Effect of peripherally inserted central catheter (PICC) parenteral nutrition on immune function and nutritional support after radical gastrectomy for gastric cancer

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Abstract: Objective of the present study was to investigate the effects of peripherally inserted central catheter (PICC) parenteral nutrition support on immune function and nutritional support in patients undergoing radical gastrectomy for gastric cancer. 140 patients who underwent radical gastrectomy for gastric cancer were selected as participants and were divided into study group and the control group by random number table, with 70 cases in each group. Patients in the two groups underwent standard gastrectomy under general anesthesia by the same group of doctors. The study group received postoperative PICC catheter parenteral nutrition, and the control group received central venous catheter (CVC) nutrition support. Comparative study was done using *t* test and Chi-square test. The serum levels of ALB, TFN, PA, Hb, $CD4^+$, $CD8^+$, $CD4^+/CD8^+$, IgA, IgG, IgM and $CD3^+$ in the two groups were observed before and after treatment, and the postoperative complications of the two groups were compared. After treatment, the levels of ALB, TFN, PA and Hb in the two groups were significantly increased ($P<0.05$). Levels of $CD3^+$, $CD4^+$, $CD4^+/CD8^+$, IgA, IgG and IgM also amplified significantly after treatment in both the groups, while $CD8^+$ decreased significantly ($P<0.05$). What's more, the improvement degree of the study group was significantly greater than that of the control group ($P<0.05$). The time of drawing drainage tube, recovering intestinal function, getting off bed and the length of hospital stay in the study group were significantly shorter than those in the control group ($P<0.05$). The incidence of postoperative complications in the study group and control group were 8.6% (6/70 cases) and 11.4% (8/70 cases) respectively, and there was no significant difference ($P>0.05$). PICC catheter parenteral nutrition support and improve the nutritional status of patients, it was proved a safe and effective nutritional support which improve the cellular immune function and accelerated the recovery of gastrointestinal function.

Keywords: Radical gastrectomy, PICC, nutritional support, immune function.

INTRODUCTION

Gastric cancer is a common malignant tumor of digestive system and ranks fourth in the global incidence of malignant tumors. According to relevant data (Bencivenga *et al*., 2017), occurrence of gastric cancer varies significantly in different regions. There are nearly 400 thousand cases of new gastric cancer in our country each year, of which about 300 thousand lose their lives. The incidence and mortality rank first of all malignant tumors. At present, the pathogenesis of gastric cancer remains unclear, but it is generally believed that the occurrence and development of gastric cancer may be related to life habits, diet structure, environmental factors, genetic factors and mental factors (Kobayashi *et al*., 2015). Usually, there are no obvious symptoms in the early stage of gastric cancer, and patients feel abdominal pain, loss of appetite, weight loss and anemia and other symptoms with the progress of the disease. In the late stage, patients present lymphadenopathy, melena, ascites and severe malnutrition (Huang *et al*., 2016). Therefore, effective treatment is very important for the prognosis of patients with gastric cancer. Radical resection of gastric cancer is a commonly used method for clinical treatment of gastric cancer, but the big traumas, much bleeding and the postoperative fasting accelerate body nutrition consumption, increase body negative nitrogen balance and affect the nutritional status of the patients, resulting in decreased immune function (Huang *et al*., 2015; Lu *et al*., 2015). Therefore, effective and reasonable postoperative nutritional support is of great significance for the rehabilitation of gastric cancer patients, the improvement of immune function and the control of complications. Peripherally inserted central venous catheter (PICC) is a safe and effective method for total parenteral nutrition after gastrointestinal tumor operation with a high primary success rate and less local complications (Nakauchi *et al*., 2016). However, there is a lack of deep study on the immune function and nutritional support of patients with PICC after radical gastrectomy. In order to further explore the effect of PICC for total parenteral nutrition after radical resection of gastric cancer, here we reported the effect of 70 cases of PICC for parenteral nutrition support after radical resection operation of gastric cancer and expected to provide a reasonable nutrition support method for clinical treatment.

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MATERIALS AND METHODS

Subjects and place of work

140 patients who underwent radical gastrectomy in "The Second Affiliated Hospital of Zhejiang Chinese Medicine University" from January 2014 to January 2017 were studied.

