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Progress in the Application of Chinese and Western Medicine in the Treatment of Chronic Osteomyelitis

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Abstract: *Chronic osteomyelitis is a bone infection that occurs after open fracture or other bone and joint surgeries, and its treatment period is long, costly, recurrence rate is high, and the treatment is difficult, so it is extremely difficult to deal with. In recent years, with the improvement of academic and the introduction of new technologies, the treatment methods for chronic osteomyelitis have gradually increased, and its therapeutic effect has also been significantly improved. However, the treatment of chronic osteomyelitis by Western medicine still has some disadvantages, this article summarises the progress of clinical and experimental research on the treatment of chronic osteomyelitis by Chinese and Western medicine in recent years. It is found that chronic osteomyelitis is a combination of deficiency and solidity, and it is closely related to the internal organs, so the treatment should be based on the different stages of disease progression, and the treatment should be based on both attacking and supplementing, and the treatment should be based on both supporting the correctness of the disease and eliminating the evil spirits. Chinese medicine clinical practice includes Chinese medicine internal treatment, Chinese medicine external treatment and integrated therapy, Chinese medicine experimental research includes Chinese medicine anti-infection and Chinese medicine to promote bone formation, as well as the progress of experimental research on self-proposed prescriptions and empirical formulas, while Western medicine mainly treats chronic osteomyelitis from the aspects of antibiotic application, soft tissue defects and bone defects.*

Keywords: *Traditional Chinese medicine; western medicine; chronic osteomyelitis; progress in application*

1. Introduction

With the rapid development of modern facilities, high-energy traumas such as traffic accidents and accidental injuries are increasing, and as a result, the number of patients with open fractures has risen. Most of the open fractures caused by high-energy injuries result in serious damage to soft tissues and severe haematological disorders. Moreover, after bacteria enter the bone marrow cavity from the trauma, the infection is not easy to be controlled due to the destruction of the periosteum and the reduction of haematological transport, causing chronic osteomyelitis in the long run. Chronic osteomyelitis is a chronic infectious disease involving necrosis of bone tissue and surrounding soft tissues with a more complex etiological mechanism, which is often complicated by open fractures, diabetic foot, post internal fixation and haematogenous bone infections [1]. Statistically, the tibia is the most common site of fracture-related osteomyelitis, and as the most common causative organism in bone infections, Staphylococcus aureus can be detected in lesions in more than half of patients with chronic osteomyelitis [2]. The common clinical symptoms of chronic osteomyelitis include local swelling and pain and sinus formation, which are not specific at the initial stage of the disease. However, the long duration of the disease, the high probability of recurrence and the risk of disability have a significant impact on the patient's ability to take care of himself, and increase the burden on the society to a certain extent. At present, the main treatments for chronic osteomyelitis include the application of pathogenic bacteria-sensitive antibiotics, complete removal of lesions, induction of smooth reconstruction of bone tissue and soft tissue re-coverage, and amputation for patients with rapidly spreading gangrenous infections and too great a risk of limb preservation, which is a relatively large number of therapeutic means but with a complex procedure. With the continuous deepening of Chinese medicine theory learning, the current Chinese medicine evidence-based treatment of chronic osteomyelitis has achieved certain results, compared with affordable, small adverse effects, the patient

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is more acceptable, and Chinese medicine to cure the disease because of the principle of treatment, evidence-based treatment of chronic osteomyelitis, according to the etiology of the disease using different diagnostic and therapeutic measures. Therefore, this article is a review of the research on Chinese and Western medicine in the treatment of chronic osteomyelitis in recent years, with a view to providing clinical reference for the more effective treatment of chronic osteomyelitis.

2. Chinese medicine's understanding and treatment of chronic osteomyelitis

2.1. Etiology and pathogenesis

Chronic osteomyelitis does not appear in the Chinese medical text, according to the symptomatic characteristics of this disease, it can be attributed to the category of "bone paralysis, bone gangrene, bone erosion", etc. Regarding the severity of this disease, "Ling Shu - Carbuncle Gangrene" describes it as follows: "It occurs in the femoral tibia, which is called femoral tibial gangrene, and it is called femoral tibial gangrene. "It occurs in the femur and shin, and is called gangrene of the femur and shin. Its shape is not very changeable, and the carbuncle pus beats the bone, not urgent treatment, 30 days to die". Chinese medicine treats osteomyelitis by clearing away heat and removing dampness, detoxifying the camps, and supporting the righteousness and dispelling the evil as the basic law. Cao Yixun and other experts believe that the etiology and pathogenesis of osteomyelitis is related to exogenous wind, cold and dampness, heat and toxin, coupled with kidney deficiency and Zhengqi weakness, and that the treatment is based on replenishing qi and blood in order to achieve the effect of toxin elimination [3]. Wang Yong and other experts believe that the pathogenesis of chronic osteomyelitis is based on spleen and kidney qi deficiency, and at the same time in the pathogenesis process derived from poisonous evils, virtual and real throughout the pathogenesis of osteomyelitis, the treatment pays full attention to the balanced relationship between the real and the virtual, and eliminating the evils and supporting the positive simultaneously [4]. Qin Daping [5], from the perspective of "bone and tendon flexibility", believes that the weakness of yang qi is the root cause of chronic osteomyelitis, and that damp-heat and turbid evils are retained in the local tendons and bones to cause flesh rot and bone injuries, and that the treatment of yang qi to soften the tendons and bones and improve the body's ability to resist the evils. Therefore, according to the summary of many traditional Chinese medicine scholars, the pathogenesis of chronic osteomyelitis is mainly based on deficiency. The lesion site is closely related to organs such as the liver, spleen, and kidney. The external reason is mainly due to the invasion of wind cold evil energy into the body, while the internal reason is related to the lack of one's own righteous energy, which cannot drive away evil. The evil energy is strong, the positive energy is deficient, and the external evil persists in the local bone and flesh for a long time, leading to qi stagnation and blood stasis, bone and tendon damage. Therefore, physicians should pay attention to the different time periods of disease progression and apply evidence-based medicine for differential diagnosis, which is a unique feature of traditional Chinese medicine in treating chronic osteomyelitis.

