Original Article

The Clinical Effects Study of Hepatic Failure by Intraperitoneal Injection of Antibiotics, Intravenous Injection of Terlipressin, and Combined Therapy of Coloclysis and Plasma Exchange

Hui Li¹, Ya-ling Wang¹ and De-ying Tian²

Objective To observe the therapeutic effects of intraperitoneal injection of antibiotics, intravenous injection of terlipressin, and combined treatment of coloclysis and plasma exchange on hepatic failure(HF), the subjects included 494 inpatient cases of hepatic failure who were treated in Department of Infectious Diseases, Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China from 1997 to 2008.

Methods The patients that met the inclusion criteria were divided into intraperitoneal antibiotic injection group, intravenous terlipressin injection group, coloclysis group, plasma exchange group, combination group of coloclysis and plasma exchange in terms of treatment given and a control group was set up for each of the treatment group. In the intraperitoneal injection group, the prognosis and changes in clinical manifestations were observed in HF patients complicated with spontaneous peritonitis (SBP). In terlipressin injection group, HF patients complicated with hepatorenal syndrome (HRS) were observed for prognosis and changes in serum creatinine. In the combination group, the improvement in serum total bilirubin and prothrombin activity were observed.

Results Two weeks after intraperitoneal injection of antibiotics, the ease ratios of abdominal pain, pressure pain and rebound tenderness were 87.64%, 82.02% and 82.02% in the intraperitoneal injection group, respectively and the volume of ascites obviously decreased in 69 patients (77.53%). The survival rate in intraperitoneal injection group was significantly higher than in control group ($P = 0.004$). Four to eight days after the intravenous injection of terlipressin, the survival rate and the rate of serum creatinine decline of the treatment group were significantly higher than those in the control group ($P = 0.003$, $P = 0.000$). After 4 weeks of treatment, the ratio of clinical symptoms improvement (acratia, anorexia, abdominal distension, constipation) in coloclysis group were 60.27%, 57.53%, 91.78% and 94.52%, in plasma exchange group were 71.83%, 69.44%, 75% and 72.22%, and in combination group were 82.14%, 79.46%, 92.85% and 95.54%. The serum total bilirubin was decreased and the prothrombin activity increased and the differences were statistically significant as compared with control group ($P = 0.000$).

Conclusions The intraperitoneal injection of antibiotics, intravenous injection of terlipressin and combined treatment of coloclysis and plasma exchange were all effective for the treatment of HF and its complications.

Key words: Hepatic failure; Intraperitoneal injection of antibiotics; Elevation coloclysis; Terlipressin; Plasma exchange

Viral hepatitis is common in China and cases of hepatitis A, B, C, D, E are extensively found in the country. As far as hepatitis B is concerned, the 10% of the population are HBsAg carrier. There are

currently about 30 million of HBV patients, and 60% of them are chronic hepatitis B. According to statistics, 81% of severe hepatitis are caused by HBV, 1%–6% by HAV, and 13%–44% by HCV. HEV causes severe hepatitis only in pregnant women. Combined infection of two or more than two kinds of hepatitis viruses is also an important cause of severe hepatitis in over 50% of the severe hepatitis patients.¹ Hepatitis B is the major culprit for hepatic failure in China, which is different from the Western countries where drug abuse and

¹Department of Liver Diseases, No.3 Municipal People's Hospital of Kunming, Kunming 650000, Yunnan Province, China

²Department of Infectious Diseases, Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan 430030, Hubei Province, China

Correspondence: De-ying Tian, E-mail: Dytian@tjh.tjmu.edu.cn. Telephone: +86-27-83662816

alcoholism are the major cause. In spite of all efforts, the mortality of hepatic failure is more than 70%.^{2,3}

The hepatic failure is a life-threatening condition characterized by fast progression, complicated symptoms, intractable complications and high mortality (approximately 60%–70%).⁴ The prognosis of the disease is poor and the treatment is difficult and costly. It poses heavy physical, mental and financial burdens on the patients, their families and the society at large.⁵

It is believed that damaged liver has the ability to regenerate and restore to normal functions including metabolism, synthesis and biotransformation. Liver transplantation remains the only effective therapeutic modality for chronic patients in end-stage.^{6–8} Therefore, it is necessary to develop comprehensive therapeutic modality as a transition to transplantation, to tide patients over until a liver transplant is available. The transplantation may also cause some complications, including acid-base imbalance, hyperbilirubinemia, disturbance of electrolytes, dysfunction of blood coagulation, acute rejection, etc.⁹ Therefore, a comprehensive therapeutic modality is urgently needed for hepatic failure.

