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Effects of fluid resuscitation under the guidance of PICCO on the immune function and inflammatory mediator in patients with septic shock.

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Abstract

Objective: To investigate the effect of fluid resuscitation under the guidance of Pulse indicator Continuous Cardiac Output (PiCCO) on the immune function and inflammatory mediator in patients with septic shock.

Methods: From February 2016 to May 2017, 88 septic shock patients referred to our hospital were selected and randomly divided into two groups (control group and study group) with 44 cases in each group. The control group were given treatment of liquid recovery under the guidance of central venous pressure while the study group were treated with fluid resuscitation under the guidance of PiCCO. Changes in patient condition, peripheral blood $CD4^+/CD25^+$ T regulator cells (Treg), miR-155, IL-10 and ET-1 expression, hemodynamics and oxygenation parameters, mechanical ventilation time and ICU stay evaluation were compared between the two groups.

Results: Compared with the control group, the study group had better performance in condition changes, peripheral blood $CD4^+$ $CD25^+$ Treg, miR-155, IL-10 and ET-1 expression, hemodynamics and oxygenation parameters along with shorter duration of mechanical ventilation and ICU stay of statistical significance, $P<0.05$.

Conclusion: The fluid resuscitation under the guidance of PiCCO in septic shock enables the patients to have stable change of condition, better improvement of peripheral blood $CD4^+/CD25^+$ Treg, miR-155, IL-10, ET-1 expression, hemodynamics and oxygenation parameters and moderately short duration of mechanical ventilation and ICU stay, thus worthy of clinical reference.

Keywords: PiCCO, Fluid resuscitation, Septic shock, Clinical effect.

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Introduction

Septic shock mainly refers to organ dysfunction or hypo-perfusion due to sepsis complicated with disorder of metabolism system and microcirculation system [1]. As an effective method for treatment of septic shock in clinical trials, fluid resuscitation can effectively alleviate the hypoxia condition of the body by increasing cardiac output, cardiac preload and peripheral tissue perfusion. The patients with septic shock have abnormal hemodynamics followed by certain changes of vascular permeability, thus increasing the difficulty in finishing fluid resuscitation and likely to raise the risk of acute heart failure and pulmonary edema in the case of excessive liquid recovery [2,3]. Therefore, the accuracy improvement of clinical evaluation under correct guidance of fluid resuscitation can effectively enhance the clinical efficacy of septic shock [4]. In this study, the effects of fluid resuscitation under the guidance of PiCCO on immune function and inflammatory mediators in septic shock patients were analysed as follows.

Materials and Methods

General materials

A total of 88 cases of septic shock patients treated in hour hospital from February 2016 to May 2017 were selected as the objects for statistical analysis and randomly divided into control group and study group with 44 cases in each group.

In the control group, there were 24 males and 20 females aged from 83 to 43 with an average age of 62.6 ± 7.4. In the study group, there were 23 males and 21 females aged from 84 to 44 with an average age of 63.5 ± 8.5. There was no significant difference in the above indicators between the two groups of comparability, $P>0.05$.

Research methods

The control group were given fluid resuscitation under the guidance of central venous pressure, which was maintained at the level of 8~12 mmHg. When the central venous pressure level was less than 8 mm Hg, the fluid resuscitation was performed and when the central venous pressure was beyond 12 mmHg, the fluid resuscitation was limited and instead the patients were given vaso-active agents therapy followed by keeping the central venous pressure more than 65 mmHg [5,6]. The study group received fluid resuscitation therapy under the guidance of PiCCO, which was conducted according to monitoring parameters of PiCCO. When ELWI was less than 7 ml/kg and ITBI less than 850 ml/m^3, the fluid resuscitation was performed and when ELWI ranged from 7 to 10 ml/kg and ITBI was over 1000 ml/m^2, the fluid resuscitation was limited [7,8]; If ELWI was beyond 10 ml/kg, the patients were given diuretic for the correction of water and electrolyte balance based on the treatment of limited fluid resuscitation [9,10].

Observation index

The patient's condition changes;

$CD4^+/CD25^+$ Treg in peripheral blood; the expression of miR-155, IL-10 and ET-1;

Hemodynamics and oxygenation parameters;

Mechanical ventilation time and ICU stay.

Statistical methods

The statistics of the observed indicators of this study was conducted on SPSS20.0. The measurement data including the change of disease, $CD4^+/CD25^+$ Treg in peripheral blood, expression of miR-155, IL-10 and ET-1, hemodynamics, oxygenation parameters, duration of mechanical ventilation and ICU stay were represented by mean ± standard deviation and tested by t-test. $P<0.05$ showed the difference had statistical significance.

Results

Disease changes

The disease changes in the study group were significantly better than those in the control group of statistical significance, $P<0.05$, as shown in Table 1.