2.2. Clinical Treatment

2.2.1. Traditional Chinese medicine internal treatment

As a traditional therapy of traditional Chinese medicine, internal treatment can obtain good results for different symptoms of the disease according to the differences in the effects of drug combinations. Bai Haifeng et al. [6] found that the treatment of traumatic osteomyelitis with Yanghe Tang can effectively improve the microcirculation of local tissues, reduce the level of serum C-reactive protein and blood sedimentation, and improve the immunity of the patient's body, which can reduce the probability of recurrence of osteomyelitis, and improve the quality of life of patients. Su Jianguang [7] combined the flavouring of Wuwei Disinfecting Drink to treat chronic osteomyelitis on the basis of conventional treatment, and the results showed that the flavouring of Wuwei Disinfecting Drink could accelerate the recovery process of the patients and shorten the application time of antibiotics. Zhao Zejin et al [8] randomly divided 78 patients with chronic osteomyelitis of the tibia into a control group and an observation group with 34 cases in each group. The patients in the control group were treated with tibial flap repair combined with conventional anti-inflammatory therapy, while the patients in the observation group were combined with Bone Injury Recovery Soup for internal administration on the basis of the control group. After 30 days of treatment, it was found that the difference between the knee HHS scores and BairdJackson scores of the two groups of patients was statistically significant. And the patients in the observation group showed a significant decrease in tumour necrosis factor-alpha, interleukin-6, and C-reactive protein, and an increase in alkaline phosphatase (ALP) content after treatment. The results of this experiment indicate that the Bone Injury Recovery Soup can reduce the

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inflammatory reaction of patients, promote the recovery of renal function, and has a better therapeutic effect on promoting the recovery of joint function of patients. Therefore, the internal treatment of Chinese medicine can benefit patients with chronic osteomyelitis in terms of preventing recurrence, improving local inflammatory reaction and accelerating recovery.

2.2.2. External treatment of traditional Chinese medicine

External treatment of Chinese medicine is a characteristic therapy of Chinese medicine, which plays a therapeutic role by directly stimulating the local or lesion parts on the body surface, and has the advantages of small gastrointestinal stimulation and good patient compliance, including fumigation, external application, acupuncture and other therapeutic measures, which can all play a role in the treatment of chronic osteomyelitis. Guo Zairan [9] washed 20 cases of chronic osteomyelitis (heat and toxicity condensation evidence) patients with traditional Chinese medicine, another 20 patients with conventional surgical dressing. Its findings showed that osteomyelitis external wash II for heat and toxicity condensation chronic osteomyelitis compared with the conventional surgical dressing to reduce local swelling and pain, reduce tissue secretion, accelerating granulation tissue repair has a better therapeutic effect. Through a study onCiemy and Mader typing type II chronic osteomyelitis patients, Qiang Shenglin et al. [10] found that the Chinese traditional medicine de-tubularisation has a strong antibacterial effect. It can improve the local microcirculation state, accelerate the healing of the wound, and the adverse reaction is small, and will not form drug-resistant strains of bacteria. In the application of antibiotic bone cement carrier medical treatment of chronic tibial osteomyelitis based on the addition of thunder fire moxibustion, Zhang Yong et al. [11] found that the recurrence rate of patients in the observation group, wound closure time and the frequency of drug changes are less than the control group, the therapeutic effect is significant, worthy of clinical promotion.

