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Application value of limited fluid resuscitation in early treatment of hemorrhagic shock.

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Abstract

Objective: This study aims to explore clinical results of limited fluid resuscitation in early treatment of hemorrhagic shock and its effects on blood coagulation and arterial blood gas.
Methods: From June 2015 to April 2017, a total of 98 cases of hemorrhagic shock patients were selected in our hospital and divided into study group and control group according to the time of admission with 49 patients for each group. Patients in the control group received single positive capacity recovery method at the early stage of resuscitation while the patients in the study group were treated with limited fluid resuscitation followed by the positive capacity recovery method. Success rate, mortality and complication rate of shock therapy, blood coagulation function and blood gas index were compared in the two groups.
Results: Compared with the control group, the success rate of the study group was significantly higher and the mortality and the incidence of complications lower of statistical difference, P<0.05. What's more, with different treatment methods, the blood gas index and test results of coagulation function in the study group were significantly better than those of the control group of statistical difference, P<0.05.
Conclusion: Limited fluid resuscitation is worthy of promotion and clinical application with its desirable effects in early treatment of hemorrhagic shock. It can effectively raise the success rate and facilitate the recovery of blood gas index and coagulation function.

Keywords: Limited fluid resuscitation, Hemorrhagic shock, Early recovery, Application value.

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Introduction

Hemorrhagic shock, also known as hypovolemic shock, is a life-threatening condition that results when you lose more than 20 percent (one-fifth) of your body's blood or fluid supply. This severe fluid loss makes it impossible for the heart to pump enough blood to your body. This type of shock can cause many organs to stop working. There are often no advance warnings of shock. Instead, symptoms tend to arise only when you're already experiencing the condition. A physical examination can reveal signs of shock, such as low blood pressure and rapid heartbeat. Hemorrhagic shock is mainly treated by means of positive liquid resuscitation, which is, however, proved to cause some damages for the patients' body, thus making it very important to explore a more effective and harmless treatment method of hemorrhagic shock [1-3]. Researchers have proposed the treatment effect of limited resuscitation is better than that that of the positive flow recovery [4], as to which 98 hemorrhagic shock patients enrolled in our hospital from June, 2015 to April, 2017 were selected to participate in the study with good results reported as following.

Materials and Methods

General data

98 hemorrhagic shock patients enrolled in our hospital from June 2015 to April 2017 were selected as the objects in this study and all patients were diagnosed with hemorrhagic shock with the exclusion of major diseases like heart, lung liver and kidney illness. Patients were divided into study group and control group according to the time of admission with 49 cases in each group. Among the control group there were 28 males and 21 females, aged 20-53 y old, 34.2 ± 3.8 y old on the average, including 22 traumatic hemorrhagic shock patients, 14 hemorrhagic shock patients caused by acute gastrointestinal bleeding and 13 hemorrhagic shock cases caused by gynecological diseases; While among the study group there were 30 males and 19 females, aged 21-54 y old, 34.8 ± 3.7 y old on the average, including 20 traumatic hemorrhagic shock patients, 15 hemorrhagic shock patients caused by acute gastrointestinal bleeding and 14 hemorrhagic shock cases caused by gynecological diseases. There was no significant difference in general information of the patients in the two groups (P>0.05).

Recovery principle

Firstly, the condition of the patients with shock was rapidly and accurately assessed; blood clots, secretions and other debris inside of the respiratory tract were removed; patients took conventional oxygen inhalation to ensure the capability of breath and the heavier patients unable to breathe normally were treated with endotracheal intubation for assisted respiration. Indicators like electrocardiogram, blood pressure and pulse of the patients were monitored, with the establishment of two venous channels at least, the patient were treated with infusion of saline solution, colloid fluid and other liquid for resuscitation based on the actual situation. Comprehensive examination, including blood and skin preparations, was performed followed by a transfer of the patients to appropriate department for the next treatment.

Treatment methods

Control group: Patients received positive capacity recovery treatment with a maintenance of systolic pressure above 90~100 mmHg as the standard.

Study group: Patients received limited fluid resuscitation method with hydroxyethyl starch as colloid solution and Ringer's solution crystalloid liquid with a compound proportion of 1:2 in this study. Hemostatic treatment was conducted with systolic blood pressure of the patients controlled at the level of 70~80 mmHg followed by positive capacity resuscitation with same standard as the control group.

Clinical observation index

Success rate and mortality of hemorrhagic shock patients in the two groups; Complications including Multiple Organ Dysfunction Syndrome (MODS), pulmonary infection, Acute Respiratory Distress Syndrome (ARDS) and Disseminated Intravascular Coagulation (DIC). The comparison of coagulation function and blood gas index 2 h after treatment in the two groups; blood gas indexes including arterial oxygen pressure (PaO_2), Base Excess (BE), the change of pH in the blood and Blood Lactic Acid (BL) and partial pressure of carbon dioxide ($PaCO_2$); blood coagulation indexes including Prothrombin Time (PT), Thrombin Time (TT) and Partial Thromboplastin Time (APTT) [5-8].

Statistical approach

Count data were described as percentage and measurement data as mean ± standard deviation (mean ± SD). T test was applied of statistical significance, $p<0.05$. Statistical software: SPSS 19. 0 and Microsoft office excel.