PATIENTS AND METHODS

Patients

The subjects of the study were 494 inpatient cases of hepatic failure who had been treated in the Department of Infectious Diseases, Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China, from Jan. 1997 to Dec. 2008. Of them, 417 were male and 77 were female, with age ranging from 14–78 years. All of the subjects had hepatitis B, and only 29 cases of them suffered from superinfection of hepatitis B and C virus.

Grouping

The subjects who met the inclusion criteria were divided into different groups according to the treatments received as follows:

Intraperitoneal injection of antibiotics

Total of 171 hepatic failure patients complicated with spontaneous bacterial peritonitis (SBP) were selected for the study of the effect of intraperitoneal injection of antibiotics. The intraperitoneal injection group included 89 cases receiving intraperitoneal injection of antibiotics. The control group included 82 patients who had not received intraperitoneal injection of antibiotics. There were no statistical differences in gender, age, cause of disease, disease course and profile of liver function between the two groups ($P > 0.05$).

Intravenous injection of terlipressin

Total of 46 hepatic failure patients complicated with type I hepatorenal syndrome (HRS) were selected for the study of the effect of intravenous injection of terlipressin. The serum creatinine in all the cases was

elevated before the treatment [the average of serum creatinine: $(187.2 \pm 51.4) \mu\text{mol/L}$], and subjects with primary kidney diseases were excluded. The terlipressin group consisted of 26 cases receiving intravenous injection of terlipressin while control group included 20 patients who had no been given intravenous injection of terlipressin. There were no statistically significant differences in gender, age, origin of disease, cause of disease, disease course and profile of liver function between the two groups ($P > 0.05$).

Coloclysis and plasma exchange

Total of 297 hepatic failure patients were selected for the study of the effect of coloclysis. Coloclysis group contained 73 cases who received coloclysis alone, plasma exchange group contained 72 cases who received only plasma exchange, and the combination group consisted of 112 patients who had been treated by both coloclysis and plasma exchange. The control group was composed of 40 patients who received neither coloclysis nor plasma exchange. There were no statistically significant differences in gender, age, origin of disease, cause of disease, disease course and profile of liver function among the four groups ($P > 0.05$).

Diagnosis

The diagnosis of hepatic failure was based on the diagnostic criteria of “Diagnostic and Treatment Guidelines for Liver Failure” which had been revised in 2006 by Chinese Society of Infectious Diseases and Chinese Society of Hepatology under Chinese Medical Association (CMA).¹⁰

The diagnostic criteria of SBP included:¹¹ a. symptom and signs (fever, abdominal pain, abdominal tenderness and rebound tenderness, seroperitoneum), b. routine examination for seroperitoneum ($\text{WBC} > 0.25 \times 10^9/\text{L}$ or neutrophilic granulocyte ratios > 0.5), c. positive results of bacterial culture of peritoneal fluid and d. exclusion of secondary peritonitis. Diagnosis of SBP could be established when the conditions of b, c and d or a, b, d were satisfied. When WBC of peritoneal fluid $> 0.3 \times 10^9/\text{L}$ and neutrophilic granulocyte ratios > 0.25 , SBP should be highly suspected and treatment for SBP should be given.

