
The Effect of Xiongning Decoction on Improving Pain and Coagulation in Patients with Rib Fracture and Hemothorax

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Introduction. To investigate the effect of Xiongning decoction on pain and coagulation in patients with rib fracture and hemothorax.

Methods. 94 patients with rib fractures and hemothorax admitted to our hospital from April 2016 to April 2018 were selected as research objects, and randomly divided into observation group (n=47) and control group (n=47). The control group received routine emergency treatment, and the observation group received routine emergency treatment like the control group combined with xiongning decoction for 2 weeks. The total effective rate of treatment, the pain at the 1st day/1 week/2 weeks after the operation (VAS score) and the coagulation indexes at the 1st day/2 weeks after the operation were compared between the two groups.

Results. the total effective rate of observation group was 97.4%, which was higher than control group which is 80.6% ($P < 0.05$). The length of stay in the hospital of the observation group was shorter than that in the control group ($P < 0.05$). There was no statistically significant difference in VAS pain scores between the two groups on the first day after surgery ($P > 0.05$), and the VAS pain scores of the two groups were both significantly lower than that of the first day after surgery at 1 and 2 weeks after surgery ($P < 0.05$). VAS pain scores at 1 and 2 weeks after operation were lower in the observation group than in the control group ($P < 0.05$). There was no significant difference in PT, APTT and FIB between the two groups on the first day after surgery ($P > 0.05$). Two weeks after surgery, PT and APTT were significantly increased and FIB significantly decreased in both groups ($P < 0.05$). The FIB of the observation group was lower than that of the control group 2 weeks after surgery ($P < 0.05$). There was no statistically significant difference between the PT and APTT

groups ($P>0.05$). Conclusion. Xingning decoction is helpful to relieve pain and improve coagulation in treating rib fracture with hemothorax, and can effectively promote hemothorax absorption and fracture healing.

Keywords. Rib Fracture, Hemothorax, Ning Soup, The Pain, Blood Coagulation

INTRODUCTION

Rib fractures are common chest injuries, accounting for about 50% to 80% of chest fractures [1]. The fracture ends can stimulate the intercostal nerves, causing severe pain, which not only limits the patient's breathing and mobility, but also causes airway secretions and sputum retention, increasing the risk of lung infection and atelectasis. Patients with rib fractures and hemothorax often have a mild hypercoagulable state. In addition to symptomatic treatment such as hemostasis and promoting hemothorax absorption, clinical treatment should also focus on improving pain and coagulation [2]. Traditional Chinese medicine has been widely used in clinical practice due to its advantages of high efficiency and low toxicity, but research on its effect on improving pain and coagulation in surgical patients is still lacking. This study took 94 patients with rib fractures and hemothorax as an example to explore the effect of Xiongning Decoction on patients' pain and coagulation. The results are reported as follows.

1 MATERIALS AND METHODS

1.1 Materials

A total of 94 patients with rib fracture and hemothorax admitted to our hospital from April 2016 to April 2018 were selected for a prospective study and divided into an observation group (n=47) and a control group (n=47) according to a random number table.

Inclusion criteria: (1) Patients with history of chest trauma; (2) Patients with obvious chest pain and respiratory limitation, positive on chest squeeze test; (3) Patients who meet the diagnostic criteria for rib fractures criteria in Huang Jiasi's

Surgery, and were confirmed by X-ray with bleeding; (4) Patients with fresh fracture, with a course of disease within 72 hours; (5) Patients age 18 to 65 years; (6) Patients who signed informed consent. Exclusion criteria: (1) Patients with a history of other chest diseases; (2) Patients with a history of anticoagulant use; (3) Patients with open or progressive hemothorax (drainage volume exceeds 200 ml/h after closed drainage); (4) Patients with multiple fractures or comminuted fractures in other parts of the body and spinal nerve injury; (5) Patients with abnormal coagulation function or severe medical diseases before surgery; (6) Patients with severe heart, kidney, brain and other serious diseases; (7) Pregnant and lactating women; (8) Patients allergic to therapeutic drugs; (9) Patients with mental illness; (10) Patients who failed to cooperate with the entire study.

There was no significant difference in general data between the two groups ($P > 0.05$), which was comparable. See Table 1. The study was approved by the ethics committee of our hospital.