Results

Comparison of success rate, mortality and complications

Compared with the control group, the treatment success rate of patients in the study group was significantly higher and the rate of mortality and complication rate were strikingly lower of statistical difference, $P<0.05$, shown in Table 1.

Comparison of blood gas index

After the treatment, PaO_2, BE and blood pH values of the patients in the study group were significantly higher while detection value of $PaCO_2$ and BL were lower by contrast of statistical difference $P<0.05$, shown in Table 2.

Comparison of coagulation function

With different methods of treatment for 2 h, three indexes of coagulation function of the study group were significantly lower than those of the control group of statistical difference ($P<0.05$) shown in Table 3.

Table 1. *Comparison of success rate, mortality and complications in the two groups.*

Group	Success rate	Mortality	Pulmonary infection	MODS	ARDS	DIC
Study	47 (95.92)	2 (4.08)	4 (8.16)	2 (4.08)	3 (6.12)	1 (2.04)
Control	41 (83.67)	8 (16.33)	11 (22.45)	9 (18.37)	12 (24.49)	9 (18.37)
χ^2	4.009	4.009	3.857	5.018	6.376	7.127
P	0.045	0.045	0.049	0.025	0.012	0.008

Table 2. *Comparison of blood gas indexes in the two groups 2 h after treatment.*

Group	PaO_2	$PaCO_2$	BE	BL	pH value
Study	93.12 ± 1.23	25.14 ± 2.38	-3.95 ± 1.32	5.22 ± 1.43	7.06 ± 0.08
Control	80.56 ± 1.48	31.35 ± 2.76	-7.49 ± 1.21	6.34 ± 1.58	7.39 ± 0.02
t	45.687	11.928	13.838	3.679	28.013
P	0.017	0.036	0.025	0.015	0.041

Table 3. *Comparison of coagulation functions in the two groups 2 h after treatment.*

Group	PT (s)	APTT (s)	TT (s)
Study	10.02 ± 1.35	32.16 ± 2.25	14.12 ± 1.73
Control	12.11 ± 1.38	36.71 ± 2.43	17.46 ± 1.85

t	7.578	9.617	9.231
P	0.022	0.039	0.025

Discussion

Hemorrhagic shock is the shock resulting from massive blood loss, mainly including trauma bleeding and massive hemorrhage caused by digestive system lesion, gynecological diseases or rupture of esophageal varices [9-13]. Whether shock occurs or not after massive blood loss is not only directly related to the amount of bleeding, but also relevant to the blood loss rate. The occurrence of hemorrhagic shock depends on following conditions: the amount of blood loss is greater than 1/3 of the total blood volume with a moderately rapid rate and no blood can be provided to make timely supplement [14,15].

All the time, medical scholars and experts have been carrying out in-depth studies on the pathophysiology and pathogenesis of hemorrhagic shock. As the pathogenesis and the cause of the disease are gradually clear, success rate of the early recovery treatment is rising, but the mortality due to the failure of treatment remains no significantly less than before [16]. And main causes of death include tissue hypo-perfusion and mass blood loss, which is likely to cause multiple organ dysfunction syndromes for the patients and then make them end up in death due to the failure of timely treatment. A large number of clinical researches and experience have confirmed that before effectively controlling the bleeding conditions of the patients with hemorrhagic shock, the treatment of positive recovery therapy would affect the blood coagulation function, cause dilutional coagulopathy or elevated blood pressure after resuscitation and lead to a second bleeding due to gradual falling of blood clots in blood vessels; The recovery treatment dilutes the blood of patients, causes lower hemoglobin levels in the blood and a lack of oxygen, thus raising mortality of patients. Therefore, the application effects of positive fluid resuscitation fail to be desirable, thereby limited fluid resuscitation method comes into being [17-19]. The limited fluid resuscitation method means treating the patients with small volume fluid resuscitation firstly before the effective control of bleeding conditions with the inclusion of hypotension in a short period. Perfusion into important organs and oxygen supply are maintained for the patients to avoid excessive dilution of blood. Then the hemostatic treatment is taken followed by positive volume fluid resuscitation. Early resuscitation of hemorrhagic shock patients is a damage process of “ischemia-reperfusion” and the treatment of limited fluid resuscitation enables to effectively reduce the content of reactive oxygen species produced during reperfusion, has good inhibitory effects on the production of inflammatory mediators, effectively improves the patient's immune response, considerably decreases the activity of NF-kB and expression of mRNA in PBMC and prevents excessive release of inflammatory factors [20]. In addition, it can also effectively suppress inflammatory reaction and SIRS, alleviate and inhibit the inflammatory reaction caused by platelet activating factor after hypovolemic shock, decrease accumulation of neutrophils in the lung tissues, inhibit the immune response induced by the activation of neutrophils, thus significantly lessening the complication rate after the treatment [21].

The results of this study showed that the treatment success rate, complication rate and recovery of blood coagulation function and blood gas indexes of the patients in the study group were all significantly better than those of the patients in the control group of statistical significance ($P<0.05$), proving the limited fluid resuscitation has higher application value in clinical practices.

Conclusion

Limited fluid resuscitation is a new type of emergency resuscitation, which is worthy of application and promotion with good effects and value in the early recovery of hemorrhagic shock.

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