

# Effect of Jianpi Yiqi Decoction in the Treatment of Post-Splenic Rupture Repair

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## Cao *et al.*: Effect of Jianpi Yiqi Decoction on Post-Splenic Rupture Repair

To explore the treatment effect of Jianpi Yiqi decoction in patients after splenic rupture repair. 68 patients with spleen rupture admitted to the hospital from January 2017 to October 2020 were randomly divided into the control group and the observation group. They were all treated with repair. The control group was treated with routine treatment after operation. The observation group was treated with Jianpi Yiqi decoction addition and subtraction at the same time of routine treatment after operation. The symptom scores before and after treatment was compared between the two groups, including fever, abdominal pain and fatigue. The recovery effect of spleen structure was compared between the two groups. Safety of medication and postoperative complications during treatment were compared between the two groups. After treatment, the scores of fever, abdominal pain, asthenia in the two groups decreased and the scores of the above symptoms in the observation group were lower than those in the control group, with statistically significant differences ( $p < 0.05$ ). There was a significant difference in the distribution of the effect of spleen structure recovery between the two groups ( $p < 0.05$ ). The total effective rate of the observation group was higher than that of the control group, with a statistically significant difference ( $p < 0.05$ ). The levels of cluster of differentiation 3, cluster of differentiation 4, cluster of differentiation 4/cluster of differentiation 8 in the two groups after treatment increased, in which the observation group were higher than those in the control group after treatment, with statistically significant differences ( $p < 0.05$ ). There was no significant difference in the incidence of adverse reactions between the two groups ( $p > 0.05$ ). The treatment of Jianpi Yiqi decoction addition and subtraction in patients after splenic rupture repair can significantly reduce symptoms, promote the recovery of spleen structure and T cell immunity and it is safe and reliable.

**Key words:** Jianpi Yiqi decoction, splenic rupture repair, cluster of differentiation cells, T cell immunity

Splenic rupture is a common type of clinical emergency of abdomen that can form a haematoma even leading to abdominal haemorrhage, haemorrhagic shock and death. It has been shown that splenic rupture accounts for 40 % to 50 % of abdominal injuries, with approximately 85 % of these patients being true ruptures, that is, rupture of both the splenic parenchyma and peritoneum, which can be a serious threat to the life of the patient<sup>[1]</sup>. At present, depending on the severity of splenic rupture, clinical treatment is often carried out by splenic suture repair, partial splenectomy and splenic artery ligation, among which splenic suture repair is more commonly used to promote the recovery of splenic function<sup>[2,3]</sup>. It has been reported that although the implementation of conventional treatment after splenic rupture repair can promote recovery, patients often suffer from fever, abdominal pain, malaise and decreased immunity<sup>[4,5]</sup>. Also, the rate of recovery of

the splenic structures needs to be improved. Moreover, the incidence of complications such as postoperative splenic parenchymal haematoma, peritoneal effusion and bleeding from the surgical incision remains high. According to the theory of Chinese medicine, the spleen has the physiological function of controlling the normal flow of blood, facilitating the digestion and absorption of food from the stomach and intestines, and distributing the absorbed water and grain essence throughout the body. The rupture of the spleen can lead to a condition of splenic weakness. It is important not only to stop bleeding and remove blood stasis after traumatic splenic rupture, but also to regulate the spleen and stomach in order to control the symptoms of deficiency of fine substances and blood in the body to speed up recovery. Therefore, we applied Jianpi Yiqi decoction to patients after splenic rupture repair in addition to conventional treatment and obtained

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satisfactory results. In order to further investigate the effectiveness and application value of this formula, a study was conducted on 68 patients after spleen rupture repair.

