

Clinical Research on the Treatment of Extremity Fractures with Bushen Jiegu Decoction

Dongfeng Yu*

Huishan Yu Weijin Clinic, Wuxi 214181, Jiangsu Province, China

*Corresponding author: Dongfeng Yu, ywjzs@126.com

Copyright: © 2023 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: *Objective:* To study the therapeutic effect of Bushen Jiegu Decoction on patients with limb fractures. *Methods:* 59 patients with limb fractures were selected for this study from May 2021 to December 2022. They were divided into two groups by the random number table method. The research group received conventional treatment + Bushen Jiegu Decoction, while the control group received conventional treatment. The therapeutic effect, rehabilitation indicators, inflammatory factors, and callus growth of the two groups were compared. *Results:* The therapeutic effect of the treatment received in the research group was higher than that of the control group ($P < 0.05$); the visual analogue scale (VAS), tenderness score, and swelling of the research group were lower than those of the control group ($P < 0.05$); the interleukin-8 (IL-8), interleukin-1 β (IL-1 β), tumor necrosis factor- α (TNF- α), and other inflammatory indicators were lower than those of the control group ($P < 0.05$); the callus volume score and density score in the study group were higher than those of the control group ($P < 0.05$). *Conclusion:* Treating patients with limb fractures with Bushen Jiegu Decoction can reduce swelling, relieve pain, inhibit inflammation, and stimulate the growth of callus, which makes it a highly effective and feasible treatment method.

Keywords: Limb fractures; Bushen Jiegu Decoction; Therapeutic effect

Online publication: July 21, 2023

1. Introduction

Under the background of the rapid development of the transportation system, the risk of traffic accident has increased, and the incidence of limb fractures has increased year by year. When a limb fractures the patients will experience swelling and pain, combined with a variety of physiological and biochemical changes, such as the rapid decomposition of protein, causing the body to enter a negative oxygen state, which can aggravate pain and swelling and prolong the healing of the wound^[1]. In addition, early diagnosis and treatment is required for limb fractures, otherwise the patient will be left with a limb dysfunction, which will reduce their quality of life. Conventional closed reduction methods can correct displaced fracture fragments, but it does not relieve the local pain of the fracture, which is not conducive to the rehabilitation of patients. Traditional Chinese medicine scholars believe that patients with limb fractures have stagnation of qi and blood after surgery, which can cause pain and swelling, and they need to be treated with blood stasis dispelling and blood activating prescriptions. In

this paper, 59 patients with limb fractures treated from May 2021 to December 2022 were selected to explore the efficacy of the Bushen Jiegu Decoction.

2. Materials and methods

2.1. Information

Fifty-nine patients with limb fractures were selected as study subjects from May 2021 to December 2022, and they were grouped by the random number table method. In the research group, there were 20 males and 10 females, aged 20–68 years, with an average age of 43.11 ± 2.84 years; in the control group, there were 18 males and 11 females, aged 20–69 years, with an average age of 43.19 ± 2.79 years. There was no difference in the data of patients with limb fractures in the study group and the control group ($P > 0.05$).

2.2. Inclusion and exclusion criteria

Inclusion criteria: (i) Diagnosed with limb fractures according to the “Integrated Chinese and Western Medicine Orthopedics and Traumatology” standards [2], (ii) X-ray confirmed limb fractures with bone fractures, (iii) no damage to nerves and blood vessels, (iv) signed an informed consent, (v) closed fractures with partial swelling.

Exclusion criteria: (i) severe blood vessel and nerve damage, (ii) organ damage, (iii) drug allergy, (iv) pregnant women.

2.3. Treatment methods

The research group received routine treatment + Bushen Jiegu Decoction treatment, and the routine medication was the same as that of the control group. The prescription of Bushen Jiegu Decoction was as follows: Astragalus 30 g; *Rhizoma Drynariae*, Dipsacus, and Psoralen, each 15 g; myrrh, frankincense, *Salvia miltiorrhiza*, and natural copper 10 g each; Licorice 6 g. The following ingredients are added and removed according to the patient’s condition: for severe swelling, add 10g of coix seed and 15 g of fried herbs; for severe blood stasis, add 10g of peach kernel and safflower each; for severe pain, add 15 g of lindera root and 20 g of corydalis. Decoct 300 mL of the above-mentioned medicines and take 1 dose warm every morning and evening for 3 weeks.

The control group was treated with splint external fixation after closed reduction, and was given Jiegu Qili Tablets (Hunan Jinsha Pharmaceutical Co., Ltd.), 3 tablets orally, twice a day for 3 weeks

2.4. Observation indicators

2.4.1. Efficacy

Very effective: X-rays showed fracture healing, complete detumescence, no pain, recovery of limb function.