2.2.3. Integrated therapy

Some studies have shown that the integrated treatment of multiple TCM means has a better effect on reducing the pain of chronic osteomyelitis patients. Yin Fanbiao [12] pointed out that branding method together with Xianfang Livestrong Drink in the treatment of chronic osteomyelitis can promote the healing of trauma, reduce the local inflammatory reaction, and accelerate the recovery process. Chen Yingwen [13] showed that Lianyin Tang combined with herbal wet compresses in the treatment of patients with osteomyelitis could effectively reduce the swelling and pain symptoms of patients and shorten the wound healing time. Subsequently, early scholars combined 3 methods of bone scraping and pus expulsion, Jiuhua plaster exchange and oral Keyan bone-healthy formula to treat patients with epiphyseal gangrene, and the results showed that the integrated treatment possessed the characteristics of low cost, short treatment course, good curative effect and could significantly reduce the recurrence rate of the disease. Another early study on the efficacy of oral Chinese medicine, moxibustion and acupuncture combined with western medicine in the treatment of chronic osteomyelitis showed that the treatment group was better than the control group in terms of reduction of pain scores, growth of granulation tissues and reduction of secretions after treatment ($P<0.05$).

2.3. Experimental Research on Traditional Chinese Medicine

At present, thorough cleaning of bone infection and repair of bone defects after lesion cleaning are still the main problems in the treatment of chronic osteomyelitis. A variety of etiological factors lead to pathogenic bacteria invade bone tissue and surrounding soft tissues, so that the local foci of dead space, scar formation, blood supply is reduced, resulting in the body's autoimmune ability to reduce the power of medicine is difficult to achieve satisfactory efficacy, so the patient is often required to use surgical intervention to clear the wound. In recent years, many experts and scholars have devoted themselves to the research of Chinese medicine in anti-infection and promotion of osteogenesis, and certain results have been achieved.

2.3.1. Anti-infection of Chinese medicine

In the treatment of osteomyelitis with traditional Chinese medicine, drugs with heat-clearing and detoxification effects are mostly used as a pairing throughout the course of the disease. Wu Jiao et al [14] found that honeysuckle has the ability to clear heat and anti-inflammation, broad-spectrum antibacterial, and improve immunity, and it is often used in the clinic for all kinds of infections and inflammatory reactions caused by viruses or bacteria. Zeng Zhaoyang et al [15] showed highly similar results, and pointed out that honeysuckle-associated compound Shuanghuanglian powdered injection and vancomycin together prepared bone cement streptozotocin was superior to simple antibiotic slow-release carriers in the inhibition of inflammatory factors and immunomodulation in the treatment

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of rabbits with chronic osteomyelitis model. Another study showed that Phellodendron Bark is widely used in the treatment of chronic osteomyelitis because of its growth inhibition of various bacteria, promotion of wound healing and immunosuppressive effects.

2.3.2. Traditional Chinese medicine to promote osteogenesis

Huang Xiaowen et al [16] used lipopolysaccharide to induce osteoblast damage model in rats, and proved that Epimedoside, the main component of Epimedium, has a protective effect on it, and its mechanism is related to the inhibition of cytoskeleton-related factors RhoA and Cofilin's mRNA expression. Ding Qiang et al [17] applied Masquelet technique to treat tibial bone defects in rats and then intervened with Epimedium, the results showed that Epimedium glycoside could significantly increase the expression of TGF-β1 and bFGF when forming the induction membrane in the rat tibial bone defect model, accelerating the process of osteogenesis, which is conducive to the bone contouring and reconstruction. In another study [18], by observing the imaging changes in the tibial distraction site and the expression of Runx-2 in rats, it was found that the total flavonoids of Osteoconjugate were able to up-regulate the expression of Runx-2 protein genes in the tibial distraction osteogenesis experimental animal model, which could improve the osteogenic ability, promote the bone mineralisation and accelerate the fracture shaping. And the relevant animal experiments showed that the use of total flavonoids in bone defect animal models treated with Masquelet technique can effectively promote the blood vessel formation and osteogenesis rate in the bone defect area. Wang Jiang et al [19] applied sodium tanshinone IIA sulfonate to the rabbit mandibular distraction osteogenesis model, and the results showed that the quality and rate of new bone formation in the distraction gap of the experimental group of animals were better than that of the control group during the same period.

2.3.3. Experimental study of self-proposed prescriptions and empirical prescriptions

Self-designed formulae and empirical formulae are generally integrated from the experience of clinical treatment and are more targeted than traditional therapies. Zhang Jun et al. [20] demonstrated that Osteoarthritis Formula could improve the immune status of inflammation by reducing the serum TNF-α and IF-6 levels in rabbits with osteomyelitis, thus promoting the repair of bone tissue. Further studies showed that osteoinflammatory formula could reduce the inflammatory response in rabbits with osteomyelitis, and its mechanism of action may be related to the inhibition of pro-inflammatory cytokines and the maintenance of a dynamic balance between pro-inflammatory and anti-inflammatory factors. Pan Xinwu [21] applied Gangrene Spray to rabbit chronic osteomyelitis model, and concluded that Gangrene Spray can improve WBC, serum lysozyme, ESR, CRP, and other inflammatory indications, and then achieve good antibacterial, anti-inflammatory, and improve the ability of the body's immune system. Li Dingpeng et al. [22] concluded that Gangrene Spray could promote the increase of bone type I collagen secretion and inhibit the expression of ADAMTS-7 at the bone defect site in rabbit osteomyelitis model, thus eliminating the swelling of limbs and repairing the defective bone tissues.

