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Original Article

The changes of triacylglycerol and inflammatory factors during dialysis treatment of hypertriglyceridemia during pregnancy and analysis of nursing countermeasure

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Abstract: Objective: To investigate the changes of triacylglycerol and inflammatory factors after hypertriglyceridemia acute pancreatitis (HTG-AP) dialysis during pregnancy and to analyze the nursing strategies. Methods: 50 patients treated with HTG-AP dialysis in our hospital from February 2017 to June 2019 were selected. The patient's vital signs, triglyceride (TG), total cholesterol (TC), TG and TC decline rates before treatment, 1, 3, and 5 days after treatment and inflammatory factors [tumor necrosis factor-α (TNF-α), Interleukin-1β (IL-1β), Interleukin-6 (IL-6), Interleukin-10 (IL-10) level changes] were measured, as well as the acute physiological and chronic health evaluation II (APACHEII), multiple organ dysfunction syndromes (MODS), systemic inflammatory response syndrome (SIRS) and maternal treatment outcomes. Results: There was no significant change in body temperature before and after treatment (P>0.05); The heart rate, WBC, CRP before and after treatment were statistically different (P<0.05); Compared with before treatment, serum levels of TG and TC significantly decreased after treatment, and the rate of decrease was significantly increased (P<0.05); Compared with before treatment, the levels of inflammatory factors (TNF-α, IL-1β, IL-6, IL-10) gradually decreased after treatment, and the serum levels of patient's TNF-α, IL-1β, IL-6, IL-10 after 5 days of treatment were more significant (P<0.05); Compared with before treatment, APACHEII, MODS and SIRS scores significantly decreased after treatment, and APACHEII, MODS and SIRS scores were better after 5 days of treatment (P<0.05); The mortality rate during treatment was 2.00%; the complication rate was 32.00%, including 5 cases of acute respiratory distress syndrome, 4 cases of pleural effusion, 4 cases of lung infection, 2 cases of acute renal insufficiency and 1 case of shock. Conclusion: Dialysis treatment can promote the recovery of HTG-AP patients promptly, improve triglycerides, and reduce inflammation. After the targeted nursing intervention, the treatment efficacy significantly improved.

Keywords: Pregnancy, hypertriglyceridemia, acute pancreatitis, triacylglycerol, inflammatory factors

Introduction

Pregnant women often consume many high-protein and high-calorie foods during pregnancy, which increase serum triglycerides. On the other hand, pregnant women are in a hyperlipidemia state due to change of hormone levels and lipid metabolism during pregnancy [1]. Hyperlipidemia increases the blood's viscosity and impairs the pancreas' microcirculation. Secondly, the decomposition of a large number of triglycerides in the blood produces abundant free fatty acids, which infiltrate the pancreatic cells and induce pancreatic inflammation and necrosis [2]. Consequently, acute pancreatitis with hypertriglyceridemia (HTG-AP) during pregnancy is commonly seen over these years, especially in late pregnancy [3]. A significant quantity of exudate can cause an inflammatory response in the patient's abdominal cavity [4] that inflammatory cascade is triggered, and the fetus is seriously threatened [5]. If timely treatment is not given, it can increase the risk of premature delivery, miscarriage, and stillbirth [6]. A series of systemic inflammatory response syndromes and multiple organ dysfunctions can arise in patients [7, 8]. Therefore, it is a critical to remove harmful substances in the body as soon as possible, to reduce the systemic inflammatory response, and to increase

the fetus' survival rate. Dialysis treatment can expel all kinds of harmful and excess metabolic waste and excessive electrolytes from the body. As a result, the level of inflammation in patients will be improved in a short period of time [9]. It is also critical to monitor the status of triacylglycerol and inflammatory factors in HTG-AP dialysis treatment during pregnancy and take corresponding nursing measures. To date, no specific clinical treatment options have yet been proposed on hypertriglyceridemia of pregnancy, and no consensus has been reached on the best treatment for acute pancreatitis caused by hypertriglyceridemia of pregnancy. This study was designed to explore the clinical treatment effects of pregnant HTG-AP dialysis by evaluztion of the changes in the levels of triglycerides and inflammatory factors.