## MATERIALS AND METHODS

### Clinical information:

68 patients with ruptured spleen admitted to the hospital from January 2017 to October 2020 were selected and divided into a control group and an observation group using a random number table with the approval of the ethics committee of the hospital. In the control group, there were 22 males and 12 females, aged 20-72 y, with an average age of (49.59±7.82) y. All patients underwent splenic repair and the area of the splenic patch was 0.8 to 6.5 cm<sup>2</sup>, with a mean of (3.56±1.08) cm<sup>2</sup>. The causes of injury included traffic accidents in 20 cases, falls from height in 8 cases, fights and brawls in 4 cases, and others in 2 cases. The clinical

classification included 14 cases of grade II and 20 cases of grade III<sup>[6]</sup>. The concomitant symptoms on admission included hypotension in 11 cases, haemorrhagic shock in 7 cases and respiratory distress in 10 cases. In the observation group, there were 24 males and 10 females, aged 25 to 70 y, with an average age of (48.05±7.89) y. All patients underwent splenic repair and the area of the splenic patch was 1.0 to 6.5 cm<sup>2</sup>, with a mean of (3.68±1.12) cm<sup>2</sup>. The causes of injury included traffic accidents in 22 cases, falls from height in 6 cases, fights and brawls in 4 cases, and others in 2 cases. The clinical classification included 11 cases of Grade II and 23 cases of Grade III. The concomitant symptoms on admission included hypotension in 12 cases, haemorrhagic shock in 8 cases and respiratory distress in 9 cases. The differences in clinical data between the two groups were not statistically significant when compared ( $p>0.05$ ) (Table 1).

**TABLE 1: COMPARISON OF CLINICAL DATA BETWEEN THE TWO GROUPS**

Clinical data	Control group (n=34)	Observation group (n=34)	Statistical value	p value
Gender				
Male	22 (64.71)	24 (70.59)	0.269 <sup>a</sup>	0.604
Female	12 (35.29)	10 (29.41)		
Age (years)	49.59±7.82	48.05±7.89	0.808 <sup>b</sup>	0.422
Cause of injury				
Traffic accident	20 (58.82)	22 (64.71)	0.249 <sup>a</sup>	0.618
Fall from height	8 (23.53)	6 (17.65)	0.360 <sup>a</sup>	0.549
Fighting and brawling	4 (11.76)	4 (11.76)	0.142 <sup>c</sup>	0.707
Others	2 (5.88)	2 (5.88)	0.266 <sup>c</sup>	0.606
Clinical classification				
Class II	14 (41.18)	11 (32.35)	0.569 <sup>a</sup>	0.451
Class III	20 (58.82)	23 (67.65)		
Concomitant symptoms on admission				
Hypotension	11 (32.35)	12 (35.29)	0.066 <sup>a</sup>	0.798
Hemorrhagic shock	7 (20.59)	8 (23.53)	0.086 <sup>a</sup>	0.770
Respiratory distress	10 (29.41)	9 (26.47)	0.073 <sup>a</sup>	0.787
Splenic patch area (cm <sup>2</sup> )	3.56±1.08	3.68±1.12	0.450 <sup>b</sup>	0.654

Note: a indicates  $\chi^2$  test; b indicates t-test; c indicates a correction for  $\chi^2$  test

**Inclusion criteria:**

All had confirmed splenic rupture and all were treated by repair; all were adult patients; all signed an informed consent form<sup>[7]</sup>.

**Exclusion criteria:**

Those with other organ or tissue injuries, such as intestinal perforation, lung contusion, etc.; those with medical conditions, such as peptic ulcer, chronic hepatitis, cardiovascular disease, etc.; those who have undergone major surgical treatment within the last 6 mo; those with a history of previous surgical treatment of the spleen; those with a history of drug abuse, drug addiction, etc.; those with mental disorders, etc.,<sup>[8]</sup>.

**Methods:**

The control group was treated with conventional methods after repair, including bioprotein gel spraying to stop bleeding, negative pressure drainage, bracing, absolute bed rest, reasonable analgesia, establishment of intravenous access and nutritional support such as albumin or fat milk, prevention of stress ulcers, prevention of nosocomial infection, correction of water-electrolyte balance, rehydration, blood replenishment and strengthening of resistance, etc. The treatment continued for 4 w.