2.3.4. Other methods

Long duration of chronic osteomyelitis, decreased self-care ability of patients, and heavy psychological burden often adversely affect the treatment. Li Zhihong et al [23] found that five-element music therapy can effectively alleviate the mental stress of chronic osteomyelitis patients and improve their sleep quality. Zhang Junling [24] performed acupressure and auricular pressure beans on patients with chronic osteomyelitis who were to undergo surgery, and the results showed that the blood pressure of patients was effectively stabilised before surgery. Peng Rao et al [25] selected acupoints at the right time according to the type of evidence. The results showed that the blood pressure of the patients was effectively stabilised before the operation. This demonstrates that Chinese medicine auxiliary therapy has a positive effect on the mood of patients with chronic osteomyelitis and helps patients recover from the disease.

3. Definition of chronic osteomyelitis in western medicine and principles of treatment

Chronic osteomyelitis is a bone infection that occurs after an open fracture or other bone and joint surgery. It is caused by bacterial infection and thus infection of bone tissue, which includes inflammation of periosteum, bone cortex, bone cancellous stroma as well as bone marrow tissue. It develops from acute osteomyelitis to chronic osteomyelitis due to severe contamination of the trauma, serious soft tissue damage, incomplete debridement, or poor local blood circulation in the bone tissues, and the difficulty of antibiotics used intravenously in achieving an effective bactericidal concentration

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at the site of the lesion. It is characterised by progressive necrosis of bone tissue, formation of sinus tracts, local redness, swelling, pain and persistent ulceration as well as pus flow. The persistence of pus, progressive necrosis of bone tissue, poor haematopoiesis of most of the traumatic tissues, and the difficulty of controlling the infection make thorough debridement as well as anti-infection essential when acute osteomyelitis develops into chronic osteomyelitis. However, thorough debridement will result in different degrees of bone defects, so repairing the defective bone tissue and destroying the dead space become the key to the efficacy of the treatment.

3.1. Application of antibiotics

3.1.1. Systemic medication

Chronic osteomyelitis patients have a high bacterial culture positivity rate, early studies [26] reported that traumatic osteomyelitis patients have a positive trauma bacterial culture rate of 84.91%, Gram-positive cocci accounted for 43.24%, of which Staphylococcus aureus is the main one, accounting for 18.92%, the drug sensitivity results show that, against Staphylococcus aureus as well as the rest of the positive bacteria in the drug sensitivity test, rifampicin and vancomycin have higher The drug sensitivity test against Escherichia coli and the rest of the negative bacteria, carbapenem antibiotics, quinolones mostly had high sensitivity. Currently, the Guidelines for the Treatment of Chronic Osteomyelitis state that the systemic application of sensitive antibiotics should be for 4-6 weeks, so antibiotics that have better permeability in bone tissue and can achieve effective antibacterial concentration in the affected area should be selected according to the results of drug sensitivity, and the selection of antibiotics that are sufficiently high in dosage, sensitivity, and sufficient course of treatment is crucial to the control of the infection of osteomyelitis [27].

3.1.2. Local application

Local application of antibiotics can not only increase the concentration of antibiotics in the affected area, but also reduce the systemic toxic side effects of antibiotics, and at the same time, timely detection of local bacterial culture and drug sensitivity test, but also effectively prevent drug resistance and complexity and variability of pathogenic bacteria. Specific methods are (1) antibiotic fluid irrigation and drainage. Li Hongchao [28] found that the use of antibiotic irrigation therapy for the treatment of osteomyelitis can reduce the local inflammatory response and promote wound healing; (2) the application of antibiotic slow-release carrier: the use of bioengineered antibiotic slow-release carrier can achieve the slow release of antibiotics in the local area, to avoid the emergence of biotoxicity in the high concentration of local antibiotics, which will cause damage to local tissues. Currently commonly used antibiotic slow-release carriers are polymethyl methacrylate, hydroxyapatite and modified hydroxyapatite, calcium phosphate bone cement. Zhou Literature et al [27] used antibiotic bone cement implanted into the defective wound after osteomyelitis debridement, which had the good effect of filling the wound defect, eliminating the dead space and controlling the infection. The use of antibiotic bone cement tablets not only has the advantages of general antibiotic bone cement, but also has the advantages of increasing the contact area, increasing the local release concentration of antibiotics, and facilitating removal. Among them, hydroxyapatite and modified hydroxyapatite have physical properties such as spatial structure and hardness that are very close to natural bone matrix. Calcium phosphate bone cement has more prominent advantages, mainly in bioactivity and compatibility, autocuring ability, degradability, conductivity and easy plasticity, and the delivery of calcium phosphate as a carrier of sensitive antibiotics to the bone infection lesion can release a higher concentration of antibiotics in the lesion and completely close the incision, reducing cross and secondary infections [27].