Materials and methods

General information

Fifty pregnant HTG-AP dialysis patients admitted to our hospital from February 2017 to June 2019 were enrolled, aged 25 to 35 (29.62± 3.14) years old, and 26 to 36 (30.34±2.58) weeks of gestation. Inclusion criteria: ① Pregnant patients; ② Patients who met the diagnostic criteria of HTG-AP [10]: Acute pancreatitis (AP) and serum triacylglycerol >11.3 mmol/L or serum triacylglycerol in the range of 5.65 to 11.3 mmol/L, chloroform serum; ③ Patients or whose family members signed informed consent. Exclusion criteria: ① Patients who have undergone dialysis outside the hospital; ② Patients with contraindications related to hemodialysis; ③ Patients with severe disorders of essential organ functions and hematopoietic system. According to the *Guidelines for the Diagnosis and Treatment of Acute Pancreatitis in China* [11], 12 cases were classified as severe acute pancreatitis (SAP), 28 as moderately severe acute pancreatitides (MSAP), and 10 as mild acute pancreatitis (MAP). The approval has been obtained from the ethics committee of our hospital.

Methods

Dialysis treatment

① Monitor the vital signs and organ function, and observe the fetal condition, including fluid resuscitation, maintaining a stable internal environment, organ function support treatment, early enteral nutrition, anti-infective drugs, and monitoring fetal heart rate. ② Establish vascular access: Use central vein (right internal jugular vein or right femoral vein) to puncture and place the tube (11.5 Fr). ③ Treatment of extracorporeal circulation tubing: Rinse with normal saline (1 L) before dialysis, then circulate near with heparin saline (12,500 U of heparin, 0.5 L of normal saline) for 20 min, and then rinse with 0.5 L of saline. ④ Anticoagulation treatment: 3000 U of heparin was injected after the completion of the vascular access and pumped continuously for 1000 U/h. During the treatment, the activated coagulation time is monitored (200-250 s), and the drug is suspended 0.5 h before the end of the treatment. ⑤ Use hemodialysis treatment equipment with the blood flow rate of 125 mL/min and the plasma separation and replacement rate of 25 mL/min; The total replacement plasma volume is 1 PV (mL) = (1-Hct) × (864+ 47.2 × W), of which Hct is Hematocrit, W is body weight (kg). Calcium gluconate 1 g/h is pumped continuously during treatment, with the course of 6 hours.

Nursing methods

Medical staff should pay attention to the prevention and nursing care of related complications. During the dialysis treatment, whether the patient had bleeding should be observed. If there was coagulation disorder, the staff should adjust the heparin amount according to the patient's symptoms. Due to the sudden onset of the disease, patients were more prone to fear, depression, and anxiety. Therefore, medical staff should provide targeted psychological counseling to keep patients in a good mood and introduce relevant treatment knowledge. Besides, medical staff should eliminate patients' psychological concerns, so that they could maintain a stable mood for treatment and nursing care.

Observation indicators

(1) Vital signs, triacylglycerol, and inflammatory factor levels. The body temperature and heart rate are measured by thermometer and sphygmomanometer before treatment, and 1 d, 2 d, 3 d and 5 d after treatment; The patient's blood sample is collected to detect the white blood

Table 1. Changes in vital signs before and after treatment ($\bar{x} \pm s$)

Timing	Body temperature (C°)	Heart rate (n/min)	WBC (10^9/L)	CRP (ng/L)
Before treatment	37.40±0.73	110.22±8.68	12.46±3.68	147.08±50.28
1 d after treatment	37.30±0.68	111.71±7.60①	11.51±2.84①	108.45±43.20①
3 d after treatment	36.92±0.65	89.78±6.73②	10.40±2.37②	75.64±28.65②
5 d after treatment	36.80±0.64	81.49±5.70③	8.78±1.69③	44.60±25.43③
F	0.005	214.00	16.620	66.010
P	0.995	<0.001	<0.001	<0.001

Note: ①means P<0.05 compared with that before treatment within the group; ②means P<0.05 compared with 1 d after treatment within the group; ③means P<0.05 compared with 3 d after treatment within the group.