The $CD4^+/CD25^+$ Treg in peripheral blood and the expression of miR-155, IL-10 and ET-1

The improvements of $CD4^+$ $CD25^+$ Treg in peripheral blood and miR-155, IL-10 and ET-1 expression of the study group were obviously better than those of the control group of statistical significance, $P<0.05$, as shown in Table 2.

Hemodynamic and oxygenation parameters

The improvement of hemodynamic and oxygenation parameters in the study group was significantly better than that in the control group, $P<0.05$, as shown in Table 3.

Mechanical ventilation time and ICU stay

In the study group, the mechanical ventilation time was 16.25 ± 5.28 d and ICU 6.32 ± 2.13 d while in the control group the mechanical ventilation time was 19.63 ± 9.63 d and ICU 10.36 ± 3.25 d of statistical significance, $P<0.05$, $t=9.57$; $t=11.25$.

Table 1. Comparison of disease changes between the two groups.

Group	Case	Blood pressure (mmHg)	Fluid volume (ml)	Lactic acid (mmol/L)	BNP (pg/ml)	Creatinine (μmol/L)
Study	44	119.26 ± 9.55	1733.58 ± 253.28	3.26 ± 0.14	154.06 ± 41.25	123.25 ± 48.75
Control	44	124.12 ± 48.45	2135.35 ± 205.42	3.28 ± 0.19	36.54 ± 48.72	115.23 ± 35.48
t	-	7.26	6.24	0.28	9.25	2.58
P	-	<0.05	<0.05	<0.05	<0.05	<0.05

Table 2. Comparison of $CD4^+/CD25^+$ Treg in peripheral blood and the expression of miR-155, IL-10 and ET-1 between the two groups.

Group	Case	$CD4^+/CD25^+$ Treg in peripheral blood	miR-155 (× 10^{-4} mg/L)	IL-10 (ng/L)	ET-1 (pg/L)
Study	44	2.75 ± 1.02	17.55 ± 4.52	34.53 ± 12.52	167.34 ± 25.32
Control	44	2.01 ± 0.85	8.22 ± 2.64	57.35 ± 16.45	252.34 ± 31.25
t	-	5.26	9.65	10.25	3.29
P	-	<0.05	<0.05	<0.05	<0.05

Table 3. Comparison of hemodynamic and oxygenation parameters between the two groups.

Group	Case	CVP (mmHg)	MAP (mmHg)	$ScvO_2$ (%)	PaO_2/FiO_2

Study	44	6.24 ± 1.26	61.22 ± 12.64	56.65 ± 7.96	376.88 ± 49.52	
Control	44	10.55 ± 1.35	76.89 ± 13.06	78.68 ± 10.24	336.98 ± 56.02	
t	-	6.35	5.28	5.24	6.28	
P	-	<0.05	<0.05	<0.05	<0.05	

Discussion

Septic shock is the frequent emergency severe case in clinic and has poor prognosis as well as high fatality rate with the main manifestation that persistent hypotension to certain extent still exists in the patients after the therapy of fluid resuscitation [11,12]. The patients would suffer severe infection, inflammation and pathogen toxin. Cytokines and inflammatory mediators in the body react in the tissues and organs of patients, leading to microcirculatory disturbance, ischemia, hypoxia and metabolic disorders [13,14].

According to this study, the study group had better performance, in comparison with the control group, in condition changes, peripheral blood $CD4^+/CD25^+$ Treg, miR-155, IL-10 and ET-1 expression, hemodynamics and oxygenation parameters along with shorter duration of mechanical ventilation and ICU stay of statistical significance, $P<0.05$. This is because: PiCCO monitoring parameters mainly include hemodynamic as well as blood and oxygen supply of organs and tissues. The monitoring has the advantages of low traumatic causes, very simple operation and accurate data. It enables to conduct continuous bedside monitoring of the patients' various indicators and reflect the degree of pulmonary edema as well as the circulation function of septic shock patients timely and accurately [15,16]. Clinicians can guide the patients to receive active and accurate fluid resuscitation treatment according to the monitoring parameters of PiCCO, which helps to accurately adjust the treatment degree of the liquid resuscitation and strictly control the dose of dobutamine and vasoactive drugs in patients [17,18]. The PiCCO monitoring makes for more effective fluid resuscitation in patients with septic shock and enables to perform early fluid resuscitation and monitor systemic volume status, ensure the perfusion of tissues and organs, positively reduce unnecessary transfusion and improve the immune status and the degree of inflammatory response in the patients [19,20].

To sum up, the fluid resuscitation under the guidance of PiCCO in septic shock enables the patients to have stable change of condition, better improvement of $CD4^+/CD25^+$ Treg in peripheral blood, expression of miR-155, IL-10, ET-1, hemodynamics and oxygenation parameters and moderately short duration of mechanical ventilation and ICU stay, thus worthy of further study and reference in clinical practices.

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