3.2. Treatment of bone defects

3.2.1. Bone grafting

The treatment method is as follows: first expand and clear the wound, remove the infected tissues thoroughly, including soft tissues and bone tissues, use external fixation bracket to fix the defect, then close the wound, VSD, skin flap can be used, etc. After the wound is completely healed, implant the autologous cancellous bone or allogeneic bone in the bone defect. The indications are: (1) infected bone nonunion, or combined area less than 14cm×6cm soft tissue defect. (2) bone defect less than 4cm. (3) the disappearance of infection symptoms, local soft tissue conditions allow. If the scope of defect is small, autologous cancellous bone transplantation can be used. If the scope of defect is large and the autologous cancellous bone is insufficient, bone grafting with autologous cancellous bone combined

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with allogeneic bone can be used to promote the repair of bone defects. The disadvantages are: (1) there is no uniform standard for the judgement of infection control around the bone defect, and if bone grafting is performed in the presence of infection, there is a possibility of non-healing of the bone graft. (2) in order to improve the survival rate of bone grafting, clinicians empirically use part of the autogenous bone for grafting, and most of the autogenous bone is taken from the iliac bone of the two sides of the body, which will result in the defect of the iliac bone area and affect the aesthetics. Chen Qin et al [29] reported one-stage implantation of bone for the treatment of bone defects after osteomyelitis debridement, which has the advantages of a short treatment cycle, fewer complications, and good efficacy. At present, there is another bone grafting technique called open bone grafting, which was proposed by Papineau in 1976, so it is also called Papineau technique, and its specific method is as follows: firstly, expanding and clearing the trauma, and if necessary, it is feasible to be fixed by external fixation frame, in order to maintain the limb force line as well as the limb function, and then, when the traumatic granulation grows to a certain degree and confirms that there is no infection, then it opens the bone grafting, and then, by constantly opening the dressing, it is possible for the surface of the implanted area to be covered by granulation. When the surface of the bone graft is covered by granulation tissue, the skin grafting is performed until the wound heals [30].

3.2.2. Induced membrane technology

The induced membrane technique was proposed by French scholar Masquele in 1986, so it is also called Masquele technique. The principle is to make use of the bio-inductive membrane formed on the surface of the implanted polymethylmethacrylate to provide biological protection and promote the reconstruction and re-vascularisation of the implanted bone, and then take out the polymethylmethacrylate after 6-8 weeks, and implant a sufficient amount of cancellous bone into the bone defect, and then use a steel plate or external fixation.

After 6 to 8 weeks, the polymethylmethacrylate was removed, sufficient cancellous bone was implanted into the bone defect, and the affected limb was fixed with a steel plate or external fixation bracket, which ultimately led to the restoration of limb function [31]. Basic experiments have shown [32] that the induced membrane is mainly composed of type I collagen, with a small vascular system and a large number of fibroblast-like cells, and most importantly, it can also secrete osteogenic factors such as VEGF and BMP-2, which leads to the formation of biological properties similar to the periosteum. VEGF is a biologically active pro-vascular growth factor that acts on vascular endothelial cells through its specific receptor to promote endothelial proliferation and neointimal formation, thereby promoting new bone formation. BMP-2 not only promotes osteoblast differentiation, but also possesses the ability to induce osteogenesis in an ectopic manner, and also promotes osteoblasts to continuously form, differentiate, and proliferate, which further accelerates the calcification of extracellular matrix. extracellular matrix calcification.

3.2.3. Vascularised bone grafts

Bone graft with vascular tibia has been developed rapidly in these years, the bone part of vascularised bone grafting technique can be autologous rib, iliac spine, fibula, etc. , with complete skin, fascia, muscle and other tissues during transplantation, which can provide complete cortical bone and cancellous bone for the bone defect site, and repair the soft tissue defect at the same time. Therefore, bone grafts with vascular tips have the function of restoring blood flow to the defects, covering the trauma, and filling the bone and muscle defects. The bone grafts with vascular tips can therefore restore blood flow to the defects, cover the trauma, and fill the bone and muscle defects. In a study by Tao Liu et al [33] using vascularised bone grafts for the treatment of bone defects, it was found that the probability of complications in vascularised bone grafts was 4.2%, whereas the complication rate of non-vascularised bone and flap grafts was 25.2%. Treatment of Osteomyelitis Bone Defects The commonly used vascularised bone flap is the vascularised free fibula graft, which not only has the advantages of a general bone flap, but also has the advantages of easy harvesting and less impact on the function of the limb after harvesting.