The diagnosis of hepatorenal syndrome (HRS) was established on the basis of the definition and diagnostic criteria for HRS proposed by International Ascites Club in 1996.¹²

Therapeutic Methods

On the basis of routine combined fundamental therapy (including liver-protection, improving serum zymologic indice, decreasing bilirubin, diuresis, hepatic cells growth promotion, infusion of blood plasma and albumin, intravenous injection of the third generation cephalosporin, and so on), the treatments were given as following:

a. The patients in the intraperitoneal injection group

began to receive intraperitoneal injection of bacteria-sensitive antibiotics immediately after deep pressure pain occurred and the treatment last for 2 weeks. Abdominal paracentesis and peritoneal drainage were performed before the intraperitoneal injection). The patients in the control group received intravenous injection of the third generation cephalosporin.

b. The patients of terlipressin group was given intravenous injection of terlipressin (1 mg, minipump injections 1 h, q12h) when HRS was definitely diagnosed, and the treatment lasted 4-8 days (6 days on average).

c. The patients of coloclisis group and combination group of coloclisis and plasma exchange were treated by colon irrigation by using colon therapeutic apparatus. The fluid of retention enema contained Radix et Rhizoma Rhei, capillary wormwood herb, Polygonum cuspidatum sieb. et zucc, Gardenia jasminoides ellis, Sdeum sarmentosum bunge, Salvia miltiorrhiza bunge, Sophora flavescens ait, Amur corktree bark, Scutellaria baicalensis georgi and red peony root. The coloclisis was given 3 times per week and the course of treatment was 2 weeks. And it was approved by Ethics review committee. The patients were asked to assume left lateral decubitus position with knee bent. The operator wore sterile gloves. Per rectum examination was conducted before the treatment to see if enema was contraindicated. Trocar sheath was lubricated by paraffin oil, and inserted into anus about 5-7 cm deep, and then the probe was introduced. The direction of the probe were slightly adjusted when resistance was encountered during the advancement, and the penetration depth was 50-80 cm. Intestine-rinsing fluid, which contained Na^+ , Cl^- , Ca^{2+} , Mg^{2+} and so on, was injected at 160-180 ml/min. The temperature of the fluid was automatically controlled at 37-38°C by the equipment, and the effluent flew out via another pipe. The irrigation lasted 60 min. At the end of the irrigation, retention enema was given, with enema fluid containing Chinese herbal drugs infused through the infusion pipe.

d. The patients of plasma exchange group received plasma exchange by employing blood purifier. 2000-3000 ml plasma was exchanged for one session. Depending on the condition of each patient, the plasma exchange was performed every 3-10 days.

Observation Indexes

The patients were observed for the improvement of major symptoms (acratia, anorexia, abdominal pain, abdominal distension, constipation) and signs (jaundice, abdominal pressre pain, rebound tenderness, ascites etc). The liver function indicators (TBil, PTA) were detected before and after the treatment, and the drop rate was calculated (see following formula). The subjects who died during hospital stay and those who wanted to be discharged were identified as cases

of death, and the survival rate of each group was calculated.

$$\text{Drop rate of Cr} = \frac{\text{Value after the treatment} - \text{Value before the treatment}}{\text{Value before treatment}}$$

Judgment of Efficacy

Excellent: The clinical symptoms and signs disappear. The liver functions fundamentally restore to normal.

Good: The clinical symptoms and signs do not disappeared completely, but are obviously improved. The liver functions were decreased by more than 50%.

Poor: The clinical symptoms and signs show no improvement. The liver functions are not improved or patient died.

Data Processing

The clinical data and findings of examinations were collected using a uniform list. The data were statistically analyzed using a software package SPSS 12.0. The qualitative data were tested by Chi-square analysis, and the quantitative data were analyzed by t-test and analysis of variance.

RESULTS

Clinical effect of intraperitoneal injection of antibiotics on hepatic failure complicated with SBP and on the prognosis of the patients

Prognosis Evaluation

After 2 weeks of treatment, among the 171 patients with hepatic failure, 149 showed good results. But the results were poor in 22 cases due to death induced by progressive hepatic failure and severe infection. The survival rate of intraperitoneal injection group [91.01% (81/89)] was obviously higher than that of control group [74.39% (61/82)] and the difference was statistically significant ($\chi^2=8.11$, $P=0.004$).