Inclusion criteria: Patients diagnosed by clinical, imaging and pathological evidences and confirmed by surgery biopsies as primary gastric cancer. Patients who had surgery for the first time without chemotherapy or radiotherapy before operation. Patients with complete clinical data. Patients and their families who understood the treatment process and risks, and signed informed consent. Patients approved by the hospital ethics committee.

Exclusion criteria: Patients with heart, liver, kidney and other organs dysfunction. Patients with metabolic diseases, autoimmune diseases and recent application of drugs affecting the immune function. Patients with disturbance of consciousness, unable to cope with the treatment. Patients who met the standard were divided into the study group and the control group according to the random number table, with 70 cases in each group.

In study group: 45 cases were male, 25 were female; aged 61-78 years old with average age (67.3±2.5) years.
Body mass: Body mass was 49-70Kg and the average body weight was 59.2±8.3Kg.
Clinical staging: Stage I 40 cases and stage II 30 cases.
Pathological type: 48 cases of adenocarcinoma, 22 cases of squamous cell carcinoma.
Operation time: The operation time was 2-3h, with average operation time of 2.7±0.4h.
Hemoglobin level: Hemoglobin levels were 84-120g/L, with average hemoglobin (108.5±13.4)g/L.
In the control group: 44 cases were male and 26 were female having age of 60-77 years with the average (67.1±2.3) years
Body mass: Body mass of 48-69Kg and the average body weight was 58.8±7.4Kg. CLINICAL STAGING: Stage I 39 cases, and stage II 31 cases.
Pathological type: 49 cases of adenocarcinoma, 21 cases of squamous cell carcinoma.
Operation time: The operation time was 2-4h, the average operation time 2.8±0.2h.
Hemoglobin level: Hemoglobin was 83-119g/L and average hemoglobin was (107.6±12.2)g/L.
There was no significant difference between the two groups in gender, age, body mass, tumor staging and pathological classification at baseline (P>0.05).

Methods

In the study group, patients underwent PICC parenteral nutrition after radical gastrectomy. PICC catheter and disposable catheter package were provided by the United States Budd Company and performed by nurses receiving special training. The right cubital vein and basilica vein were usually selected as the inserted vein. Patients lie on their back and puncture arm was 90 degrees to limbs, measuring catheter length from the puncture point to the third intercostal from the right clavicular head. The catheter was injected with heparin or saline before puncture, and the guide wire was wet. Tourniquet was paced above the predetermined insertion point, sterilized partially and blanket with drapes. Then punctured the vein from the skin at 45 degrees, returned the blood, pushed the cannula, loosen the tourniquet and withdrew the puncture needle from the sheath. Inserted the catheter into the sheath of the catheter, and pushed the catheter slowly. Removed the catheter sheath when the catheter head was more than 10cm in the sheath. The catheter was pushed to the central vein and to the target position, then pulled out the guide wire, irrigated the catheter with saline, and fixed properly. Slowly injected the short peptide legislative preparations (Xi'an leskon clinical nutrition Co. production). Every package was 40g which contained 720kJ calories and 7.3g protein. The initial volume every day was 4-6 package and increased to 8-12 packages per day 2-3 days later gradually according to the patient's digestion and absorption, providing calories 5760-8640kJ and protein 58-88g every day. The principle of injection was dilute to concentrate and slow to fast. In the initial stage, the liquid insufficiency was supplemented by intravenous glucose infusion, and the continuous nutritional support lasted 7d. The blood glucose, urine glucose, electrolytes were monitored closely and nutrition components were adjusted according to the specific circumstances. After the fasting ends, the amount of nutrient input was gradually reduced.

In the control group, patients received nutrition support through central venous catheter (CVC). Amino acids, glucose, electrolytes, vitamins and other nutritional preparations were infused for 7d, accompanied by 25% Intra lipid 250ml/d.

Indexes observed

3ml of fasting venous blood from patients in the two groups were obtained before and after treatment and centrifuged at 3000r/min to separate the supernatant and stored at the temperature of -20^{o}C for detecting.