3.2.4. Ilizarov technique

The Ilizarov technique was proposed in the 1950s by the Russian physician Ilizarov, and its basic theory is the "law of tension-stress", which is based on the principle that when tissues are gradually pulled to achieve a state of tension, this state of tension can regenerate the tissues, which is histologically manifested by the migration of vascular endothelial cells to polymorphic mesenchymal cells [34]. Accompanied by bone lengthening, the collagen fibre tissue formed by the central fibroblasts in the bone scab section is in a stretched, parallel arrangement under the tension effect, which in turn leads to the formation of bone-like tissue by the osteoblasts, which finally transforms into bone

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trabeculae. The specific method is as follows: first, carry out thorough debridement of the osteomyelitis lesion, remove the dead bone, scar tissue, etc. , trim the two ends of the defective bone segment, after adjusting the force line of the lower limb, install the Ilizarove external fixation bracket, connect the bone segment that needs to be moved with the sliding part of the external fixation bracket, after confirming that the bone is completely truncated, apply pressure on the bone segment to the truncated surface, and use the sensitive antibiotics for 1 week, according to the actual situation of the patient, the bone transfer can be carried out. After 1 week of sensitive antibiotics and depending on the patient's condition, bone transfer can be initiated, with the bone block being transferred 1 mm per day until the two ends of the bone defect are aligned. The advantages are: the bone block can be fixed more firmly, the force line of the lower limb can be adjusted in multiple directions according to the moving situation, and the complications such as rotational deformity, lateral displacement, angular deformity can be reduced. Meanwhile, in the process of bone moving, the circumferential external fixation bracket can maintain the force line of the lower limb, and it has better axial compression and tissue distraction for the bone block, thus promoting the healing of the osseous defects. In the process of bone transfer, not only the fascia, muscle, neurovascular and other tissues have the stimulation effect of tension prolongation, but also can promote cell division, stimulate the blood flow around the wound and soft tissue regeneration.

3.3. Treatment of soft tissue defects

Chronic osteomyelitis is characterised by the formation of sinus tracts, persistent local ulceration and pus, which requires thorough debridement, followed by soft tissue defects. Coverage of soft tissue defects not only fills the dead space, but also promotes the regeneration of the local haematopoiesis, which can further promote the suppression of osteomyelitis and prevent its recurrence. For the treatment of soft tissue defects, currently commonly used are skin flap transplantation, VSD, etc., they have their own advantages and disadvantages and indications.

3.3.1. Skin flap transplantation

Skin flap transplantation has the following advantages: (1) rich blood transport, which is conducive to wound healing. (2) Because of the anastomosis of the local blood vessels, it restores the local blood flow state and enhances the local anti-infection ability. (3) The skin flap is obtained from the superficial muscle tissue of the body, and generally adopts the principle of proximity, which is more widely used. (4) The obtained skin flap contains thicker connective tissue and muscle tissue, which has a certain cushioning effect and buffering capacity, and can better cover the trauma and supplement the defective area. (5) Microsurgical techniques are required to transplant the flap to a distant site. However, its limitations are: (1) The flap contains skin, subcutaneous connective tissue, muscle tissue, etc. , with a large thickness, which can easily lead to limb bloat and affect the aesthetics after covering the defective wound. (2) Due to the loss of some skin and muscle tissue in the donor area, it is easy to lead to a certain degree of weakening of muscle strength in the donor area. (3) Scars and depressed deformities are often found at the flap extraction site, so the selection of the extraction site should be careful. (4) The process of taking and anastomosing the flap requires a high level of microsurgical skills to ensure the survival rate of the flap, which is difficult to be carried out widely in primary hospitals.

3.3.2. VSD technique

VSD is to carry out fully closed flushing and drainage through foam media, so as to completely isolate the trauma from the outside world, eliminate traumatic infection, improve the cure rate and survival rate of the trauma, and also play an indispensable role in covering the defective trauma. The advantages are as follows: (1) Negative pressure drainage device adopts bio-permeable membrane closure to achieve the effect of isolation of the wound from the outside world, which can prevent the invasion of external bacteria, and also avoid repeated infections caused by repeated dressing changes. (2) Negative pressure suction device can suck out the infectious exudate and necrotic tissue from the wound in time, avoid the exudate accumulating in the gap of the wound, reduce the number of infectious germs on the wound, not only prompt the infected wound to become a clean wound, but also prevent the infectious, biotoxic substances and toxins exuding from the wound from being absorbed into the blood, and avoid the systemic spread of infection. (3) Negative pressure drainage device also promotes tissue oedema and local microcirculation recovery, thereby stimulating the growth of granulation tissue and covering the wound. (4) The drainage device can effectively drain the exudate for 5 to 7 days after one negative pressure drainage operation, which can reduce the workload of medical workers to a certain extent. Wang Danfeng et al [35] reported that the use of VSD to cover

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osteomyelitis wounds can better control the infection, and can repair the soft tissue defects and reduce the incidence of postoperative complications.