In intraperitoneal injection group, abdominal pain was obviously relieved in 78 patients (87.64%). Abdominal tenderness and rebound tenderness were obviously ameliorated in 73 patients (82.02%). The ascites volume was obviously decreased in 69 patients (77.53%). In the control group, abdominal pain was obviously relieved in 40 patients (48.78%). Abdominal tenderness and rebound tenderness had been obviously relieved in 35 patients (42.68%). The ascites volume was obviously decreased of 31 patients (37.80%).

The differences in the indicators were significantly different between the two groups (all $P=0.000$) (Figure 1).

Effect of terlipressin on serum creatinine of hepatic failure patients complicated with HRS and the prognosis

Evaluation of Prognosis

In 26 patients of terlipressin group, 19 had excellent or good results, and the results were poor or patients died

Figure 1. Comparison of clinical manifestations between intraperitoneal injection group and control group after 2 weeks of treatment.

Table 1. Change and drop rate of serum creatinine during intravenous injection of terlipressin ($\bar{x} \pm s$)

Groups	n	Serum Creatinine		Drop Rate of Serum Creatinine
		Before Treatment	After Treatment	
Terlipressin group	26	191.4 $\pm$ 44.9	71.2 $\pm$ 31.6 ^a	-0.63 $\pm$ 0.25 ^b
Control group	20	185.7 $\pm$ 36.3	201.4 $\pm$ 69.4	0.08 $\pm$ 0.37

Notes: ^a: $t = 14.834$, $P = 0.000$; ^b: denoting: $\chi^2 = 66.055$, $P = 0.000$ and for both the differences were statistically significant.

in 7. In 20 patients of control group, 4 showed excellent or good results, and the results were poor in 16 patients. The causes of death were progressive hepatic failure and uremia. The survival rate of terlipressin group [73.08% (19/26)] was obviously higher than that of control group [20% (4/20)], and the difference was statistically significant ($\chi^2 = 8.691$, $P = 0.003$).

The Change and Drop Rate of Serum Creatinine during Intravenous Injection Terlipressin

Compared with the control group (0.08 $\pm$ 0.37), the drop rate of serum creatinine in terlipressin group was -0.63 $\pm$ 0.25, and the difference was statistically significant ($t = 14.834$, $P = 0.000$) (Table 1). The dynamic detection on daily basis showed that the serum creatinine began to drop 2–3 days after intravenous injection of terlipressin, and the serum creatinine restored to normal in 11 patients after one course of treatment (4–8 days).

The effects of elevation coloclisis and combination of coloclisis and plasma exchange on hepatic failure and prognosis

Curative Effect and Prognosis

After 4 weeks of treatment, among 297 chronic hepatic failure patients, 256 showed excellent or good results, and the results were poor in 41. The causes of death

were progressive hepatic failure and various kinds of severe complications. The survival rates of coloclisis group, plasma exchange group and combination group were 82.19% (60/73), 87.5% (63/72) and 94.64% (106/112), respectively. Compared with the control group 46.34% (19/40), the differences were all statistically significant ($P = 0.001$, $P = 0.000$, $P = 0.000$).

After 4 weeks of treatment, the improve ratio of acratia, anorexia, abdominal distension and constipation in coloclisis group were 60.27%, 57.53%, 91.78% and 94.52%, which were were 71.83%, 69.44%, 75% and 72.22% in plasma exchange group, and 82.14%, 79.46%, 92.85% and 95.54% in combination group (Table 2 and Figure 2).

The Change and Drop Rate of Serum Total Bilirubin (TBil) during Coloclisis

The serum total bilirubin was detected before treatment, 2 weeks and 4 weeks after treatment, and the drop rates of total bilirubin were calculated (Table 3). The drop rates of coloclisis group, plasma exchange group and combination group were all obviously higher than that of control group 4 weeks after treatment, and the differences were statistically significant ($P = 0.031$, $P = 0.023$, $P = 0.027$). However, the differences were not statistically significant 2 weeks after treatment ($P =$

Figure 2. Comparison of clinical manifestations among groups after 4 weeks of treatment.