Table 1 General Data between the Two Groups

Groups	Gender [Male/Female, (%)]	n	Age (year, $\bar{x} \pm s$)	Course of Disease(h, $\bar{x} \pm s$)	Amount of Bleeding (ml, $\bar{x} \pm s$)	Fracture Sites[Single rib/multiple ribs , n(%)]
Observation Group(n=47)	24(47.27)/23(48.94)		46.82±7.14	8.03±2.32	197.66±26.78	20(42.55)/27(57.45)
Control Group(n=47)	26(50.91)/21(44.68)		46.51±7.57	7.74±2.01	205.35±30.92	17(36.17)/30(63.83)
Statistical Data	$\chi^2=0.171$		$t=0.204$	$t=0.648$	$t=1.289$	0.401
P-value	0.679		0.839	0.519	0.201	0.527

1.2 Methods

1.2.1 Control group: The control group received routine emergency symptomatic treatment, routine antibiotics to prevent infection, fluid replacement, oxygen

inhalation, hemostasis, anti-shock and other treatments. Fracture treatment: The fracture site was fixed with a rib fixation belt to avoid strenuous exercises. It was removed after 2 to 4 weeks. Chest X-rays were reviewed regularly to observe the growth of callus. For patients with abnormal breathing, the ribs were pulled outward and fixed for 2 weeks. Then they received pressure bandaged with thick cotton pads. Hemothorax treatment: Patients with a small amount of pleural hemorrhage underwent thoracentesis to extract blood, and patients with more pleural hemorrhage conducted drainage tubes for drainage.

1.2.2 Observation group: Based on the treatment of the control group, Xiongning Decoction was combined with. The prescription was as follows: 30g of Chinese waxgourd seeds, 15g of aspongopus, 12g each of radix paeoniae alba and teasel, 10 g each of perilla seed, perilla stem, apricot kernel, peach kernel, tangerine peel, and raw rhubarb (added later), and 3 g of raw licorice. For patients with severe pain, processed myrrh, refined frankincense, and Chinese polyphaga were added as appropriate. For patients with chest tightness and loss of appetite, costus root, fructus aurantii, magnolia officinalis, radix hognoseus, and Jiaozhaqu were added as appropriate. For patients with coughing up phlegm, sea clam shell and semen lepidii were added. For patients with chest effusion, madder, pollen typhae, hairyvein agrimony, and trogopterus dung were added. 1 dose every day is required, with adding 800-1000 ml of water and boiling until the juice is concentrated to 300 ml, take it while it's still warm 3 times in the morning, noon, and evening respectively. The patients must take it continuously for 2 weeks.

1.3 Observation Indicators

1.3.1 Clinical Efficacy Two weeks after the operation, chest CT was performed to determine the efficacy of the two groups: if the chest CT showing no lung infection, clear costophrenic angle, and complete absorption of pleural effusion, it was considered as being cured. Chest CT showing mild inflammatory changes in the lungs, blunt costophrenic angle, and basic absorption of pleural effusion would be considered as being effective. If the amount of pleural effusion did not decrease

significantly, and closed drainage or thoracotomy was required, it would be considered as ineffective. Total effective rate of treatment=(cured ones+ effective ones)/n×100%.

1.3.2 Condition of Pain

The visual analogue scale (VAS) was used to evaluate the pain in the two groups on the first day, one week, and two weeks after surgery respectively: no pain was 0 points; mild pain, with no impact on life and work, was 1-3 points; moderate pain, with some impact on work but not on life, was 4-6 points; both life and work were affected, it was 7-9 points; severe pain was 10 points.

1.3.3 Length of Stay

The length of stay in the hospital after operation will be compared.

1.3.4 Coagulation Indicator

In both groups, 5 ml of fasting venous blood samples were drawn in the morning on the first day after surgery and 2 weeks after surgery. The samples were centrifuged at 350 r/min for 15 min, and the supernatant was collected. Prothrombin time (PT), activated partial thromboplastin time (APTT), and fibrinogen (FIB) were measured. PT and APTT were measured using the French STAGO semi-automatic coagulation analyzer, and FIB was detected using the OLYMPUS AU640 fully automatic biochemical analyzer.

1.4 Statistical Data Processing

SPSS19.0 was used for statistical processing, count data used χ^2 test. The measurement data were expressed with $(\bar{x} \pm s)$. The *t* test was used for comparison. $P < 0.05$ was considered statistically significant.