In the observation group, all the patients were treated with the conventional method after the repair operation along with the treatment of Jianpi Yiqi decoction. Recipe: *Astragalus* 50 g, *Codonopsis pilosula* 25 g, Cassia twig 13 g, *Pinelliae rhizoma*, *Caulis perillae*, *Magnolia officinalis*, *Rhizoma cyperi*, *Poria cocos*, *Glycyrrhiza uralensis* 12 g each and Jujube 8 g. If abdominal pain was severe, 12 g of white peony and 8 g of *Pericarpium zanthoxyli* were added. If fever was severe, *Rhizoma coptidis* 5 g and *Lonicera japonica* 10 g should be added. In case of diarrhoea, 10 g of *Scutellaria baicalensis* and 6 g of *Rhizoma coptidis* were added. In case of nausea and vomiting, dried citrus peel 10 g and *Fructus Aurantii Immaturus* 6 g were added. 1 dose of the medicine was decocted daily in 2 parts, each time to 200 ml. The juice obtained from the 2 parts was mixed well. It was taken 30 min after breakfast and dinner, 200 ml each time, for 4 w.

**Observation indexes:**

The symptom scores were compared before and after treatment in the 2 groups, including fever, abdominal pain and malaise. Both groups were evaluated on a 4-grade scale with a score of 0 describing no symptoms, a score of 1 describing symptoms but mild, a score of 2 describing symptoms and moderate, and a score of 3 describing symptoms and severe<sup>[9]</sup>.

The effect of recovery of spleen structure after treatment was compared between the two groups. The recovery of spleen structure was evaluated by ultrasound after treatment. The spleen with smooth margins, normal size, disappearance of the subperitoneal and peri-peritoneal fluid dark areas and homogeneous texture echogenicity were recorded as cured.

A slight roughening of the spleen margins, a mild change in size, almost complete disappearance of the subperitoneal and periplasmic fluid dark areas, and a slight echogenicity in texture were considered significant effect. A significant roughening of the spleen rim, a significant change in size, a significant reduction in the subperitoneal and periplasmic fluid dark areas, and an uneven texture echogenicity were considered valid. A severe roughening of the spleen margins, abnormal size, no reduction or even enlargement of the subperitoneal and peri-pleural fluid dark areas, and severe textural echogenicity were noted as invalid. The sum of the percentages of cured, apparently effective and effective was recorded as the total effective rate.

The changes in T-cell immune parameters were compared between the two groups before and after treatment. The peripheral blood was taken before and after treatment respectively and measured by flow cytometry.

The safety of medication administration during treatment was compared between the two groups.

**Statistical analysis:**

Statistical Package for the Social Sciences (SPSS) 25.0 was used for statistical analysis. The measures were first implemented as tests of normality and chi-squared, described by " $\bar{x} \pm s$ ". The differences between the two groups were compared by independent samples t-test and the differences within the groups before and after treatment were compared by paired t-test. The statistical data in percentage (%) was tested by rank sum test. The difference between the two groups was compared by  $\chi^2$  test and Fisher's exact test was required if the theoretical frequency was  $<1$ . The difference was statistically significant at  $p < 0.05$ .

**RESULTS AND DISCUSSION**

Symptom scores between two groups before and after treatment were compared. There were no deaths during treatment in either group. The fever, abdominal pain and malaise symptom scores were lower in the control and observation groups after treatment than before treatment. The differences were statistically significant using paired t-test (observation group:  $t=11.401$ ,  $p < 0.001$ ;  $t=18.576$ ,  $p < 0.001$ ;  $t=12.463$ ,  $p < 0.001$ ; control group:  $t=7.064$ ,  $p < 0.001$ ;  $t=10.315$ ,  $p < 0.001$ ;

t=6.058, p<0.001). The fever, abdominal pain and malaise symptom scores were lower in the observation group than in the control group after treatment and the differences were all statistically significant using independent sample t-tests (t=15.938, p<0.001; t=11.489, p<0.001; t=5.692, p<0.001) (fig. 1).

The effects of spleen structure recovery after treatment between the two groups were compared. The difference between the two groups was statistically significant (Z=6.289, p=0.017), when comparing the distribution of the effect of recovery of spleen structure after treatment using the rank sum test. The overall effective

rate was higher in the observation group than in the control group after treatment and the difference was statistically significant using the  $\chi^2$  test ( $\chi^2=5.100$ , p=0.024) (fig. 2).