Changes on serum levels of albumin (ALB), transferrin (TFN), pre albumin (PA), hemoglobin (Hb) were observed using OLYMPUS AU2700 automatic biochemical analyzer.

Levels of peripheral blood T lymphocyte subsets ($CD3^{+}$, $CD4^{+}$, $CD8^{+}$, $CD4^{+}/CD8^{+}$) were detected with flow cytometry and levels of immunoglobulin (IgA, IgG, IgM) were determined using immune nephelometry in the two groups before and after treatment.

The recovery of the two groups were compared after treatment, including drawing drainage tube time, intestinal function recovery time, off-bed time and hospitalization time.

Postoperative complications were also compared between the two groups.

STATISTICAL ANALYSIS

SPSS 21 was used to process the data. Comparisons on measurement data between groups were conducted using t test. Comparisons on measurement data before and after treatment within each group were conducted using paired t test. Comparisons on enumeration data between groups were conducted using Chi-Square test. $P<0.05$ was statistically significant.

RESULTS

Changes of nutritional indexes before and after treatment

After treatment, the levels of ALB, TFN, PA and Hb in the two groups were significantly increased ($P<0.05$). The improvement degree of the study group was significantly greater than that of the control group ($P<0.05$), as shown in table 1.

Changes of immune function indexes before and after treatment

$CD3^+$, $CD4^+$, $CD4^+/CD8^+$, IgA, IgG and IgM increased significantly in the two groups after treatment, while $CD8^+$ decreased significantly ($P<0.05$). The improvement degree of the study group was significantly greater than that of the control group ($P<0.05$), as shown in table 2.

Comparison of postoperative recovery

The drawing drainage tube time, intestinal function recovery time, the off-bed time and hospitalization time in the study group were significantly shorter than those in the control group ($P<0.05$), as shown in table 3.

Postoperative complications

In the study group, 8.6% (6/70 cases) complications were detected; 1 incision infection, 1 pulmonary infection, 1 urinary tract infection, 1 abnormal liver function, 1 hypokalemia and 1 hypoglycemia.

Incidence of postoperative complications in the control group was 11.4% (8/70 cases); 1 incision infection, 2 pulmonary infections, 2 urinary tract infection, 1 abnormal liver function, 1 hypokalemia and 1 hypoglycemia. There was no significant difference between the two groups on postoperative complications ($P>0.05$).

DISCUSSION

Gastric cancer is a common malignant tumor in digestive system. Surgical resection is the most common radical treatment to improve the quality of life and the survival rate of the patients. Because of the complicated anatomical structure of the stomach, surgical operation often bring great damages to the patient, and the elderly patients tend to be less tolerant and recover slowly after the operation (Jeong *et al*., 2015; Abdikarim *et al*., 2015). Gastric cancer patients usually suffer different degrees of immune dysfunction and malnutrition, the main reasons include slow intestinal peristalsis and reduced secretion of digestive juice. Besides, some jejunum replace the function of stomach, which worsen the slow recovery of digestive system and increase the immunosuppressive state of the body, causing more serious complications. In order to satisfy the normal nutrition requirement of human body, nutrition support should be given after the surgery operation (Lu, 2015). Nutrition support can provide nutrition for the body and maintain nitrogen balance, the metabolism of immune cells. It can also regulate physiological function, repair tissue function, and improve immune function of the somatic cells and normal organ function (Yang *et al*., 2015; Wang *et al*., 2015; Ma *et al*., 2017; Procopiuc *et al*., 2016).

PICC insert a catheter into central venous which have large and fast blood flow through peripheral veins. It can avoid vascular injury caused by long-term or high concentration infusion or strong irritant drugs, and can alleviate repeated puncture pain to patients. PICC is simple and convenient and can ensure the smooth progress of the treatment (Lee *et al*., 2016). The present study mainly focused on the application value of PICC in gastric cancer patients with postoperative parenteral nutrition. Research found that PICC wass very simple and completed within 5min, while the CVC took about 10 min, and also the one-time success rate was higher than that of CVC group. The present data showed that there was no significant difference in the complications of PICC compared with CVC. Therefore, PICC was safe and feasible. Applying PICC in patients for parenteral nutrition ensured the input of nutrition, especially fat emulsion, amino acid and other high concentration liquid, and ensured patients to get enough nutritional support and went through perioperative period smoothly.