Effective: X-rays showed fracture healing, reduced swelling, pain relief, improved function of affected limbs.

Not effective: X-rays showed non-union of fractures, severe pain.

2.4.2. Rehabilitation index

The Visual Analogue Scale (VAS) scale evaluates the degree of pain of the affected limb from 0–10 points; the VAS score is directly proportional to the pain of the fracture. The circumference of the affected limb and the circumference of the healthy limb were measured, and the degree of swelling = (circumference of the affected limb – circumference of the healthy limb) / circumference of the healthy limb. The degree of tenderness was evaluated based on the patient’s response, and score 0, 2, 4, and 6 points, respectively, such as no response when pressing, tolerable pain, frowning from pain, and severe pain when lightly touched.

2.4.3. Inflammatory factors

The changes of the interleukin-8 (IL-8) the interleukin-1 β , IL-1 β , tumor necrosis factor- α (TNF- α), and other indicators were detected.

2.4.4. Bone callus growth

The bone callus growth was scored as follows: 0, 1, 2, 3, and 4, which represent no bone callus growth, a small amount of callus, slightly more callus, a large amount of callus, and callus growth that covers the fractured site completely, respectively. The bone density was measured using an instrument where the lighter the color of the bone appears, the lower the bone density, which is scored from 0–4, with 0 being the closest to the healthy bone.

2.5. Statistical analysis

Data of patients with limb fractures were processed with SPSS 21.0 the count data of limb fractures were represented by percentages, and a χ^2 test was performed; $\bar{x} \pm s$ recorded measurement indicators of limb fractures, t test. There is a statistical difference, $P < 0.05$.

3. Results

3.1. Therapeutic effect

The therapeutic effect of the treatment received in the research group was higher than that of the control group ($P < 0.05$), as shown in **Table 1**.

Table 1. Comparison of curative effects in patients with limb fractures (n, %)

Group	Very effective	Effective	Not effective	Total efficacy
Research group (n = 30)	21 (70.00)	8 (26.67)	1 (3.33)	96.67
Control group (n = 29)	16 (55.17)	7 (24.14)	6 (20.69)	79.31
χ^2	-	-	-	4.2480
P	-	-	-	0.0393

3.2. Rehabilitation indicators

Before treatment, the VAS, tenderness score, and swelling degree of the research group were no different from those of the control group ($P > 0.05$); after treatment, the VAS, tenderness score, and swelling degree of the study group were lower than those of the control group ($P < 0.05$), as shown **Table 2**.

Table 2. Rehabilitation index analysis (mean \pm standard deviation)

Group	VAS score (points)		Tenderness score (points)		Degree of swelling (%)	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Research group (n = 30)	8.81 \pm 1.25	3.19 \pm 0.42	5.53 \pm 1.21	2.29 \pm 0.51	38.74 \pm 2.35	25.99 \pm 1.84
Control group (n = 29)	8.83 \pm 1.27	4.68 \pm 0.59	5.57 \pm 1.19	3.18 \pm 0.84	38.79 \pm 2.39	31.25 \pm 1.96
t	0.0610	11.2050	0.1280	4.9384	0.0810	10.6314
P	0.9516	0.0000	0.8986	0.0000	0.9357	0.0000

3.3. Levels of inflammatory factors

After medication, the indexes of IL-8, IL-1 β , TNF- α , and other inflammatory factors in the study group were lower than those of the control group ($P < 0.05$); there was no difference between groups ($P > 0.05$), as shown in **Table 3**.

Table 3. Analysis table of inflammatory factor levels (mean \pm standard deviation)

Group	IL-8 (pg/ml)		IL-1 β (pg/ml)		TNF- α (ng/L)	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Research group ($n = 30$)	26.11 \pm 2.84	15.11 \pm 1.75	16.18 \pm 3.25	5.91 \pm 1.35	138.41 \pm 6.25	29.11 \pm 2.15
Control group ($n = 29$)	26.16 \pm 2.83	20.09 \pm 1.96	16.21 \pm 3.29	9.58 \pm 1.96	138.38 \pm 6.72	54.19 \pm 3.61
<i>t</i>	0.0677	10.3028	0.0352	8.4006	0.0178	32.5514
<i>P</i>	0.9462	0.0000	0.9720	0.0000	0.9859	0.0000

3.4. Growth of callus

Before treatment, there was no difference in the amount of callus and density scores between the study group and the control group ($P > 0.05$); after treatment, the amount of callus and bone density scores of the study group were higher than those in the control group ($P < 0.05$), as shown in **Table 4**.