Table 2. Comparison of clinical manifestation between each group after 4 weeks of treatment

Groups	Acratia	Anorexia	Abdominal Distension	Constipation
Coloclysis group	60.27% (44/73)	57.53% (42/73)	91.78% (67/73)	94.52% (69/73)
Plasma exchange group	71.83% (51/72)	69.44% (50/72)	75.00% (54/72)	72.22% (52/72)
Combination group of coloclysis and plasma exchange	82.14% (92/112)	79.46% (89/112)	92.85% (104/112)	95.54% (107/112)
Control group	37.50% (15/40)	32.50% (13/40)	30.00% (12/40)	37.50% (15/40)

Table 3. Comparison of changes and drop rate of serum TBil during coloclysis

Groups	N	Serum TBil and drop rate ($\bar{x} \pm s, \%$)		
		Before treatment	2 weeks after treatment	4 weeks after treatment
Coloclysis group	73	384.7 $\pm$ 92.1	322.6 $\pm$ 103.7 (-0.16 $\pm$ 0.22)	169.3 $\pm$ 64.6 (-0.56 $\pm$ 0.16) ^a
Plasma exchange group	72	391.3 $\pm$ 97.4	317.8 $\pm$ 91.2 (-0.06 $\pm$ 0.21)	137.6 $\pm$ 71.1 (-0.52 $\pm$ 0.11) ^a
Combination group of coloclysis and plasma exchange	112	397.5 $\pm$ 103.8	304.0 $\pm$ 81.6 (-0.21 $\pm$ 0.17)	112.5 $\pm$ 61.6 (-0.63 $\pm$ 0.28) ^a
Control group	40	387.1 $\pm$ 94.3	394.8 $\pm$ 100.4 (0.02 $\pm$ 0.23)	310.6 $\pm$ 119.8 (-0.20 $\pm$ 0.17)

Notes: Analysis of variance revealed statistically significant difference among the four groups. Further SNK test showed that there existed statistically significant differences between treatment group and control group at the same time point ($P = 0.000$).

a: The drop rates of coloclysis group, plasma exchange group and combination group were all obviously higher than that of control group 4 weeks after treatment, and the differences were statistically significant ($P = 0.031, P = 0.023, P = 0.027$).

Table 4. Comparison of elevation rate of serum PTA during coloclysis

Groups	N	Serum PTA and drop rate ($\bar{x} \pm s, \%$)		
		Before treatment	2 weeks after treatment	4 weeks after treatment
Coloclysis group	73	27.41 $\pm$ 7.35	30.66 $\pm$ 7.86 (0.12 $\pm$ 0.18)	33.02 $\pm$ 9.46 (0.46 $\pm$ 0.17) ^a
Plasma exchange group	72	25.32 $\pm$ 7.21	31.35 $\pm$ 8.37 (0.08 $\pm$ 0.29)	39.62 $\pm$ 11.04 (0.17 $\pm$ 0.25) ^a
Combination group of coloclysis and plasma exchange	112	28.27 $\pm$ 8.16	33.23 $\pm$ 6.27 (0.14 $\pm$ 0.70)	40.99 $\pm$ 8.92 (0.45 $\pm$ 0.33) ^a
Control group	40	26.35 $\pm$ 7.69	25.56 $\pm$ 9.74 (0.03 $\pm$ 0.23)	25.02 $\pm$ 8.63 (0.02 $\pm$ 0.53)

Notes: Analysis of variance revealed statistically significant difference among the four groups. Further SNK test showed that there existed statistically significant differences between treatment group and control group at the same time point ($P = 0.000$).

a: The elevation rates of coloclysis group, plasma exchange group and combination group were all obviously higher than that of control group 4 weeks after treatment, and the differences were statistically significant ($P = 0.046, P = 0.016, P = 0.003$).

0.101, $P = 0.135, P = 0.068$).