Further analysis revealed that the levels of nutritional indicators ALB, TFN, PA and Hb in the study group were significantly higher than those in the control group, indicating that the PICC nutritional support was better than the CVC nutritional support in maintaining the nutritional status of the patients. In addition, the levels of $CD3^+$, $CD4^+$, $CD8^+$, $CD4^+/CD8^+$, IgA, IgG, IgM in the study group increased significantly, while $CD8^+$ decreased significantly ($P<0.05$), suggesting that PICC nutritional support can stimulate the immune cells, regulate immune cell function, enhance immunity response and anti-infection ability (Gong *et al*., 2015).

Table 1: Changes of nutritional indexes before and after treatment (n=70)

Items	Time	ALB (g/L)	TFN (mg/L)	PA (mg/L)	Hb (g/L)
Study group	Before	32.78±1.86	136.09±27.93	209.87±31.69	103.46±15.08
	After	39.72±2.03	164.54±26.82	298.43±34.75	131.17±16.54
Control group	Before	33.02±1.74	136.13±26.35	210.04±26.56	104.26±14.15
	After	37.01±1.65	151.27±23.54	278.71±32.28	117.33±12.71
Within study group (t/P)		13.092/0.000	13.672/0.000	14.093/0.000	16.753/0.000
Within control group (t/P)		8.452/0.000	11.092/0.000	12.314/0.000	10.672/0.000
Between groups before treatment (t/P)		0.982/0.541	0.672/0.671	0.148/0.732	0.102/0.815
Between groups after treatment (t/P)		9.691/0.000	7.087/0.000	9.672/0.005	8.126/0.003

Table 2: Changes of immune function indexes before and after treatment (n=70)

Item	Time	$CD3^+$ (%)	$CD4^+$ (%)	$CD8^+$ (%)	$CD4^+$ $CD8^+$	IgA (g/L)	IgM (g/L)	IgG (g/L)
Study group	Before	58.12±4.36	36.32±3.29	29.05±3.21	1.37±0.32	1.86±0.41	1.38±0.23	11.04±2.36
	After	64.47±3.98	43.91±4.06	23.19±3.35	1.61±0.45	2.34±0.55	2.24±0.63	17.92±3.13
Control group	Before	58.64±4.02	37.17±3.18	21.04±2.12	1.40±0.32	1.85±0.37	1.40±0.17	11.03±2.31
	After	60.35±3.47	40.93±4.01	28.64±3.07	1.47±0.56	2.77±0.56	1.72±0.45	15.16±2.17
Within study group (t/P)		9.095/0.000	11.943/0.000	12.16/0.000	15.042/0.000	13.066/0.000	9.074/0.000	11.074/0.000
Within control group (t/P)		6.935/0.000	7.078/0.000	9.304/0.000	11.051/0.000	7.732/0.000	9.002/0.000	8.044/0.000
Between groups before treatment (t/P)		0.732/0.541	0.541/0.676	0.653/0.732	0.732/0.812	0.726/0.715	0.176/0.903	0.183/0.605
Between groups after treatment(t/P)		8.042/0.000	6.983/0.000	9.007/0.005	7.796/0.003	8.005/0.003	8.761/0.003	9.005/0.003

Table 3: Comparisons of postoperative recovery between the two groups (n=70)

Group	Drawing drainage tube (h)	Intestinal function recovery (h)	Time off bed (h)	Hospitalization (d)
Study	47.36±7.85	54.64±9.03	53.87±10.95	9.62±1.58
Control	63.05±8.32	61.25±8.77	66.32±8.04	12.04±2.27
T	5.126	4.053	7.043	6.168
P	0.000	0.027	0.000	0.000

CONCLUSION

The results of this study showed that the recovery of the organs in the study group was more stable and rapid than that of the control group, shortening the length of stay and reducing the medical expenses, suggesting that the PICC nutritional support was effective and economical.

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