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Original Article

Comparison of therapeutic effects of peritoneal dialysis on uremia patients with diabetic nephropathy and non-diabetic nephropathy

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Abstract: Objective: To compare therapeutic effects of peritoneal dialysis on uremia patients with diabetic nephropathy and non-diabetic nephropathy. Methods: Forty patients with non-diabetic nephropathy uremia (Group A) and forty with diabetic nephropathy uremia (Group B) treated in our hospital from May 2014 to May 2016 were selected. All patients in two groups were treated with peritoneal dialysis. Dialysis duration, urine volume, serum creatinine, urea nitrogen, triglyceride, cholesterol, hemoglobin, serum albumin, blood calcium, blood phosphorus levels, calcium-phosphorus product, as well asthe incidences of peritonitis and cardiovascular disease were statistically analyzed.Results: Dialysis duration in Group A was significantly longer than that in Group B (P=0.032); urine volume in Group A was obviously more than that in Group B (P=0.001). Urea nitrogen content in Group A was less than that in Group B (P=0.026) after peritoneal dialysis; while the difference of serum creatinine between two groups was not significant (P=0.08). The incidences of peritonitis and cardiovascular disease in Group A were both significantly lower than those in group B (P<0.001, P=0.001). After dialysis, triglyceride, cholesterol and serum albumin levels in Group A were substantially lower than those in Group B (P=0.047, P=0.018, P=0.028), while hemoglobinin Group A was higher than that in Group B (P=0.023). Blood calcium level and calcium-phosphorus product of patients in Group A were obviously higher than those in Group B (P=0.047, 0.013); blood phosphorus level in Group A was significantly lower than that in Group B (P=0.036). Conclusion: The therapeutic effects of peritoneal dialysis on uremia patients with non-diabetic nephropathy are better than those with diabetic nephropathy, for the lower incidences of peritonitis, cardiovascular disease and malnutrition in the uremia patients with non-diabetic nephropathy.

Keywords: Peritoneal dialysis, non-diabetic nephropathy uremia, therapeutic effects, peritonitis, malnutrition

Introduction

Chronic kidney disease is very common in clinic. The findings of epidemiological investigation indicate that the prevalence of chronic kidney disease is about 8% to 9% in people over 40 years old in China [1, 2]. Meanwhile, the growth rate of patients with end-stage renal disease reaches more than 10% per year; among the various causes, the most main cause is chronic renal failure, followed by diabetic nephropathy [3]. Peritoneal dialysis treatment is the major method used in clinical practice now [4, 5]. In end-stage renal disease, renal replacement therapy has significant therapeutic effects; however, along with the limited donor resource, it is still covering high prevalence of cardiovascular side effects, high mortality, as well as the poor prognosis [6, 7]. Therefore, in the treatment of end-stage renal disease, peritoneal dialysis becomes an important substitute of renal replacement therapy.

Diabetic nephropathy patients suffer from many complications, including multiple complications of end-stage kidney disease, and complications of diabetes, especially the malnutrition, cardio-cerebral vascular lesion, etc. [8, 9]. In the meantime, it also has short survival period, high mortality, poor life quality and high morbidity and morbidity [10]. In addition, it shows high dialysis withdrawal rate and high demands for medical care. The donor shortage restricts kidney transplant; besides, the older age, multiple complications, poorer physical conditions of most diabetic nephropathy pa-

tients make it more difficult for them to carry out kidney transplant than those with non-diabetic nephropathy. Peritoneal dialysis usesthe body's own peritoneum as a dialysis membrane. Dialysis fluid is injected into abdominal cavity, and then excessive metabolite and moisture in the body are discharged by ultrafiltration and diffusion [11, 12]. Peritoneal dialysis is becoming the first choice for diabetic nephropathy patients in renal replacement therapy.

This study is to compare and discuss the therapeutic effects of peritoneal dialysis on uremia patients with or without diabetic nephropathy. Reports are as follows.

Materials and methods

Object of study

Forty uremia patients with non-diabetic nephropathy and forty with diabetic nephropathy treated in our hospital from May 2014 to May 2016 were selectedby pair principle, they were all in the late uremia stage. The peritoneal therapy was approved by Ethics Committee and all patients had signed informed consents.

Inclusion criteria: All the patients who were ≥18 years old with renal biopsy report of decompensated chronic kidney failure, accepting and maintaining peritoneal dialysis therapy (9-12 h/week).

Exclusion criteria: The patients with diabetes combined with other serious complications concerning heart, brain, lung, etc.