Changes in T-cell immune indexes before and after treatment in the two groups were shown below. The levels of cluster of differentiation (CD), 3 (CD3<sup>+</sup>, CD4<sup>+</sup> and CD4<sup>+</sup>/CD8<sup>+</sup>) were higher in both groups after treatment than before treatment and the above T-cell immune indexes were higher in the observation group than in the control group after treatment, with statistically significant differences (p<0.05) (fig. 3).

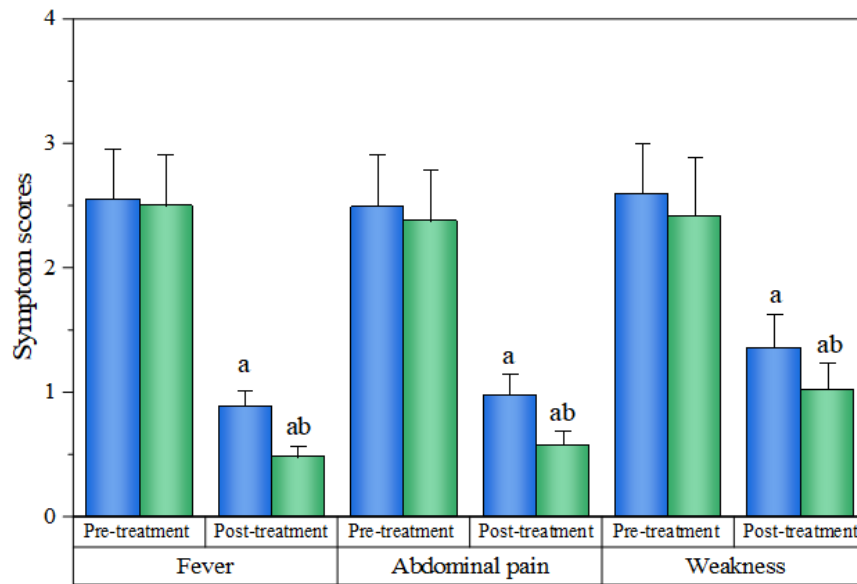


Fig. 1: Comparison of symptom scores between two groups before and after treatment, a indicates comparison with pre-treatment, p<0.05; b indicates comparison with control group, p<0.05, (■) Control group; (■) Observation group

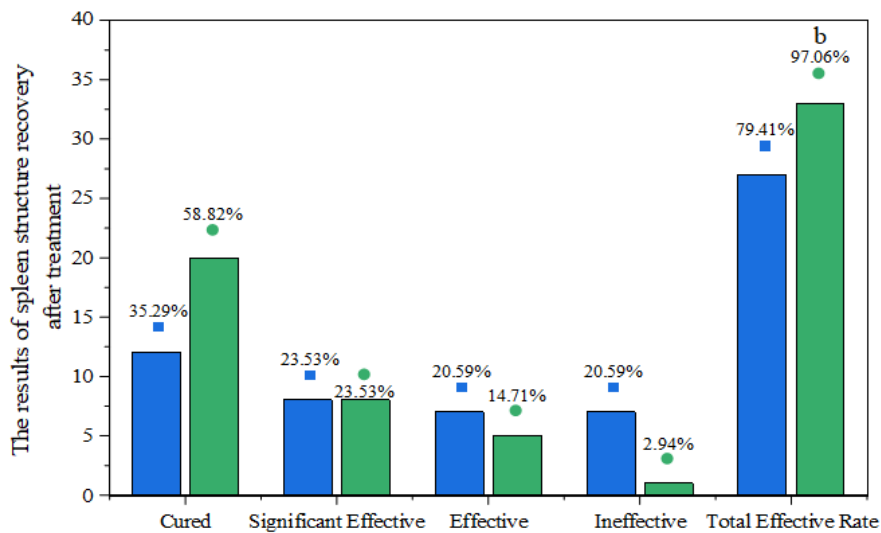
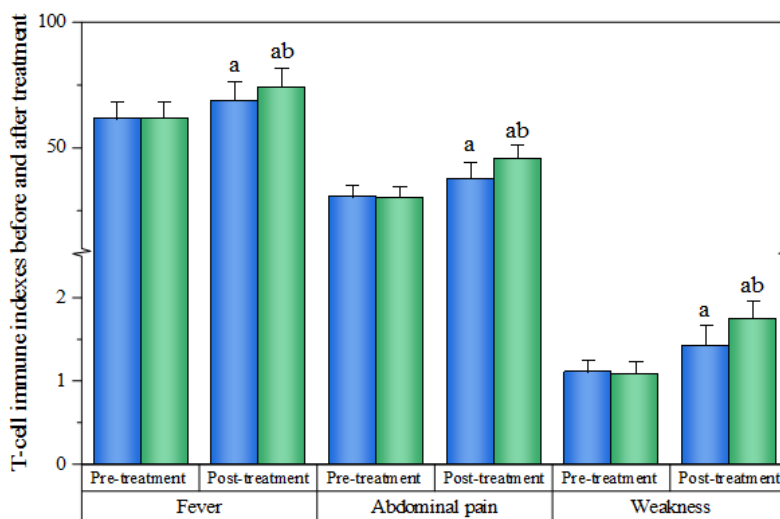