Table 4. Analysis table of callus growth ([mean \pm standard deviation], points)

Group	Callus score		Bone density scores	
	Before treatment	After treatment	Before treatment	After treatment
Research group ($n = 30$)	0.35 \pm 0.11	3.49 \pm 0.51	0.27 \pm 0.08	3.61 \pm 0.15
Control group ($n = 29$)	0.37 \pm 0.13	2.79 \pm 0.43	0.29 \pm 0.09	2.98 \pm 0.21
<i>t</i>	0.0677	10.3028	0.0352	8.4006
<i>P</i>	0.9462	0.0000	0.9720	0.0000

4. Discussion

Fractures of extremities are injuries that can affect local microcirculation and cause ischemia at the fractured site, which affects the healing of fracture fragments^[3]. In addition, patients with limb fractures often experience severe pain and muscle reflex spasm, which can further affect venous return, and the abnormal expansion of blood vessels at the fractured site leads to increased vascular permeability, which can aggravate the swelling of the affected limb. In the theory of traditional Chinese medicine, fractures of extremities are under the categories of “muscle injuries” and “fractures”^[4]. Limb fractures has been recorded in literature as early as “Su Wen · Yin Yang Ying Xiang Da Lun when a patient experience limb fractures, the patient’s qi and shape are injured, which can cause pain and swelling at the fractured site^[5]. Studies have shown that the treatment of extremity fractures with traditional Chinese medicine can correct local microcirculation, reduce the problem of insufficient blood oxygen supply at the fracture site, stimulate the body’s metabolism, and promote the absorption of inflammation^[6]. In addition, Chinese medicine treatment of extremity fractures can also increase the accumulation of calcium ions and phosphorus ions in the human body, as well the production of chondroitin, causing calcification at the fracture end, stimulating the differentiation of mesenchymal cells and the proliferation of bone cells.

Chinese medicine scholars believe that the pathogenesis of pain and swelling after limb fractures is stagnation of qi and blood, so it should be treated with prescriptions for relieving pain, reducing swelling,

removing blood stasis, and promoting blood circulation. In addition, extremity fractures can damage the vitality of the patient, stagnation of blood in the body can block the circulation of qi and blood, and long-term stasis of qi and blood can aggravate pain and swelling symptoms ^[7]. In this paper, Bushen Jiegu Decoction is selected for treatment. *Rhizoma Drynariae*, Radix Dipsaci and Fructus Psoraleae, etc. belong to the monarch drug, which can restore tendons, bind bones, tonify the kidney, and strengthen the bones; *Salvia miltiorrhiza* is an adjuvant medicine, which can soothe the nerves, nourish blood, remove blood stasis, and promote blood circulation; natural copper can restore tendons, set bones, relieve pain, and remove blood stasis; It can reconcile various medicines and also serves as an envoy. In the dialectical formula, adding coix seed and fried herbs to can reduce swelling and remove water; adding peach kernel and safflower to treat blood stasis can dispel blood stasis and activate blood circulation; adding lindera root and corydalis can relieve pain and promote qi ^[8,9]. The combination of all the aforementioned helps in relieving pain, reducing swelling, dispelling blood stasis, and promoting blood circulation. Combined with modern pharmacological analysis, the active ingredients of Radix Astragali and Danshen can resist platelet accumulation and regulate the microcirculation of the body; the active ingredients like *Rhizoma Drynariae*, Dipsaci Radix and Fructus Psoraleae can inhibit the release of inflammatory mediators in the body and restore vascular permeability, which prevents vascular bleeding ^[10].

Based on the results of this paper, the therapeutic effect of the treatment received in the research group was higher than that of the control group ($P < 0.05$); the VAS, tenderness score, and degree of swelling of the research group were lower than those of the control group ($P < 0.05$). These results suggest that Bushen Jiegu Decoction is more effective in treating extremity fractures. Swelling of the fractured site is related to the displacement of the fracture block and damage to the veins, causing blood to leave the meridian, accumulate, and linger, when then causes swelling. The common type is stagnation of qi and blood. Traditional Chinese medicine scholars believe that damage to tendons and veins leads to stagnation of blood and qi, and poor blood circulation, stasis without pain, and swelling. In Bushen Jiegu Decoction, Fructus Psoraleae contains psoralen B and other ingredients, Dipsaci Radix contains loganin and other ingredients, *Rhizoma Drynariae* contains flavonoids, which can optimize the body's metabolism and stimulate the calcification of proteoglycans. Furthermore, it promotes the formation of new bone in the affected limb, has analgesic and anti-inflammatory effects, and can also improve osteoporosis; Astragalus contains astragalus polysaccharides and astragalus saponins, which can promote bone marrow hematopoiesis and enhance the immune function of the body; myrrh and frankincense contain resin Corydalis contains tetrahydropalmatine, which can block the activity of the cerebral cortex, thereby enhancing the analgesic effect ^[11,12]. Another set of data showed that the indexes of inflammatory factors such as IL-8, IL-1 β , and TNF- α in the study group were lower than those in the control group ($P < 0.05$); the callus volume and bone density in the study group were higher than those in the control group ($P < 0.05$). It is suggested that Bushen Jiegu Decoction can inhibit the progression of inflammation and promote bone growth in the treatment of patients with limb fractures. This is because the combination of various medicines in Bushen Jiegu Decoction can remove free radicals and inhibit the release of inflammatory mediators. In addition, natural copper contains a variety of trace elements, such as copper, nickel, antimony, etc., which can promote the metabolism of proteases and stimulate the growth of fractured bones ^[13].