Catherization for peritoneal dialysis

Catherization for peritoneal dialysis was performed by three experienced nephrologists. Under general anesthesia, an incision was performed on the central line. Nephrologists regularlydisinfected theskin, incised patients' skin, blunt dissected subcutaneous tissues, made a small incision on the peritoneum, which was only available to a Tenckhoff peritoneal dialysis tube, and madea circle of purse-string sutureround the incision without ligation temporarily. Then they soaked the terylene cover with sterile saline, inserted the guidewire into the peritoneal dialysis tube, took peritoneum gently, inserted the tube into the abdominal cavity, placed the tube at the end of the bladder/uterus-rectum-fossa, pulled out thewire guide, and heparin saline rinse and smooth drainage were adopted. At last, they tightened the purse string and tied the peritoneum; sutured rectus sheath, fixed internal terylene coverinto the rectus abdominis, connected the catheter to the tunnel needle, constructed subcutaneous tunnel in the fat layer of the abdominal wall following the tube, introduced the dialysis tube; fixed externalterylene coverinto subcutaneous 1 to 1.5 cm of the inner side of tunnelportal; closed the tube, sutured subcutaneous fat and skin incisionlayer by layer, and applied sterile dressing.

Dialysis methods

Patients in both groups were treated by peritoneal dialysis. Ultrabag peritoneal dialysis fluid (Baxter Medical Supplies Co., Ltd.) was adopted to treat patients by continuous ambulatory peritoneal dialysis. Dialysis solutions were injected for 4 times per day with 2,000-2,500 ml each time. The daily exchange volume was more than 8,000 ml, and its constituents including sodium (132 mmol/L), calcium (1.77 mmol/L), magnesium (0.25 mmol/L), chloride (96 mmol/L) and lactate (40 mmol/L). At the same time, diuretics and hematonic were applied according to patients' actual conditions to maintain blood pressure and blood glucose, and correct the acidosis. Common used medicines included ferrous succinate tablets, sodium bicarbonate, furosemide, etc., and patients' blood pressure, and blood glucose were periodically monitored. Peritoneal dialysis was stopped when the level of serum creatinine reached 44-133 μmol/L and urea nitrogen reached 9-20 mg/dL.

Observation measurements

The dialysis duration and urine volume of all patients were recorded; the levels of serum creatinine and urea nitrogen were detected; the treatment effect was evaluated; peritonitis, cardiovascular disease, and other adverse reactions were recorded. In addition, follow-up was carried out every six months until December 2016. During the follow-up, triglyceride and cholesterol were recorded, the levels of hemoglobin, serum albumin, blood calcium, and blood phosphorus were tested, and then calci-

Table 1. Comparison of general data before dialysis between two groups

	Group A	Group B	t/X^2	P
Cases	40	40		1
Male/Female	18/22	20/20	0.201	0.654
Age	59.6±8.6	60.3±8.4	0.136	0.9496
Chronic glomerulonephritis	18	-	-	<0.001
Hypertensive nephropathy	11	-	-	<0.001
Obstructive nephropathy	6	-	-	<0.001
Other primary diseases	5	-	-	<0.001
Hypertension	12	19		0.108
Blood glucose concentration (mmol/L)	5.2±0.9	10.3±1.2	-5.889	0.004
Serum creatinine before treatment (μmol/L)	420±122	424±120	-0.013	0.990
Glomerular filtration rate before treatment (ml/min)	6.2±2.4	5.2±2.2	0.532	0.623
Urea nitrogen before treatment (mmol/L)	24±12	22±13	0.196	0.854
Triglyceride (mmol/L)	5.21±0.8	5.56±0.7	-0.603	0.579
Cholesterol (mmol/L)	1.60±0.5	1.62±0.6	-0.044	0.967
Hemoglobin (g/L)	74.3±5.6	74.1±4.9	0.047	0.965
Blood calcium (mmol/L)	3.8±1.8	3.1±1.7	0.49	0.650
Blood phosphorus (mmol/L)	2.6±1.3	3.2±1.4	-0.544	0.615

Note: Group A, non-diabetic nephropathyuremia group; Group B, diabetic nephropathy uremia group.

Table 2. Comparison of the levels of dialysis duration, urine volume, serum creatinine and urea nitrogen between two groups ($\bar{x} \pm s$)

Groups	Case	Dialysis duration (d)	Urine volume (ml/d)	Serum creatinine (μmol/L)	Urea nitrogen (mmol/L)
Group A	40	26.3±2.2	744±30.4	150±25	10.8±1.7
Group B	40	20.1±2.5	550±29.4	190±20	16.2±2.1
t		3.225	7.945	4.869	3.362
P		0.032	0.001	0.08	0.026

Note: Group A, non-diabetic nephropathy uremia group; Group B, diabetic nephropathy uremia group.

um-phosphorus product was calculated to evaluate patients' nutritional statues effectively in the third month after dialysis.