2 RESULTS

2.1 Clinical Efficacy

The total effective rate of the observation group was higher than that of the control group. ($P < 0.05$, see table 2 below)

Table 2 Comparison of the Clinical Efficacy between Two Groups *n* (%)

Groups	Cured	Effective	Ineffective	Total effective rate
Observation Group(<i>n</i> =47)	33(70.21)	12(25.53)	2(4.26)	45(95.74)
Control Group(<i>n</i> =47)	29(61.70)	10(21.28)	8(17.02)	39(82.98)
χ^2 value				4.029
<i>P</i> value				0.045

2.2 The Length of Stay and Pain after Surgery

The length of stay (LOS) in the observation group was shorter than that in the control group ($P<0.05$). There was no significant difference in the VAS pain score between the two groups on the first day after surgery ($P>0.05$). The VAS pain scores of the two groups were significantly reduced 1 week and 2 weeks after surgery compared with the first day after surgery ($P<0.05$). The VAS pain scores of the observation group were lower than those of the control group 1 week and 2 weeks after surgery ($P<0.05$, see table 3).

Table 3 Comparison of the Length of Stay and Pain after Surgery of Two Groups ($\bar{x} \pm s$)

Group	LOS(d)	VAS score		
		1 day after the surgery	1 week after the surgery	2 weeks after the surgery
Observation Group (<i>n</i> =47)	10.67±2.54	6.19±1.58	3.42±0.77*	2.24±0.49*
Control Group(<i>n</i> =47)	14.52±2.97	6.24±1.73	4.43±0.94*	2.81±0.54*
<i>t</i> value	6.754	0.146	3.442	3.479
<i>P</i> value	0.000	0.884	0.001	0.001

Note: Compared with the VAS at the 1st day after the surgery, * $P<0.05$.

2.3 Coagulation Indicators

There was no significant difference in PT, APTT, and FIB between the two groups on the first day after surgery ($P>0.05$). Two weeks after surgery, PT and APTT in both groups increased significantly, and FIB decreased significantly ($P<0.05$). The FIB in the observation group was lower than that in the control group 2 weeks after surgery ($P<0.05$), and there was no significant difference in PT and APTT between the two groups ($P>0.05$, See Table 4).

Table 4 Comparison of Coagulation Indicators between Two Groups ($\bar{x} \pm s$)

Group	PT(s)		APTT(s)		FIB(g/L)	
	1 day after surgery	2 weeks after surgery	1 day after surgery	2 weeks after surgery	1 day after surgery	2 weeks after surgery
Observation Group($n=47$)	11.12±1.73	12.31±2.43*	25.52±4.05	27.41±4.55*	4.21±0.92	2.25±0.62*
Control Group($n=47$)	11.32±1.80	12.43±2.64*	25.34±3.91	27.33±4.64*	4.16±1.03	2.73±0.81*
<i>t</i> value	0.549	0.390	0.216	0.844	0.248	3.226
<i>P</i> value	0.584	0.700	0.830	0.933	0.805	0.002

Note: Compared with the VAS at the 1st day after the surgery, * $P<0.05$.

3 DISCUSSION

There are 12 pairs of ribs distributed on both sides of the chest. Ribs are most likely to be damaged and fractured during trauma. Studies have shown [3] that fractures caused by indirect violence often occur in the middle section of the ribs. The broken ends are easily displaced outward, causing puncture of the soft tissue of the chest wall and chest wall hematoma. Direct violence often acts on a limited part of the chest. The broken ends are displaced inward and puncture the intercostal blood vessels, pleura and lungs, causing damage to the lungs or chest wall blood vessels, which can cause hemothorax or (and) pneumothorax. Hemothorax is more serious

