

## Original Article

# Study on the effect of PICC in parenteral nutrition support for colorectal cancer

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Received February 17, 2021; Accepted April 30, 2021; Epub August 15, 2021; Published August 30, 2021

**Abstract:** Objective: To study the effect of peripherally inserted central catheters (PICC) in parenteral nutrition support for patients with colorectal cancer. Methods: A total of 98 patients with colorectal cancer who were admitted to our hospital from January 2019 to June 2020 were selected into this study. The selected patients were randomly divided into two groups. Both groups were given parenteral nutrition support treatment. Patients who received central venous catheter (CVC) nutritional support therapy were included in the CVC group, and those who received PICC nutritional support were included in the PICC group (49 cases in each group). The two groups were compared in terms of the indicators of catheterization, the one-time success rate of catheterization and the occurrence of complications. The changes in nutritional status indicators and serum inflammatory factor levels of the two groups of patients before and after treatment were observed, and the tolerance of the two groups of patients to intubation was investigated. Results: The puncture time and catheter indwelling time in the PICC group were longer than those in the CVC group ( $P < 0.05$ ); the complication rate was 14.29% in the PICC group, and 32.65% in the CVC group ( $P < 0.05$ ); there were no statistically significant differences in TP, PA, ALB, and TF between the two groups before and after treatment ( $P > 0.05$ ); after treatment, the expression of CRP and IL-6 in the PICC group was lower than that in the CVC group ( $P < 0.05$ ). The CRP and IL-6 levels of patients in both groups were higher than those before treatment ( $P < 0.05$ ); the tolerance of PICC group was higher than that of the CVC group ( $P < 0.05$ ). Conclusion: The application of PICC in parenteral nutrition support for colorectal cancer can improve the nutritional status of patients with few adverse reactions and high tolerance.

**Keywords:** Colorectal cancer, parenteral nutrition support, PICC, CVC

## Introduction

Parenteral nutrition support treatment is a method in which the necessary nutrients for human body are directly supplemented into the circulation through the non-gastrointestinal digestive system [1, 2]. At present, parenteral nutrition support therapy has become an important nutritional supplement method for the rehabilitation of gastrointestinal system tumors, short bowel syndrome, and intestinal fistulas [3, 4]. Due to certain factors, such as irritation, high osmotic pressure and long infusion time, etc., in parenteral nutrient solution, central venous catheter (CVC) is normally considered [5, 6]. A peripherally inserted central catheter (PICC) and a CVC are two common catheterization methods, and they are different in terms of operation methods and maintenance programs [7, 8]. So far, there is no uni-

form standard for the choice of the two catheterization methods in colorectal cancer. The author conducted this study with an aim to objectively evaluate the effects of the two catheterization methods for colorectal cancer patients.

## Materials and methods

### Subjects

In total, 98 colorectal cancer patients admitted to our hospital from January 2019 to June 2020 were selected for this study. Inclusion criteria: ① Patients who were diagnosed with colorectal cancer by colonoscopy biopsy, surgical pathology, etc. and received surgery or palliative care in this hospital; ② Patients who needed parenteral nutrition support for more than 5 days; ③ Patients with a nutritional risk score of 3 to 4

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points (European Society for Clinical Nutrition); ④ Patients aged 18-70 years old; ⑤ Body mass index (BMI)  $\geq 18.5$  kg/m<sup>2</sup>; ⑥ Patients who voluntarily participated and signed the informed consent. Exclusion criteria: ① Patients with a history of asthma and drug allergy; ② Patients with contraindications to infusion; ③ Patients who have received radiotherapy and chemotherapy within 7 days before enrollment; ④ Severe brain, heart, liver, and kidney insufficiency or serious diseases; ⑤ Patients with disorders of glucose or lipid metabolism; ⑥ Patients with unstable vital signs or with and estimated survival period < 3 months; ⑦ Patients with history of venous thrombosis and vascular surgery; ⑧ Patients with mental system diseases, cognitive dysfunction, or communication barriers; ⑨ Patients in the acute phase of infectious diseases, acute cardiovascular and cerebrovascular events, acute episodes of various chronic diseases, and other patients with clear incentives for other inflammatory reactions. The selected patients were divided into two groups according to a random number table method. The patients receiving CVC nutrition support treatment were included in the CVC group, and the patients receiving PICC nutrition support treatment were included in the PICC group. The protocol was approved by Ethics Committee of the Xingtai People's Hospital with the Approved No. of 2018018-173.

### *Methods*

Both groups were given Kabiven nutrient solution (SFDA approval number J20090046). Both groups were punctured by the same group of nursing staff in the hospital.