Statistical analysis

SPSS 20.0 was adopted for statistical analysis. The enumeration data like the incidences of peritonitis, cardiovascular disease and other adverse reactions was expressed by rate (%), and tested by X^2. And the measurement data like dialysis duration, urine volume, serum creatinine, urea nitrogen, triglyceride, cholesterol, hemoglobin, serum albumin, blood calcium, blood phosphorus levels and calcium-phosphorus product were shown by standard deviation ($\bar{x} \pm sd$), and tested by paired samples t-test. t and *P* values in two groups were recorded, and there was statistical significance when P<0.05.

Results

Comparison of general data of patients between two groups

There was no statistical significance of general data between two groups (all P>0.05). See **Table 1**.

Comparison of the levels of dialysis duration, urine volume, serum creatinine and urea nitrogen between two groups

The dialysis duration of patients in Group A was significantly longer than that in Group B (P=0.032), urine volume was significantly more than that in Group B (P=0.001), urea nitrogen was significantly lower than that in Group B (P=0.026), but the difference of the serum creatinine level between two groups was not significant (P=0.08). See **Table 2** and **Figure 1**.

Comparison of the incidences of peritonitis and cardiovascular disease between two groups

The incidences of peritonitis (12.5%, 5/40) and cardiovascular disease (55.0%, 22/40) in Group A were significantly lower than those in Group B, which were 50.0% (20/40), 87.5%

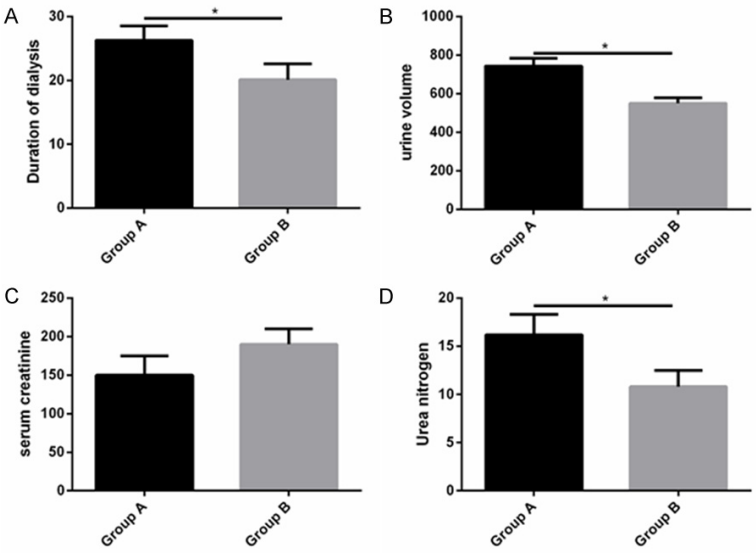

Figure 1. Comparison of the levels of dialysis duration, urine volume, serum creatinine and urea nitrogen between two groups (A), dialysis duration (B), urine volume (C) serum creatinine (D) urea nitrogen *P<0.05. Group A, non-diabetic nephropathy uremia group; Group B, diabetic nephropathy uremia group.

Table 3. Comparison of the incidences of peritonitis and cardiovascular disease between two groups (case/%)

Groups	Cases	Peritonitis	Cardiovascular disease
Group A	40	5 (12.5)	22 (55.0)
Group B	40	20 (50.0)	35 (87.5)
P		<0.001	0.001

Note: Group A, non-diabetic nephropathy uremia group; Group B, diabetic nephropathy uremia group.

(35/40) respectively, (P<0.001, P=0.001). See **Table 3**.

Comparison of the changes of triglyceride, cholesterol, hemoglobin and serum albumin levels after dialysis between two groups

The levels of triglyceride, cholesterol, and serum albumin after dialysis of patients in Group A were significantly lower than those in Group B (P=0.047, P=0.018, P=0.028), while hemoglobin level in Group A were significantly higher than that in Group B (P=0.023). See **Table 4**.

Comparison of blood calcium, blood phosphorus and calcium-phosphorus product between two groups

The blood calcium level and calcium-phosphorus product in Group A was significantly higher than those in Group B (P=0.047, P=0.013), and the blood phosphorus level in Group A was much lower than that in Group B (P=0.036). See **Table 5**.