Table 2. Comparison of changes in serum TG and TC levels and reduction rates before and after treatment ($\bar{x} \pm s$)

Timing	TG (mmol /L)	TG reduction rate (%)	TC (mmol /L)	TC reduction rate (%)
Before treatment	25.71±4.68	-	14.71±5.79	-
1 d after treatment	13.42±3·05①	30.23±20.44	11.38±4.83①	22.71±14.46
3 d after treatment	7.34±1.35①,②	43.42±24·89[a]	9.77±3.62①,②	30.71±13.38[a]
5 d after treatment	3.12±0.52①,②,③	50.02±13.80[a,b]	4.90±2.38①,②,③	45.71±13.10[a,b]
F/X²	580.5	12.420	46.640	36.540
P	<0.001	<0.001	<0.001	<0.001

Note: ①means P<0.05 compared with that before treatment within the group; ②means P<0.05 compared with 1 d after treatment within the group; ③means P<0.05 compared with 3 d after treatment within the group; [a]means P<0.05 compared with 1 d after treatment; [b]means that P <0.05 compared with 3 d after treatment.

cell count (WBC), C-reactive protein (CRP), triglyceride (TG), total cholesterol (TC), tumor necrosis factor-α (TNF-α), and interleukin-1β (IL-1β), interleukin-6 (IL-6), interleukin-10 (IL-10) level changes. (2) TG and TC reduction rate. (3) Symptoms and signs scores. The acute physiological and chronic health evaluation II (APACHE II score), multiple organ dysfunction syndromes (MODS), and systemic inflammation response syndrome (SIRS) are employed to respectively evaluate the clinical signs of patients before dialysis treatment, and 1 d, 2 d, 3 d, and 5 d after treatment. (4) The outcome of maternal medicine. The mortality and complication rate are mainly involved.

Statistical methods

SPSS23.0 software was applied for data analysis. Quantitative data were described by mean ± standard deviation ($\bar{x} \pm s$), and the comparison of each index at different time points before and after treatment was conducted by repeated-measures analysis of variance. The adjustment test level of the pairwise comparison within the group was $\alpha = 0.05/6 = 0.008$, and the difference was statistically significant with P<0.008.

Results

Comparison of changes in vital signs before and after treatment

There was no significant change in body temperature before and after treatment (P>0.05); the difference in heart rate, WBC, CRP, and APACHE II scores before and after treatment was statistically significant (P<0.05). See **Table 1**.

Comparison of changes in serum TG and TC levels and reduction rates of patients before and after treatment

Compared with before treatment, serum TG and TC levels were significantly reduced after treatment, and the reduction rate significantly increased (P<0.05). See **Table 2**.

Changes in inflammatory factor levels before and after treatment

Compared with before treatment, the levels of inflammatory factors (TNF-α, IL-1β, IL-6, IL-10) gradually decreased after treatment, and the decrease was more noticeable after 5 d of treatment (P<0.05). See **Table 3**.

Table 3. Changes of inflammatory factor levels before and after treatment ($\bar{x} \pm s$)

Timing	TNF-α (pg/mL)	IL-1β (pg/mL)	IL-6 (pg/mL)	IL-10 (pg/mL)
Before treatment	415.61±56.48	95.31±17.98	300.28±44.26	378.63±54.97
1 d after treatment	271.61±45.29①	59.04±11.36①	198.25±34.25①	182.52±35.81①
3 d after treatment	213.54±35.17②	48.21±7.15②	142.16±30.14②	153.78±29.69②
5 d after treatment	148.61±25.48③	36.13±6.04③	108.24±22.35③	128.29±23.43③
F	363.8	241.5	310.9	453.7
P	<0.001	<0.001	<0.001	<0.001

Note: ①means P<0.05 compared with that before treatment within the group; ②means P<0.05 compared with 1 d after treatment within the group; ③means P<0.05 compared with 3 d after treatment within the group.

Table 4. APACHEII, MODS and SIRS score before and after treatment ($\bar{x} \pm s$)

Timing	APACHEII (point)	MODS (point)	SIRS (point)
Before treatment	17.59±3.37	17.60±3.42	16.87±3.11
1 d after treatment	13.21±2.58①	11.30±2.60①	13.18±2.68①
3 d after treatment	11.17±1.35②	9.64±1.37②	10.82±1.30②
5 d after treatment	10.01±0.61③	8.53±0.73③	9.46±0.53③
F	110.200	157.300	111.900
P	<0.001	<0.001	<0.001

Note: ①means P<0.05 compared with that before treatment within the group; ②means P<0.05 compared with 1 d after treatment within the group; ③means P<0.05 compared with 3 d after treatment within the group.