The PICC group was treated with PICC tube nutrition support. A 5F single-lumen central venous catheter with a length of 60 cm was used, and the right side vein or median cubital vein and cephalic vein were used as the puncture point. During the puncture, the patient's right arm was stretched out 90 degrees, and the length of the catheter was estimated with a measuring tape, that is, the puncture point was folded down through the sternoclavicular joint to reach the third intercostal distance; the skin at the puncture point was disinfected, the drape was routinely laid, and the tourniquet was tied to fill the vein; 1% lidocaine was used

for local anesthesia, the needle was inserted at 15 to 30 degrees, the puncture angle was diminished after confirming that the blood return was normal, and then the needle was inserted a little more, the catheter was slowly pushed to the estimated length, and the blood was drawn back to confirm that the catheter was unobstructed and normal, and then the guide wire was removed. Heparin and sodium chloride injection were used to seal the tube under positive pressure, a sterile transparent dressing was applied to properly fix it, and then the catheter was placed at a depth of 40-55 cm. The dressing was replaced twice a week.

The CVC group was treated with CVC intubation nutrition support. A 16G single vena cava catheter was used with a length of 20 cm and a diameter of 3.5 mm. The patient adopted a supine position to fully expose the internal jugular vein to fill the vein; the puncture point was at the apex of the sternocleidomastoid muscle such that it could touch the outer side of the common carotid artery pulsation, and the puncture direction was toward the ipsilateral nipple. The needle was inserted about 3 cm from left to right, and the needle and the syringe were withdrawn simultaneously. If the blood return was normal and the bolus was smooth, the puncture was considered successful; the needle was fixed, the catheter was pushed along the guide wire into the internal jugular vein, and the guide wire was withdrawn, and the venous blood was seen to be unobstructed and then the catheter was successfully inserted. The skin was sutured and fixed with a sterile applicator; the length of the catheter placement was 12-14 cm. The tube was sealed with heparin and sodium chloride injection. The dressing was replaced twice a week.

### *Observation indicators*

The outcome measures included catheterization indicators, the success rate of catheterization and the incidence of complications, the changes of nutritional status indicators and serum inflammatory factor levels, and the tolerance to catheterization.

Catheterization indicators included puncture time and catheter indwelling time. The former one represents the time from the start of skin disinfection to the proper fixation of the puncture, and the latter one refers to the time after

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**Table 1.** Comparison of the general data of the two groups of patients

Groups	N	Gender (Male/Female)	Age ( $\bar{x} \pm s$ , years)	disease types (colon cancer/rectal cancer)
CVC group	49	26/23	51.65±8.31	27/22
PICC group	49	27/22	51.71±8.25	25/24
t/ $\chi^2$		0.041	0.036	0.164
p		0.839	0.972	0.686

**Table 2.** Comparison of two groups of catheterization indicators ( $\bar{x} \pm s$ )

Groups	n	Puncture time (min)	Catheter indwelling (d)
CVC group	49	21.61±6.87	27.28±5.97
PICC group	49	32.32±9.55	115.14±10.14
T		6.369	52.259
P		< 0.001	< 0.001

from the fixation of catheter to the extubation or the catheter falling off. Three ml of fasting venous blood was collected before and after nutritional support treatment from the two groups of patients, centrifuged at 3000 r/min for 10 minutes, and the serum was isolated. Nutritional status indicators included total protein (TP), prealbumin (PA), albumin (ALB), transferrin (TF), which were detected by the turbidimetry method. Serum inflammatory factors consisted of C-reactive protein (CRP), interleukin-6 (IL-6). The enzyme linked immunosorbent assay (Elisa) kits provided by R&D Systems were adopted to detect the serum levels of CRP (Catalog #PDCR00) and IL-6 (Catalog #PD6050). Tolerance was assessed using an anonymous survey method, and graded into three levels: tolerable, basically tolerable, and intolerable.

### Statistical analysis

The ranked data was analyzed by the rank sum test, and the count data [n (%)] was analyzed by the chi-square test; the measurement data ( $\bar{x} \pm s$ ) comparison was conducted by the t test. A P value of < 0.05 was considered statistically significant. SPSS 23.0 software was applied for data analysis.

## Results

### The general data

In the CVC group, there were 26 males and 23 females; the age ranged from 36 to 70 years, with an average of 51.65±8.31 years old; dis-

ease types: 27 cases of colon cancer and 22 cases of rectal cancer. In the PICC group, there were 27 males and 22 females; the age ranged from 38 to 70 years old, with an average of 51.71±8.25 years old; disease types:

25 cases of colon cancer and 24 cases of rectal cancer. There was no statistical difference in the above general data between the two groups (P > 0.05), see **Table 1**.

### Intubation indicators

Considering the puncture time and catheter indwelling time, the PICC group had longer durations than CVC group (P < 0.05), see **Table 2**.