Discussion

With the development of social economy and improvement of people's life quality, the incidence of diabetes is increasing year by year in the world. Diabetic nephropathy is one of the most common leading causes of end-stage renal disease, and the number of patients with non-diabetic nephropathy is also growing year after year [13, 14]. In the 80 patients with long-term follow-up at peritoneal dialysis center in our hospital, diabetic nephropathy, chronic glomerulonephritis, and hypertensive nephropathy ranked the top three causes of performing peritoneal dialysis. According to the results of American SRDS, diabetic nephropathy accounted for 45.8% of patients with renal failure between 2002 and 2003, and the ratio of Sweden and Australia were 23.8% and 25.7%, which was similar to the construction of primary disease ofcontinuous ambulatory peritoneal dialysis patients in our hospital [15]. Renal damage and complications in patients with non-diabetic nephropathy, will endanger the life quality of the patients, therefore, the prevention and control of the disease should be taken seriously [16].

Peritoneal dialysis is a dialysis method that uses the body's own peritoneum as a dialysis membrane. Through the exchange of solutes and moisture between dialysis solutions infused into the abdominal cavity and the plasma components in capillary on the other side of peritoneum, the metabolites retention and excessive moisture will be scavenged, at the same time, necessary material for the body can be supplemented. The purpose of renal replacement or renal support treatment will be achieved by renewing the dialysis solutions continuously [17]. At present, peritoneal dialysis has been widely used in the treatment of the end-stage renal disease. Vega-Diaz et al. found that the effect of peritoneal dialysis on patients

Table 4. Comparison of the changes of triglyceride, cholesterol, hemoglobin and serum albumin levels after dialysis between two groups ($\bar{x} \pm s$)

	Group A	Group B	t	P
Triglyceride (mmol/L)	3.54±0.76	5.32±0.70	2.828	0.047
Cholesterol (mmol/L)	1.50±0.20	2.30±0.30	3.843	0.018
Hemoglobin (g/L)	90.2±7.4	72.6±4.2	-3.583	0.023
Serum albumin (g/L)	30.2±1.3	35.2±2.2	3.389	0.028

Note: Group A, non-diabetic nephropathy uremia group; Group B, diabetic nephropathy uremia group.

Table 5. Comparison of blood calcium, blood phosphorus and calcium-phosphorus product between two groups ($\bar{x} \pm s$)

Groups	Cases	Blood calcium (mmol/L)	Blood phosphorus	Calcium-phosphorus product (mmol/L^2)
Group A	40	3.8±1.0	1.6±0.3	4.0±0.4
Group B	40	1.8±0.7	2.5±0.4	2.6±0.4
t		1.141	-3.118	4.287
P		0.047	0.036	0.013

Note: Group A, non-diabetic nephropathy uremia group; Group B, diabetic nephropathy uremia group.

with non-diabetic nephropathy was obviously better than those with diabetic nephropathy [18, 19]. The results of this study also demonstrated that dialysis duration of patients in Group A was remarkably longer than that in Group B; urine volume in Group A was obviously more than that in Group B; urine nitrogen level in Group A was obviously lower than that in Group B, but the difference between serum creatinine in both two groups was not significant, which may be associated with the poor prognosis and poor survival of patients with diabetic nephropathy. It also revealed that the incidences of peritonitis and cardiovascular disease in Group A were significantly lower than those in Group B, besides, hypoproteinemia had direct and profound impacts on the onset of peritonitis at the same time.

Meanwhile, after dialysis, the triglyceride, cholesterol, and serum albumin in Group A were significantly lower than those in Group B, while hemoglobin level in Group A were significantly higher than that in Group B, which was in line with the study results of Wang [20]. It indicates that after peritoneal dialysis, the fat in the plasma is cleared, which is healthier for patients with non-diabetic nephropathy.

End-stage renal disease is often associated with the disorder of calcium phosphate metabolism. When the disease worsens, it will cause secondary hyperparathyroidism. Hypocalcemia, decreased $1,25(OH)_2D_3$ synthesis and its weakened function, and hyperphosphatemia are the major causes of this complication, which will eventually lead to bone destruction and bone metastatic calcification [21]. The results in this study showed that the blood calcium level and calcium-phosphorus product in Group A were significantly higher than those in Group B; blood phosphorus level was significantly lower than that in Group B, fully confirming this point. At the same time, the incidence of peritonitis should be reduced as much as possible, which will effectively improve the prognosis of the patients.

There are also some limitations in this study. It was reported that there were varying therapeutic effects of peritoneal dialysis indifferent age of patients [22]. However, there are different ages of the cases collected in this study, without effect evaluation and analysis on the age factor, which may have a certain effect on the experimental results. Because of the small samplesize in this study, the conclusion may not be fully representative. We will expand the clinical samplesize, and do related researches in the future.

In short, the therapeutic effects of peritoneal dialysis on uremia patients with non-diabetic nephropathy are better than those with diabetic nephropathy, with less peritonitis and less poor nutritional status.

Disclosure of conflict of interest

None.

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