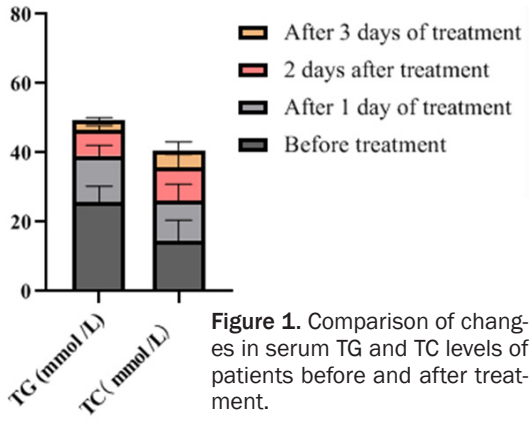

Figure 1. Comparison of changes in serum TG and TC levels of patients before and after treatment.

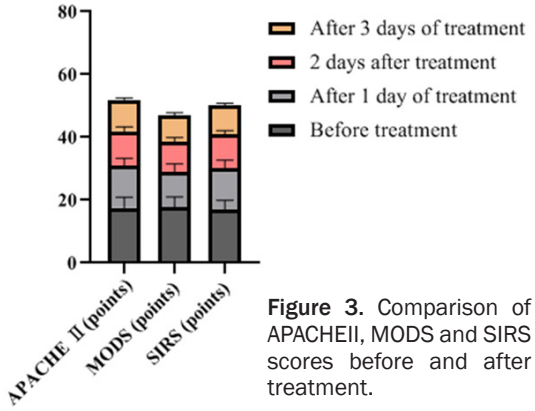

Figure 3. Comparison of APACHEII, MODS and SIRS scores before and after treatment.

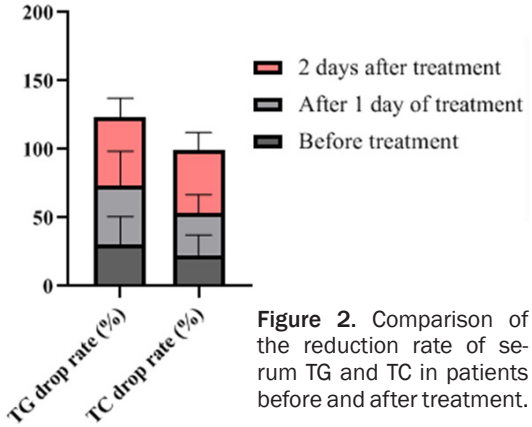

Figure 2. Comparison of the reduction rate of serum TG and TC in patients before and after treatment.

Comparison of APACHEII, MODS and SIRS scores before and after treatment

Compared with before treatment, APACHEII, MODS, and SIRS scores were significantly reduced after treatment, and APACHEII, MODS, and SIRS scores were more satisfactory after 5 d of treatment (P<0.05). See **Table 4** and **Figures 1**-**3**.

Maternal treatment outcome

During treatment, the mortality rate was 2.00% (1/50); the complication rate was 32.00%

Table 5. Maternal treatment outcome

Treatment outcome		N (%)
Mortality		1 (2.00)
Complication	Total	16 (32.00)
	Pleural Effusion	5 (10.00)
	ARDS	4 (8.00)
	Lung Infection	4 (8.00)
	Acute Renal Insufficiency	2 (4.00)
	Shock	1 (2.00)

(16/50), including 5 cases of ARDS, 4 cases of pleural effusion, 4 cases of lung infection, 2 cases of acute renal insufficiency and 1 case of shock. See **Table 5**.

Discussion

Due to the change of hormone levels in pregnant women, the synthesis of lipoproteins and metabolic disorders increases, which promotes the gradual growth of blood lipid levels, especially the level of triacylglycerol. Coupled with the irrational diet and high-frequency intake of high-fat foods, the risk of hyperlipidemia is aggravated [12]. Hyperlipidemia is one of the causes of AP [13]. Previous studies [14] revealed that AP is closely related to serum triacylglycerol levels. The mechanism of hyperlipidemia is mainly through the interaction between the increase of free fatty acids, the activation of inflammatory factors, and the decrease of trypsin activity, which promotes the pancreas' inflammation, thereby causing inflammation of the pancreatic tissue. High serum triglyceride levels can damage the pancreas' protective barrier of the pancreas, affect self-digestion and the pancreatic enzyme activation, release quantity of pro-inflammatory factors, and finally trigger a cascade effect [15]. Therefore, monitoring triacylglycerol levels during pregnancy is of particular importance for treatment and early prevention of AP. Besides, AP is also closely associated with the level of inflammatory factors [16]. Pro-inflammatory factors such as TNF-α, IL-1, and IL-6 can promote and enhance the inflammatory response process, and anti-inflammatory factors such as IL-10 can reduce or even terminate the inflammatory response [17]. Consequently, it is the primary goal of treating HTG-AP patients to minimize serum TG levels.