### One-time success rate and complication rate of catheterization

The one-time success rate of catheterization did not differ in the two groups (P > 0.05); the complication rate was 14.29% in the PICC group, and 32.65% in the CVC group (P < 0.05); see **Table 3**.

### Nutritional status indicators

No marked difference was observed in TP, PA, ALB, TF between the two groups before treatment (P > 0.05); after treatment, TP, PA, ALB, and TF in the PICC group was elevated compared with those before treatment (P < 0.05), and TP, PA, and ALB in the CVC group increased more significantly than those before treatment (P < 0.05), as shown in **Table 4**.

### Serum inflammatory factor levels

We found no statistical difference in serum inflammatory factor levels between the two groups before treatment (P > 0.05); after treatment, the expression levels of CRP and IL-6 in the PICC group were lower than those in the CVC group (P < 0.05). The CRP and IL-6 level were both higher than that before treatment in this group (P < 0.05), see **Table 5**.

### Intubation tolerance

The tolerance of patients for intubation in the PICC group was higher than that of the CVC group (P < 0.05), see **Table 6**.

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**Table 3.** Comparison of the one-time success rate and complication rate of the two groups [n (%)]

Groups	n	one-time success rate	Exudation in puncture point	Nerve injury	Entering artery by accident	phlebitis	Catheter obstruction	Catheter falling off	Catheter-related infection	pneumothorax	Local venous injury	Total incidence
CVC group	49	44 (89.8)	5 (10.2)	3 (6.12)	1 (2.04)	1 (2.04)	1 (2.04)	0 (0)	2 (4.08)	1 (2.04)	2 (4.08)	16 (32.65)
PICC group	49	46 (93.88)	2 (4.08)	0 (0)	0 (0)	2 (4.08)	1 (2.04)	1 (2.04)	0 (0)	0 (0)	1 (2.04)	7 (14.29)
$\chi^2$		0.544	1.385	3.095	1.010	0.344	< 0.001	1.010	2.042	1.010	0.344	4.602
<i>p</i>		0.461	0.239	0.079	0.315	0.558	1.000	0.315	0.153	0.315	0.558	0.032

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**Table 4.** Comparison of nutritional indicators between the two groups before and after treatment ( $\bar{x} \pm s$ )

Groups	Time	TP (g/L)	PA (mg/L)	ALB (g/L)	TF (g/L)
CVC group n=49	Before treatment	64.71±5.18	226.46±8.89	34.34±3.65	2.64±0.53
	After treatment	68.07±4.12*	267.26±10.03*	39.11±3.35*	2.81±0.36
PICC group n=49	Before treatment	64.37±4.87	226.18±8.45	34.01±3.54	2.62±0.49
	After treatment	68.48±4.38*	268.11±10.94*	39.60±3.91*	2.83±0.28*
Before treatment	<i>t</i>	0.328	0.159	0.448	0.128
	<i>p</i>	0.744	0.874	0.655	0.899
After treatment	<i>t</i>	0.478	0.399	0.666	0.300
	<i>p</i>	0.633	0.691	0.507	0.764

Note: \*represents the comparison within the group  $P < 0.05$ .

**Table 5.** Comparison of serum inflammatory factor expression levels before and after treatment between the two groups ( $\bar{x} \pm s$ )

Groups	Time	CRP (mg/L)	IL-6 (pg/ml)
CVC group n=49	Before treatment	6.17±1.03	38.32±5.00
	After treatment	14.66±1.76*	112.69±8.15*
PICC group n=49	Before treatment	6.21±0.98	38.36±4.87
	After treatment	8.01±1.13*	52.70±6.00*
Before treatment	<i>t</i>	0.213	0.037
	<i>P</i>	0.832	0.971
After treatment	<i>t</i>	22.276	41.508
	<i>P</i>	< 0.001	< 0.001

Note: \*represents the comparison within the group  $P < 0.05$ .

**Table 6.** Comparison of the tolerance of the two groups of patients [n (%)]

Groups	n	tolerable	Basically tolerable	intolerable
CVC group	49	15 (30.61)	26 (53.06)	8 (16.33)
PICC group	49	29 (59.18)	19 (38.78)	1 (2.04)
$\chi^2$			-3.201	
<i>p</i>			0.001	

### Discussion

Colorectal cancer is a common malignant tumor in the digestive system, which has a detrimental impact on patients' health and it is even life-threatening. Nutritional status is closely related to the immune function of patients during treatment, and immune function can have an important impact on the efficacy of patients with colorectal cancer. Therefore, nutritional status is a key part of the treatment of colorectal cancer [9-11]. Since colorectal cancer occurs in the digestive sys-

tem, patients need to receive parenteral nutrition support during treatment to ensure their nutritional supply, enhance immune function, and maintain the treatment effect. PICC and CVC are the mainstay for gastrointestinal nutritional support, which can provide effective nutritional supply for patients with colorectal cancer and other critically ill patients [13]. Modern medicine has evolved from traditionally being symptom-centered to being patient-centered, underlying the improvement of care for pa-

tient's feelings and quality of life [14]. Therefore, the operability, safety and tolerability of venous catheterization have received widespread attention. A favorable catheterization method can reduce the number of punctures during the whole process of parenteral nutrition support, reduce the patient's pain and mental stress, reduce the stimulation and damage of the infusion component to the vein, and subsequently promote the recovery of the patient and ensure good nutritional supply [15].