Fig. 2: Comparison of the effect of spleen structure recovery after treatment between the two groups, b indicates comparison with control group, p<0.05, (■) Control group; (■) Observation group



**Fig. 3: Changes in T-cell immune indexes before and after treatment in the two groups, a indicates comparison with pre-treatment,  $p < 0.05$ ; b indicates comparison with control group,  $p < 0.05$ . (■) Control group; (■) Observation group**

Adverse reactions during treatment in both groups were compared. There were no adverse reactions during the treatment period in the control group while in the observation group there were two cases of diarrhoea, both of which were mild and did not affect the treatment schedule. The incidence of adverse reactions in the control group and the observation group were 0.00 % and 5.88 % respectively. The incidence of adverse reactions during treatment in the two groups was compared using Fisher's exact test and the difference was not statistically significant ( $p = 0.473$ ).

The spleen, a substantial organ with a rich blood supply, is held in the posterior aspect of the left upper abdomen by ligaments attached to its peritoneum and protected by the structural tissues of the chest wall, abdominal wall and diaphragm. The spleen is fragile and can easily rupture after a direct or indirect violent blow, leading to internal bleeding and in some severe cases, hypotension and haemorrhagic shock, with a high mortality rate. Studies have shown that the spleen is the largest lymphatic organ in humans and is responsible for blood supply, filtration and storage of blood, and the production of lymphocytes for immune functions. In the event of splenic rupture, these functions are impaired and require active treatment. Although conventional splenic repair and perioperative symptomatic support have a positive effect, their results are unsatisfactory and need to be improved<sup>[10,11]</sup>.

According to Chinese medicine, the spleen is an essential organ of the body as it mainly transports and transforms substances, stores blood and warms the organism. The location of the spleen is described in "The Illustrated Wings of the Classified Canon": The spleen is on the

same membrane as the stomach and attached to its upper left side, and the spleen acupoint is located in the eleventh rib space. In the classic of questioning, it is said that "The spleen weighs two catties and three taels and is responsible for wrapping blood, warming the organs, and hiding the will", describing not only the weight and shape of the spleen, but also detailing its functions. According to modern Chinese medicine practitioners, the spleen is the basis of the postnatal life and all life activities depend on the nutrients ingested by the postnatal spleen and stomach<sup>[12]</sup>. The functions of the spleen in Chinese medicine can be summarized as follows: Firstly, it can take in food and export refined nutrients for use throughout the body and is the hub of fluid metabolism. Secondly, the spleen can produce blood and regulate it. Thirdly, the spleen is the master of muscles, nourishing them and moistening the muscles and bones. Fourthly, the spleen regulates immunity and strengthens the exterior of the body. If the spleen is ruptured, it will damage the fundamentals of the postnatal system. The functions of transportation, blood circulation and immune regulation will be damaged and the muscles, tendons and bones will be deprived of moistening. When the spleen is damaged, it is unable to distribute essence and nutrients are sharply reduced, which can lead to a weakened organism, reduced resistance and loose muscles and skin, allowing germs to take advantage of the situation and endanger health. Therefore, patients with ruptured spleen should be treated with Chinese medicine that strengthens the spleen and enhances vital energy to promote recovery. In this study, the scores of fever, fatigue and abdominal pain decreased in both groups after treatment, and the