4. Summary

With the modernisation of the society, the transport industry and industrial development are climbing rapidly, the number of patients with bone injuries is also increasing dramatically, thus the number of chronic osteomyelitis will also increase, even if the antibiotic anti-infective ability is increasing and the treatment means are becoming more and more abundant, the difficulty of treating chronic osteomyelitis still remains high. Western medicine treatment of chronic osteomyelitis focuses on prevention, and thorough debridement of patients after trauma is crucial. If chronic osteomyelitis occurs, it must follow its treatment principles of thorough debridement, effective anti-infection, and elimination of dead space. Chinese medicine has developed corresponding diagnostic and therapeutic methods according to different etiological and pathological mechanisms of chronic osteomyelitis, which have achieved certain results in promoting patients' recovery and inhibiting the progress of the disease. However, the clinical cases of TCM treatment are scattered, the sample size is insufficient, and the exactness of the treatment effect is not rigorous enough to form a relatively unified treatment system, which all adversely affects the promotion of TCM treatment of osteomyelitis. Therefore, future research can focus on exploring the combination of Chinese and Western medicine in the treatment of osteomyelitis, experimental research should be strictly controlled variables, while the clinical need to increase the sample size, so as to make the therapeutic effect criteria more objective, based on the identification of evidence-based treatment of traditional Chinese medicine combined with the application of bacterial-sensitive antibiotics and the treatment of traumatic injuries or reconstruction of bone tissue, to improve the quality of life of patients with chronic osteomyelitis.

References

[1] Yi Guanhao, Han Ming. Research Progress on Traditional Chinese Medicine in the Treatment of Chronic Osteomyelitis [J]. Guangming Journal Of Chinese Medicine, 2023, 38(5):865-868.

[2] Mitchell C. Birt, David W. Anderson, E. Bruce Toby, et al. Osteomyelitis: Recent advances in pathophysiology and therapeutic strategies [J]. Journal of Orthopaedics, 2017, 14(1):45-52.

[3] Wang Xiao, Tan Guoqing, Ma Chen, et al. Cao Yixun's Experience in Treatment of Chronic Suppurative Osteomyelitis [J]. Shandong Journal of Traditional Chinese Medicine, 2021, 40(1):83-86.

[4] Tan JT, Wang Y. A summary of Wang Yong's experience in the treatment of chronic osteomyelitis by using Hu Xuan Zi Tang [J]. Shanxi Journal of Traditional Chinese Medicine, 2019, 35(10):4-5.

[5] Qin Daping, Zhang Xiaogang, Song Ming, et al. Discussion on TCM Treatment Strategy of Chronic Osteomyelitis from The Theory of Fuyang and nourishing Tendons [J]. Chinese Journal of Basic Medicine in Traditional Chinese Medicine, 2019, 25(8):1157-1160.

[6] Bai Haifeng, et al. Effectiveness Observation of Yanghe Decoction in Treatment of Patients with Traumatic Osteomyelitis [J]. Medical & Pharmaceutical Journal of Chinese People's Liberation Army, 2019, 31(7):88-91.

[7] Su Jianguang. Clinical Effect of Modified Wuwei Disinfectant Soup in Treating Chronic Suppurative Osteomyelitis [J]. Journal of Mathematical Medicine, 2019, 32(3):416-417.

[8] Zhao Zejin, et al. Effect of Bone Fracture Restoring Decoction on Chronic Osteomyelitis of Tibia and Its Influence on Paley and HHS Score [J]. Liaoning Journal of Traditional Chinese Medicine, 2018, 45(7):1414-1417.

[9] Guo Zairan. Clinical observation on the treatment of chronic osteomyelitis of tibia bone (heat-toxicity embedded knot evidence) by external washing of traditional Chinese medicine [D]. Henan University of Traditional Chinese Medicine, 2016.

[10] Qiang Shenglin, Song Pengcheng. Clinical observation on 23 cases of type II chronic osteomyelitis treated with de-tubularisation powder [J]. Journal of Gansu University of Chinese Medicine, 2017, 34(4):61-63.

[11] Zhang Yong, Wu Houxin, He Zhengbing. Clinical Study of Thunder Fire Moxibustion plus Implantation of Bone Cement Chain Beads Containing Antibiotics for Chronic Tibial Osteomyelitis [J]. Shanghai Journal of Acupuncture and Moxibustion, 2020, 39(10):1304-1308.

[12] Yin Fanbiao. Clinical effect of branding method combined with the addition and subtraction of Xianfang Livestrong Drink in the treatment of epiphyseal gangrene [J]. Henan Medical Research, 2020, 29(16):3020-3022.

[13] Chen Yingwen. Clinical efficacy of Lian Yin Tang combined with external application of