In this study, we detected significantly decreased serum TG and TC levels after treatment, compared with before treatment, and the rate of decrease also significantly increased. By monitoring the changes in serum triacylglycerol and inflammatory factor levels during dialysis in HTG-AP patients, it was found that as the dialysis time increased, TNF-α, IL-1β, IL-6, and IL-10 in the patient's body gradually decreased. This is because dialysis treatment can remove harmful substances such as cytokines and inflammatory factors, block the inflammatory response, improve organ function, and restore the patient's immune function. TNF-α is an early cytokine elevated in pancreatitis, and plays an essential role in AP's pathogenesis, such as triggering and initiation. It can even cause waterfall reactions in other factors, leading to inflammation and MODS [18]. IL-6 can act on vascular endothelial cells and increase their permeability, leading to the exudation of inflammatory substances. Related studies demonstrated that [19] the level of serum TNF-α can reflect AP's severity and is closely related to its prognosis. The results of this study confirmed that as the time of dialysis treatment increased, the patient's APACHEII, MODS and SIRS scores gradually decreased, indicating that the patient's condition gradually improved during dialysis. APACHEII score is a clinically used system to evaluate the severity of the disease. It is in the form of a score according to the signs, symptoms, and major organ functions of patients with AP [20]. In this study, the patients' APACHEII score decreased after dialysis treatment, suggesting that dialysis treatment has a significant therapeutic effect on patients. The inflammatory response caused by HTG-AP can damage vascular endothelial cells and change the permeability of blood vessels, thereby cause damage to the functions of the kidney, lung, heart, liver, and other organs, resulting in MODS. This study showed that after dialysis treatment and nursing intervention, the patients had a satisfactory pregnancy outcome.

To quickly, effectively, and safely reduce the patient's serum TG, TC, TNF-α, IL-1β, IL-6, IL-10 levels during the treatment, the main nursing measures were implemented in this paper as follows. ① Negative emotions such as tension and anxiety are inevitable since most patients may undergo dialysis for the first time. Medical staff should provide targeted psychological

counseling to ensure patients maintain a good mood, instruct relevant treatment knowledge and successful cases, and build confidence and avoid adverse events. ② Strictly check the dialysis equipment to ensure that the equipment is fixed correctly. The pipeline is installed accordingly to prevent problems such as twisting and falling off the blood vessels and ensuring sufficient blood flow. ③ Closely monitor the puncture site for bleeding and oozing to avoid infection at the puncture site. ④ If the patient has bleeding gums, gastrointestinal bleeding, or bleeding from puncture needles, the anticoagulant dosage must be adjusted. ⑤ Carefully observe the patient's vital signs, state of consciousness, body temperature, etc., and prepare for cesarean section at any time to avoid fetal suffocation and death. Record information such as internal drainage volume and urine output within 24 h, and adjust the speed and dosage of fluid infusion or hemofiltration dehydration according to the patient's condition to balance the intake and work and avoid acute lung injury, acute renal failure, and other complications. ⑥ Fasting can reduce gastrointestinal pressure. ⑦ Pay close attention to the patient's serum triacylglycerol, TNF-α, IL-1β, IL-6, IL-10 levels, so as to acknowledge the patient's disease progression in time to adjust the treatment scheme. However, there are still disadvantages in this study. It is an observational study with a small number of participants and short follow-up. A randomized controlled study with a large sample is needed to confirm this conclusion.

To conclude, dialysis treatment can promote the early recovery of HTG-AP patients, improve triglyceride levels, and reduce inflammation. After the targeted nursing intervention, the treatment outcome is more satisfactory.

Disclosure of conflict of interest

None.

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