scores of these symptoms in the observation group were lower than those in the control group after treatment, suggesting that the application of Jianpi Yiqi decoction add-down to spleen rupture repair can significantly control all the symptoms of patients. In the comparison of the results on the recovery of spleen structure, the observation group was significantly better than the control group, indicating that the application of Jianpi Yiqi decoction add-down could also promote the recovery of spleen structure after spleen rupture repair. The conventional approach advocates symptomatic supportive treatment, which can provide favourable conditions for the patient's postoperative recovery<sup>[13]</sup>. However, clinical follow-up revealed that intensive spleen strengthening is still needed for patients after spleen rupture repair. *Astragalus* and Cassia twig are the main herbs in this soup. *Astragalus* is effective in tonifying and strengthening the spleen and promoting dampness, while Cassia twig is effective in warming the spleen and transporting it, inducing diuresis, permeating dampness, and relieving pain. The combination of the two can promote rapid recovery of the spleen's function of transport and transformation. The herb is complemented by *Codonopsis pilosula*, *Pinelliae rhizoma*, *Caulis perillae*, *Magnolia officinalis*, *Rhizoma cyperi*, *Poria cocos*, *Glycyrrhiza uralensis* and Jujube, which are used to tonify and strengthen the spleen, induce dampness and enhance the function of transportation and digestion. The combination of the above mentioned herbs works together to strengthen the spleen, nourish the body and induce diuresis. On the basis of this, the treatment can be differentiated and supplemented to control all symptoms. As a result, the symptoms are removed and the structure and function of the spleen are rapidly restored. In addition, in this study, the T-cell immunity indexes of both groups improved significantly after treatment compared with those before treatment and the observation group outperformed the control group, suggesting that Jianpi Yiqi decoction can help to enhance the T-cell immunity function of patients after spleen rupture repair. The spleen holds about a quarter of the body's circulating T lymphocytes, which are directly involved in cellular immunity and also play an important role in regulating peripheral blood T cell immune indicators. Both splenic rupture and surgical trauma can lead to a decrease in CD3<sup>+</sup>, CD4<sup>+</sup> and CD4<sup>+</sup>/CD8<sup>+</sup>. The treatment with Jianpi Yiqi decoction can promote the recovery of the spleen structure and function. Modern pharmacological studies have concluded that *Astragalus* is rich in saponins and flavonoids, all of which can contribute to the restoration

of spleen structure and also stimulate immune activity<sup>[14]</sup>. The active ingredients in Cassia twig can improve the constitution and strengthen the resistance of patients with ruptured spleen<sup>[15]</sup>. It can be seen that the treatment of patients after spleen rupture repair with Jianpi Yiqi decoction on top of the conventional *Astragalus* injection can promote the elimination of symptoms and accelerate recovery.

In addition, the incidence of adverse reactions during treatment was similar in the two groups and all adverse reactions were mild and tolerable, suggesting that it was safe to use the drug. It is consistent with the principle of symptomatic treatment and can promote rapid recovery of the spleen structure and function while controlling all common symptoms, as well as ensuring the safety of the medicine.

In conclusion, it is recommended that the conventional treatment after spleen rupture repair should be accompanied by the use of Jianpi Yiqi decoction. It can not only effectively control the symptoms of fever, weakness and abdominal pain, but also promote the recovery of spleen structure and T-cell immunity. It is safe and reliable, having certain clinical promotion and application value. However, the specific mechanism of action of Jianpi Yiqi decoction in such patients and whether there is an optimized formula for its use need to be explored in depth which can be the focus of later studies.

#### Conflict of interests:

The authors declared no conflict of interest.

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