ISSN 2706-6819 Vol.5, Issue 12: 54-62, DOI: 10.25236/IJFM.2023.051208

traditional Chinese medicine in the treatment of traumatic septic osteomyelitis [J]. Chinese Journal of Clinical Rational Drug Use, 2018, 11(18):111-112.
[14] Wu Jiao, et al. Chemical Constituents and Pharmacological Effect of Lonicerae Japonicae Flos [J]. Chinese Journal of Experimental Traditional Medical Formulae, 2019, 25(4):225-234.
[15] Zeng Shaoyang, Hu Wenbing, Li Hongzhi, et al. Influence on serum CRP, TNF-α and IL-6 with local treatment of bone cement beads contained Shuanghuanglian Fenzhenji in rabbits with chronic osteomyelitis [J]. Journal of Gansu University of Chinese Medicine, 2017, 34(2):1-6.
[16] Huang Xiaowen, et al. Protective Effect of Icariin on Lipopolysaccharide-induced Cytoskeleton F-actin Injury [J]. Chinese Journal of Modern Applied Pharmacy, 2019, 36(13):1612-1616.
[17] Ding Qiang, et al. Effect of glycoside of short-horned epimedium Herb on the expressions of transforming growth factorβ1 and basic fibroblast growth factor induced membrane by Masquelet technology [J]. Chinese Journal of Reparative and Reconstructive Surgery, 2020, 34(11):1405-1409.
[18] Liu Wei. Effects of total flavonoids of Boneset on the expression of Runx-2 in rat distraction osteogenesis model [D]. Changsha:Hunan University of Traditional Chinese Medicine, 2020.
[19] Wang Jiang, Peng Liwei. Effects of sodium tanshinone IIA sulfonate on osteogenesis of rabbit mandibular distraction [J]. Chinese Remedies & Clinics, 2021, 21(10):1672-1673.
[20] Zhang Jun, et al. Experimental Study of Guyan Prescription on Chronic Osteomyelitis in Rabbits [J]. Chinese Journal of Traditional Medical Traumatology & Orthopedics, 2018, 26(9):14-18.
[21] Pan Xinwu. Experimental study on the efficacy of Chinese traditional medicine "Gangrene Spray" in rabbit chronic osteomyelitis model [D]. Gansu University of Traditional Chinese Medicine, 2018.
[22] Li Dingpeng, Xie Xingwen, Pan Xingwu, et al. Mechanism of ADAMTS-7 and bone type I collagen expression in bone repair of rabbit osteomyelitis model[J]. Chinese Journal of Pharmacology and Toxicology [J]. Chinese Journal of Pharmacology and Toxicology, 2019, 33(10):836.
[23] Li Zhihong, et al. Observation on the Effect of Five-element Music Therapy in Patients of Chronic Osteomyelitis with Anxiety [J]. Guiding Journal of Traditional Chinese Medicine and Pharmacy, 2019, 25(16):72-74+78.
[24] Zhang Junling. Effect of auricular pressure bean with acupressure on preoperative symptoms of elevated blood pressure in patients with chronic osteomyelitis [J]. Biped and Health Care, 2018, 27(6):94-95.
[25] Peng Rao, Liao Tao, He Kaiyuan, et al. A study on the effect of time-selective acupoint massage method based on the theory of meridian flow injection on negative emotions of patients with qi and blood deficiency type of epiphyseal gangrene [J]. Modern Journal of Integrated Traditional Chinese and Western Medicine, 2021, 30(12):1351-1355.
[26] Chi Taosheng, Wu Hongjun, Zhai Jianguo, et al. Analysis of bacterial drug sensitivity and resistance in traumatic osteomyelitis [J]. Chinese Journal of Traditional Medical Traumatology & Orthopedics, 2014, 22(2):52-53.
[27] Yuan Weiqing, Zhou You, Yang Kun, et al. Research Progress in the Treatment of Chronic Osteomyelitis [J]. Popular Science & Technology, 2022, 24(271):106-109.
[28] Li Hongchao. Clinical efficacy of antibiotic irrigation therapy combined with hyperbaric oxygen in the treatment of osteomyelitis [J]. Chinese Journal of Clinical Rational Drug Use, 2018, 11(36):79-80.
[29] Chen Qin, Huang Kai. The one-stage surgical treatment of traumatic chronic osteomyelitis on the calcaneus [J]. Journal of Clinical Orthopaedics, 2016, 19(5):580-582.
[30] Lin Peng, et al. Comparative Study of Modified Papineau Technique and Vancomycin Loaded Calcium Phosphate Topical Filling in the Treatment of Ceirny Type III Osteomyelitis after Distraction Osteogenesis [J]. Progress in Modern Biomedicine, 2017, 17(13):2486-2490.
[31] Jia Chao, et al. Masquelet technique for reconstruction of infected tibial defects with intramedullary nail in the second stage [J]. Journal of Regional Anatomy and Operative Surgery, 2020, 29(1):29-33.
[32] Henrich D, Seebach C, Nau C, et al. Establishment and characterization of the Masquelet induced membrane technique in a rat femur critical-sized defect model [J]. Journal of tissue engineering and regenerative medicine, 2016, 10(10):E382-E396.
[33] Liu Tao, Xie Bin, Miao Qiang, et al. Clinical Application Value of Vascularized Bone Graft in the Treatment of Bone Tumor of Extremities [J]. The Practical Journal of Cancer, 2017, 32(5):827-829.
[34] He Guoyu, et al. Advantages and improvement strategies of Ilizarov technique in the treatment of tibial bone defect [J]. Chinese Journal of Tissue Engineering Research, 2020, 24(24):3870-3876.
[35] Wang Danfeng, Sun Weidong. The Clinical Observation of Negative Pressure VSD in the Drainage of Chronic Osteomyelitis [J]. Guide of China Medicine, 2019, 17(35):163-165.