The Elevation Rate of Serum Prothrombin Activity (PTA) during Coloclysis

The serum prothrombin activity was detected before treatment, 2 weeks and 4 weeks after treatment, and

the elevation rates of prothrombin activity were calculated (Table 4). The elevation rates of coloclysis group, plasma exchange group and combination group were all obviously higher than that of control group 4 weeks after treatment, and the differences were significant

($P = 0.046$, $P = 0.016$, $P = 0.003$). However, no statistically significant differences were found 2 weeks after treatment ($P = 0.164$, $P = 0.081$, $P = 0.114$).

DISCUSSION

Clinically, SBP is a common complication of hepatic failure, and represents a major cause of death in patients. The incidence of SBP, as a complication of hepatic failure, was somewhere between 17.7% to 47.0%.¹³ A survey on nosocomial infection in liver disease patients showed that the incidence of infection was highest in patients with severe viral hepatitis, and the abdominal cavity was the most commonly infected site. SBP refers to the infection of peritoneal cavity by bacteria originating from intestinal wall, blood or lymph system in the absence of infection of intra-abdominal neighboring organs (such as intestinal perforation, inflammation, etc.).¹⁴ Once occurring, SBP is difficult to control and tends to aggravate patients' condition. And it could induce renal failure secondary to spontaneous peritonitis. Its prognosis is poor and mortality rate is high.

The SBP takes place in patients with hepatic failure because of liver functions were seriously damaged by liver inflammation, pH in intestinal tract was lowered and mucosal barrier destroyed. Meanwhile, the altered environment of pathogenic bacteria inhibited T-cell immunity and decreased secretion of IgA lead to unchecked breeding of pathogenic bacteria, flora alteration, translocation of microorganisms and increased level of intestinal endotoxin. Especially, the chance of pathogenic bacteria immigrating to peritoneal cavity of cirrhosis patients is increased because of depressed immunity and increased portal venous pressure.¹⁵ The major abdominal symptom of SBP is abdominal distension, and about half of patients have persistent abdominal pain and pressure pain. But tension of abdominal muscles and rebound tenderness are less commonly seen. It suggests that the symptoms of toxemia were slight and the symptoms of peritoneal irritation were either absent or atypical in patients with hepatic failure complicated with SBP. Therefore, for severe hepatitis patients complicated with SBP who had serious ascites, these features should be taken into account and treatment should be started as soon as possible.¹⁶

Doctors have agreed concerning the combined modality therapy for hepatic failure complicated with SBP in many ways, such as early and sufficient treatment with bacteria-sensitive antibiotics (The third-generation cephalosporin is the drug of choice). In addition, symptomatic supporting therapy and immunity-promoting treatment should be adopted. The value of peritoneal tapping, irrigation and injection of antibiotics remain controversial. Some researchers

believed that peritoneal tapping is, to some extent, beneficiary, but it may cause electrolyte disturbances and hepatic coma, and peritoneal injection of antibiotics may induce drug-resistance.¹⁷ This study examined 171 hepatic failure patients complicated with SBP and the results showed that the results in survival rate and improvement of clinical symptoms and signs (abdominal pain, abdominal tenderness, rebound tenderness, ascites) of intraperitoneal injection group were significantly better than those of control group, suggesting that both peritoneal tapping and intraperitoneal injection of antibiotics were effective for the treatment of SBP. In clinical practice, we noticed that when intraperitoneal injection of bacteria-sensitive antibiotics was given immediately after deep abdominal pressure pain occurred (without symptoms of peritonitis), the clinical symptoms were quickly relieved. This can be explained by high concentration of antibiotics in abdominal cavity and reduced absorption of endotoxin. The injection of antibiotics could prevent liver functions from deteriorating quickly, and stop septic shock from happening, thereby improve prognosis and survival rate.