We found in this study that the one-time success rate of PICC and CVC did not statistically differ, suggesting that the one-time success rate of the two catheterization methods are similar. The results about the one-time success rate of the two catheterization methods are controversial. Some scholars believe that PICC has multiple choices for blood vessels with obvious veins, and a high success rate of one-time puncture. However, there are also reports stating that without ultrasound guidance, the

success rate of one-time puncture is mainly affected by factors such as the technical level and psychological quality of the puncture, the patient's vascular state, and the degree of cooperation [16]. The *American Society of Intravenous Infusion Nursing* recommends PICC as the method for central venous catheterization, of which catheter indwelling time can reach 48 h to 1 year, while CVC can only go out 48 h to 4 weeks. The longer the catheter indwelling time, the smaller the number of punctures, and thus the pain and psychological pressure of the patient can be effectively reduced. The results of this study demonstrated that the PICC catheter exhibited a longer indwelling time compared to CVC, suggesting that PICC can maintain a longer catheter indwelling time and reduce the number of punctures during the nutritional support treatment of patients and reduce the pain of patients. Studies have shown that PICC has excellent biological compatibility and does not easily react with the fusion of intravascular substances. Therefore, the incidence of blood coagulation and bacterial infection is extremely low. Even when the catheter is blocked, the treatment will be finally completed after urokinase thrombolysis, hence the catheterization time is significantly longer than that of CVC [17]. In addition, the PICC puncture time was longer than that of CVC. This is contributed to factors such as, there is a long distance of PICC delivery when the venous valve or blood vessel is ectopic during delivery, and the superior vena cava must be passed through imaging positioning. We compared the total incidence of complications and found that the PICC group was lower than the CVC group, suggesting that PICC is much safer. Compared with CVC, PICC can effectively reduce phlebitis caused by long-term infusion, poor infusion, and drug leakage damage, and can also reduce the stimulation of drugs to peripheral veins and local tissues, and significantly reduce the incidence of adverse reactions [18]. We found from this study that after nutritional support treatment, the nutritional indicators of the both groups were improved, and the TF of the CVC group was not improved, but there was no statistical difference in the nutritional indicators between the two groups before and after treatment. Both methods can improve the nutritional status of patients, but PICC should be pulsed after transfusion of fat emulsion,

human albumin, high sugar and other macromolecules and viscous liquids, so that patients can comfortably complete medium and long-term intravenous treatment [19]. The levels of serum CRP and IL-6 in both groups after treatment were higher than those before treatment, suggesting that the patients may develop certain inflammatory reactions after intubation, which is related to the occurrence of puncture trauma, the disease itself and other complications. However, serum CRP and IL-6 levels in the PICC group were much lower than those in the CVC group after treatment; this was mainly due to the higher incidence or severity of inflammatory reactions induced by complications in the CVC group. Disappointedly, there are few studies on the relationship between inflammatory factor levels and catheterization complications, and whether there is a positive correlation between the two requires further research to prove. Meanwhile, we found that the PICC group was more tolerant than the CVC group in intubation; this suggests that CVC has a deeper puncture position, more complex physiological anatomy, and larger catheter diameter, which leads to a higher risk of complications [20]. Catheter indwelling time is short, which leads to repeated catheter changes and can cause greater pain. While despite that the fact that PICC has complications such as catheter blockage and phlebitis, it can be treated through thrombolysis, topical hydrocolloid dressing, microwave therapy, etc., thereby enhancing the patient's tolerance. This study compared the application of PICC and CVC in nutritional support for patients with colorectal cancer, and provided a scientific basis for clinical treatment. In addition, this study evaluated the levels of serum inflammatory factors CPR and IL-6, providing new ideas for the prevention and prediction of complications.

In summary, the application of PICC in parenteral nutrition support for colorectal cancer can improve the nutritional status of patients, and is equivalent to CVC catheterization. However, the incidence of PICC-related adverse reactions is lower and the patient's tolerance is higher, and the inflammatory reaction is milder, hence PICC is more suitable for parenteral nutrition support treatment of colorectal cancer.

## Disclosure of conflict of interest

None.

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