than pneumothorax [4]. The occurrence of hemothorax can cause chest instability, increase chest cavity pressure, cause abnormal respiratory movements, and ultimately lead to pathophysiological disorders, such as respiratory and circulatory dysfunction, threatening the patient's life. Fractures often cause significant pain, and the occurrence of hemothorax can easily lead to abnormal coagulation function and a mild hypercoagulable state. Therefore, for patients with rib fractures and hemothorax, clinical treatment should promote the absorption of blood accumulation, prevent the occurrence of fibrothorax, and protect the patient's respiratory function. At the same time, it is also necessary to take into account the relief of the patient's pain and the improvement of coagulation abnormalities [5-6]. In this study, the observation group used Xiongning Decoction for 2 consecutive weeks along with the conventional emergency treatment. The results showed that the total effective rate of treatment reached 97.4%, which was higher than 80.6% in the control group. At the same time, the VAS pain scores of the observation group 1 week and 2 weeks after surgery were lower than those of the control group, indicating that the application of Xiongning Decoction not only effectively promoted the absorption of hemothorax, but also effectively relieved the patient's pain. Compared with injuries to other parts of the body, chest injuries have their own particularities. The chest is where the heart and lungs are located, and is related to the circulation of qi and blood. It contains many important organs, especially the lungs. The lungs control qi and control breathing, while chest protects the body. According to traditional Chinese medicine, the human body is composed of internal organs, skin/flesh, tendons/bones, meridians, qi/blood, and body fluids, among which tendons and bones are important parts and cannot be separated from the nourishment of qi and blood. The occurrence and development of fractures are all related to qi, blood, internal organs, and tendons [7-8]. After a fracture, local skin, flesh, tendons and veins are damaged, resulting in obstruction of qi, blood, and meridians, stagnation of qi in lung, and abnormal descending and ascending, which causes disharmony of internal organs from the outside to the inside, causing respiratory dysfunction [9]. Hemothorax belongs to the category of internal

chest injuries in traditional Chinese medicine. The pathogenesis is mainly blood stasis in the chest and stagnation of qi [10]. If blood stasis is not eliminated for a long time, it will develop into "dry blood" adhesion, forming coagulated hemothorax. It can be seen that the traditional Chinese medicine treatment of patients with rib fracture and hemothorax should be based on the main principles of tonifying qi and nourishing blood, promoting qi and relieving pain, promoting blood circulation and removing blood stasis [11]. Xiongning Decoction functions from the lung. The selected drugs include: Chinese waxgourd seeds, aspongopus, radix paeoniae alba, perilla seed, perilla stem, apricot kernel, peach kernel, tangerine peel, and raw rhubarb and raw licorice. Aspongopus regulates qi, relieve pain and warm yang. Radix paeoniae alba nourishes blood and relieves pain. Teasel can strengthen the muscles and bones. Perilla seeds eliminating phlegm and relieving asthma. Caulis perillae promotes qi and relieve pain. Almond improves the cough and asthma. Peach kernel remove blood stasis. Dried tangerine peel clears the organs, regulates qi, dry dampness and conduct expectorant. Raw rhubarb is to remove blood stasis and conduct hemostasis. Raw licorice nourishes the spleen and replenishes qi, eliminates phlegm and relieves pain, and harmonizes various medicines [12-13]. The whole prescription combines the effects of moistening the lungs, clearing the bowels, regulating qi, activating blood circulation, resolving phlegm, and relieving pain. By taking into account the characteristics of chest injuries, the common characteristics of qi and blood injuries, and increasing or decreasing according to the symptoms, the decoction makes the effect more significant. Modern pharmacological studies have shown that [14-16] almond has anti-inflammatory and analgesic effects, and peach kernel has hemostatic effect. besides it has been confirmed by animal experiments that peach kernel can shorten the time of plasma recalcification in rabbits and significantly improve coagulation. Angelica polysaccharide, the active ingredient of *Angelica sinensis*, can inhibit platelet aggregation, improve local microcirculation and hemorheology, reduce blood viscosity and plasma fibrinogen. Animal experiments have found that [17], the active ingredient emodin of rhubarb can effectively improve the coagulation disorder

in septic rats, suggesting that it has a significant improvement effect on coagulation function. Many kinds of Chinese herbal medicines in Xiongning Decoction have the effects of anti-inflammatory, analgesic and improving coagulation. This is the main reason why the patients in the observation group have lighter pain loudness at different time points after operation, and the coagulation index has been significantly improved, which promotes the improvement of the overall state of the patients and improves the clinical efficacy. It is worth noting that strengthening nutrition and improving physical fitness are also important aspects of clinical treatment. Patients should be encouraged to pay attention to their eating habits. Eating less but more frequently, and drinking plenty of water to ensure smooth bowel movements should be also encouraged. After the pain is relieved, they can actively carry out respiratory function exercises and guide them to take steady, slow, and even deep breaths to help expand their lung capacity. By increasing gas exchange in the lungs, the sunken chest can be restored to fullness, so that abnormal breathing can be corrected.[18].

In summary, the application of Xiongning Decoction in patients with rib fracture and hemothorax can effectively relieve the patient's pain, improve coagulation, promote hemothorax absorption and fracture healing.

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