Hepatorenal syndrome (HRS) is the syndrome of kidney failure secondary to hepatic decompensation in severe liver diseases such as cirrhosis, hepatic failure. In this case, the renal impairment only involves functional change and is reversible. The pathogenesis of HRS is not fully understood, and it may have something to do with the general dilation of arterioles secondary to portal hypertension, which results in the decreased resistance of systemic circulation, lowered arterial hypotension and relative deficiency of effective circulation volume, thereby leading to the renal hypoperfusion and vasoconstriction, and eventually, renal failure results. The mortality of HRS was high and so far no effective therapeutic methods are available for HRS. Liver transplantation was believed to be a definitely effective treatment for HRS but the long-term result of renal transplantation is not satisfactory. Although the traditional therapies, including injection of isotonic saline solution, glucose, low molecular dextran, whole blood, plasma and albumin, can substantially increase blood volume, clinical symptoms and signs are not improved but even get worse due to severe water-electrolyte disturbances (hyponatremia and hypochlorinemia), decreased osmotic pressure of plasma and blood pressure, oliguria, alimentary tract hemorrhage, disseminated intravascular coagulation and hypotonic cerebrosis. Some patients die because of hypotonic shock and coma caused by hypotonic cerebrosis.

On the basis of understanding of the etiological factors and pathogenesis of HRS, 26 patients were treated by injection of terlipressin and satisfactory therapeutic effect was achieved. In the terlipressin group, improvement was attained in 19 cases. And

the survival rate and serum creatinine drop rate of the terlipressin group were significantly higher than those of control group. Terlipressin was a synthetic non-selective agonist of V1 vasopressin, and has strong vasoconstrictive effect. It works more on systemic circulation than on renal circulation. Terlipressin could cause re-distribution of blood flow, re-direct visceral blood flow to systemic circulation and elevate blood pressure, thereby increasing renal perfusion and lowering the activity of endogenous vasoactive substances and in the end, increasing the renal blood flow and GRF. In vivo, the residual group of glycine was decomposed and converted to vasopressin. Terlipressin can be given every 4 hours since its biological half-life is long. The injection action of terlipressin was 10 times of vasopressin. Terlipressin injection was one of the effective treatments for HRS.

Artificial liver supporting system has been effectively used for the treatment of hepatic failure in clinical practice¹⁸ and it substantially lowered the mortality of severe hepatitis. Currently, the middle-mode artificial liver was extensively used in China, and the plasma exchange is most popular. With plasma exchange, the patients' blood plasma is separated and discarded, and then replaced with fresh frozen plasma or replacement fluid containing albumin of equal volume. The plasma exchange could get rid of the metabolic toxins and pathogenic agents such as bilirubin and endotoxin in the body, and at the same time, provide large quantity of physiologically active substances such as proteins and blood coagulation factors. So the artificial liver (plasma exchange) could serve some functions of liver, thereby creating a good internal environment for patients with severe hepatitis. It provisionally stops the vicious cycle in which harmful substances damage liver.

The colon therapeutic apparatus provides an effective intracolonic dialysis system in colon. The specially-made perfusion probe unit can reach 50 cm further into enteric cavity. So it could fully clean the intestinal tract, and remove poisonous substances which were not neutralized by liver, thereby substantially decreasing the absorption of poisonous substances (ammonia, thiols) in intestinal tube, extending the area of dialysis was enlarged, and exploiting the potential of colonic mucosa and intestinal glands. It promotes the elimination of poisonous substances, enteral pathogen and bilirubin and thus improves the internal environment and maintains the balance of water, electrolytes and acid-base system. The coloclisis can serve as a new alternative for improving the quality of life of patients with hepatic failure.

This study examined the therapeutic effects of combined treatment of coloclisis and plasma exchange on severe hepatitis. The results showed that at the 4th week, the clinical symptoms (acratia, decreased food appetite, abdominal distension and constipation) of

the treatment group were obviously improved, and the results in survival rate, drop rate of serum creatinine and serum PTA in the treatment group were all significantly better than those of control group.

To sum up, on the basis of comprehensive treatment of the hepatic failure, it is necessary to intensively observe the condition of patients with hepatic failure patients, strengthen basic nursing, and identify and treat various kinds of complications as early as possible in order to minimize the possibility of the complications and death.

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