5. Conclusion

In short, Bushen Jiegu Decoction treatment for patients with limb fractures can inhibit the progression of inflammation, relieve pain and swelling at the fracture end, and promote bone growth, which has promotional value.

Disclosure statement

The author declares no conflict of interest.

References

- [1] Yang G, Zhang Y, Yin J, 2021, Study on the Clinical Effect of Modified Bushen Jiegu Decoction in the Treatment of Acute Pain and Swelling After Extremity Fractures. *Chinese Science and Technology Journal Database (Full Version) Medicine and Health*, 7(12): 368–369.
- [2] Sun Z, 2001, *Integrative Traditional Chinese and Western Medicine Orthopedics and Traumatology*, 2001, China Press of Traditional Chinese Medicine, Beijing, 202–204.
- [3] Ren L, Qiu W, Xiang Z, et al., 2021, Effects of Bushen Jiegu Decoction Combined with External Application of Drugs on Pain, Inflammatory Factors and Microcirculation in Patients with Acute Swelling After Limb Fractures. *Clinical Medicine Research and Practice*, 6(27): 116–118 + 125.
- [4] Dong R, 2021, Clinical Efficacy of Bushen Jiegu Decoction in the Treatment of Extremity Fractures and Its Impact on Pain. *Reflexology and Rehabilitation Medicine*, 7(15): 50–52.
- [5] Ding X, 2022, Effect of Bushen Jiegu Decoction Combined with Fumigation on Fracture Healing and Wrist Joint Function After Distal Radius Fracture Operation. *Modern Distance Education of Chinese Medicine*, 20(5): 108–110.
- [6] Wang B, Huang J, Zheng M, 2022, Clinical efficacy of Bushen Jiegu Decoction Combined with Fumigation and Washing Therapy in the Treatment of Postoperative Distal Radius Fractures. *Shenzhen Journal of Integrated Traditional Chinese and Western Medicine*, 2(11): 49–51.
- [7] Ren L, Qiu W, Xiang Z, et al., 2021, Effects of Bushen Jiegu Decoction combined with External Application of Drugs on Pain, Inflammatory Factors and Microcirculation in Patients with Acute Swelling after Limb Fractures. *Clinical Medicine Research and Practice*, 6(27): 116–118 + 125.
- [8] Yang S, 2020, Effect of Bushen Jiegu Decoction on Pain, Swelling and Fracture Healing after Limb Fracture. *Chinese Folk Therapy*, 28(4): 34–36.
- [9] Jiao Y, 2020, Effect of Bushen Zhuanggu Decoction Combined with Double-Reverse Traction Reduction and Percutaneous Minimally Invasive Locking Plate Internal Fixation on Postoperative Knee Joint Function in Patients with Distal Femoral Fractures. *Capital Food and Medicine*, 27(7): 196.
- [10] Gong T, He S, Xu R, 2021, Clinical Research on Floating Acupuncture Combined with Bushen Jiegu Decoction in the Treatment of Fractures Around the Knee Joint. *New Chinese Medicine*, 53(13): 140–143.
- [11] Lu B, Xie D, 2022, Efficacy and Effective Rate Evaluation of Traditional Chinese Medicine Sticking Combined with Modified Taohong Siwu Decoction in the Treatment of Early Limb Pain and Swelling of Limb Fractures. *North Pharmacy*, 19(11): 88–90.
- [12] Feng H, Zeng Q, 2022, The Effect of Traditional Chinese Medicine Xuxuan Jiegu Decoction Combined with Compound Bone Peptide Injection in the Treatment of Limb Fractures and the Impact on the Improvement of Patient Prognosis. *North Pharmacy*, 19(8): 51–53 + 57.
- [13] Dong X, 2020, Clinical Research on the Treatment of Acute Pain and Swelling After Limb Fracture with Modified Bushen Jiegu Decoction. *Clinical Research of Traditional Chinese Medicine*, 12(29): 85–87.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.