate swelling; in the middle stage of the fracture, patients should continue finger grasping exercises and add shoulder and elbow joint swinging exercises. Rotation of the forearm can be added as appropriate; in the late stage of the fracture, when the external fixation device has been removed, patients are advised to perform active flexion and extension exercises of the wrist joint, resistance training for wrist joint flexion and extension, and application - based hand activity training.

Traditional Chinese medicine emphasizes the concept of paying equal attention to the whole and the local. Therapeutic exercises are divided into local and whole - body exercises. Whole - body exercises can promote the circulation of qi and blood and restore the functions of the internal organs as soon

as possible. There are many ways of traditional Chinese therapeutic exercises. Ba Duan Jin and Taijiquan can regulate the overall function of the human body. For local exercises, plans are formulated according to joint function. Oral administration of traditional Chinese medicine, external application of local plasters, and fumigation and washing with traditional Chinese medicine can be used to promote blood circulation, remove blood stasis, activate qi, relieve pain, or tonify the liver and kidneys and strengthen the tendons and bones, so as to help restore the function of the wrist joint [4, 22, 33, 34].

6. Summary

In conclusion, for elderly patients with Colles fractures, traditional Chinese conservative treatment is still a good choice in terms of wrist joint function recovery, reducing complications, relieving patients' pain, and medical costs. Of course, traditional Chinese conservative treatment should not be limited to "conservatism". In terms of fracture reduction techniques, although there are different schools, they all reflect the core idea of traditional Chinese medicine, "separate first and then reunite". In terms of external fixation, from bamboo splints in ancient times to today's new equipment such as intelligent dynamic air - bag splints, 3D - printed splints, and special traction splints, all of these have good clinical effects and reflect the principle of "combining movement and stillness" in traditional Chinese medicine treatment. Personally, I think that external fixation is a direction worthy of in - depth study. It is the key to the whole treatment. We should base on traditional Chinese medicine ideas, give full play to our creativity, and make bold innovations to pursue better clinical effects.

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