

A Modified Patients' Posture for PICC Catheter Placement Makes Patients more Comfortable and Relaxed

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ABSTRACT

Objective: This paper aimed to evaluate a modified posture for PICC (peripherally inserted central catheter) catheter placement by comparing with traditional posture in terms of procedure-related complications and catheter heterotopia.

Method: From December 2006 to December 2008, 519 patients were recruited into control group. These patients received PICC insertion by holding the traditional posture, i.e., horizontal position, arm abducted about 90°, and when the needle successfully entered vein, patients were required to turn his/her head to the procedure side and touch his/her chin to clavicle until the catheter reached the expected position. From January 2009 to June 2010, 508 patients to receive PICC insertion were recruited to the experiment group by holding a modified posture, in which the patients hold horizontal position, arm abduces about 90°, with no other specific requirement during the insertion procedure.

Results: No significant differences were found between the traditional and the modified posture group in the incidence of catheter heterotopia and other procedure-related complications.

Conclusion Modified posture makes patients more comfortable and relaxed during the PICC procedure. And it's especially more applicable for non-cooperative patients.

Keywords: Catheter heterotopia, modified posture, PICC

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INTRODUCTION

PICC (peripherally inserted central catheter) is an intravenous procedure to reach superior vena cava through peripheral veins, including median cubital vein, basilic vein and cephalic vein(1).

PICCs can be used for intravenous delivery of chemotherapy regimens, antibiotics or other medications. Since it can transfuse stimulant medicine safely and ease pain, PICC provides a relative painless transfusion passage for patients(2).

Studies revealed that patients with PICC had high satisfaction(3,4), and application of PICC presented strong clinical value⁵. However, PICC catheter placement has its limitations, especially for those non-cooperative patients, and catheter heterotopia could also happen and it needs operators to pay special attention to.

Background

PICC is widely used as an intravenous access to superior vena cava, and it's usually performed by certified registered nurses due to its relative high risk. When catheter tip is not located in superior vena cava it is called catheter heterotopia, in which the tip is usually located in jugular vein, axillary vein or right atrium⁶. The incidence of catheter heterotopia is about 12.5% (7), and it's usually related with vascular disease, improper body posture, insertion pathway (cephalic

vein) and mediastinal mass 8. Catheter heterotopia contributes to complications of PICC (9) and can even lead to paravertebral hydrops and atrial fibrillation (10).

In traditional PICC operation, when the needle successfully entered vein, patients are required to turn his/her head to the procedure side and move his/her chin to touch clavicle to interdict jugular vein until the catheter gets to the expected position (11-15) in order to avoid catheter heterotopias. However, patients with dementia, Parkinson disease, cerebral infarction and mental disorder are difficult to cooperate with operators to finish this procedure. Even with cooperative patients, it's also very difficult to make the patients feel comfortable with this posture.

This study compared a modified patient posture for PICC catheter placement with a traditional posture which had been widely used in China, and checked the incidence of catheter heterotopia and followed up with the complications caused by catheter insertion. The results suggested that the modified patient posture for PICC catheter placement could make patients more comfortable and relaxed during the procedure without increasing rates of complications and is worth being utilized more in the clinical practice. Meanwhile, we analyzed potential reasons for catheter heterotopia and suggested some precautions before catheter insertion.

The study

Aim

The aim of the study was to evaluate a modified posture for PICC catheter placement by comparing with traditional posture in complications and catheter heterotopia in a Chinese population.

Design

The participants to receive PICC catheter placement were recruited from December 2006 to June 2010 and their clinical information and follow-up data were collected for analysis.

Participants

From December 2006 to June 2010, 1027 patients to receive PICC catheter placement were recruited into study. They were from general internal medicine department, oncology department, neurosurgery department, general surgery department and hematology department in ZhongNan hospital of Wuhan University. All patients enrolled into study of PICC catheter placement signed informed consent. In the control group, 519 patients holding traditional posture for catheter insertion were recruited from December 2006 to December 2008. In experiment group, 508

patients holding modified posture for catheter insertion were recruited from January 2009 to June 2010.

Procedure

The puncture kits were from BD company (4F or 5F, BD First PICC, BD infusion therapy system Inc, USA). All the placement procedures were performed by certified registered nurses.

The patients in the control group took traditional PICC posture, i.e. horizontal position, arm abduces about 90°, and when the when the needle successfully entered vein, patients turned his/her head to procedure side and moved chin to touch clavicle until the catheter reached the expected position. The patients in experiment group took modified posture, i.e. horizontal position, arm abduces about 90°, for those patients who can't fulfill this action can put their arm freely, and when the cathether was being inserted, patients can hold their comfortable and relaxed posture without the requirements mentioned for patients in control group.

Data collection

Data of the 1027 participants from different departments were collected, starting from enrollment into the in-patient departments of the hospital. Variables collected included gender, age,

diagnosis, concomitant diseases, key information related to PICC catheter placement (inserted arm, inserted vein, and treatment protocol), incidence and position of catheter heterotopia by X-ray location after catheter insertion, and incidence of complications and catheter retention time during follow-up visit. The participants were also asked about their feeling during the catheter insertion.

Ethical considerations

The study was approved by the appropriate ethics committee. Participants were informed that participation was voluntary and they could withdraw at any time. They signed consent forms after having received written and oral information about the study and none withdrew from the study.

Data analysis

The data analysis technicians are blind to the data sources. All data were analyzed using SPSS 13.0 (SPSS Inc., Chicago, IL, USA) statistical package. Chi-square tests were used to determine

whether there is a significant difference between the expected frequencies and the observed frequencies in the two groups. Statistical significance level was set at $p < 0.05$.

RESULTS

Patient distribution and general information of participants from control and experiment group

The study participants were recruited from general internal medicine department, oncology department, neurosurgery department, general surgery department and hematology department in ZhongNan Hospital of Wuhan University. There was no statistical significant difference with regard to the distribution of departments between participants in control and experiment group (shown in Table 1). And follow-up data showed that the catheter retention time was quite similar in two groups. There are 519 patients in the control group and catheter retention time ranged from 7 to 366 days, with mean time being 305 days, while there were 508 patients in the experiment group and catheter retention time ranged from 10 days to 456 days, with mean time being 360 days.

There was also no significant difference in participants' age distribution between the two groups, 51.38% versus 49.92% were less than 50 years old, and 48.62% versus 50.08% were 50 or older in control and experimental group respectively. Furthermore, gender distribution, catheter insertion arm, insertion vein and treatment protocols were also comparable between control group and experiment group. Detailed information was shown in table 1 and 2.

Complications and incidence of catheter heterotopia of patients between control and experiment group

Complications and incidence & positions of catheter heterotopia caused by PICC catheter placement was recorded in our study. The complications were phlebitis, catheter obstruction, skin allergy, catheter emersion, infections and insertion problems. The complication incidence in modified posture group was even lower in experiment group (4.92%) than that in control group (7.71%). However the statistical analysis showed that the difference is not statistically significant ($p=0.800$).

Catheter heterotopia was another main problem in PICC catheter placement. In our study, the incidence of catheter heterotopias was lower than mean level 12.5% reported by other study(4).Confirmed by X-ray radiograph, positions of heterotopia were jugular vein, axillary vein, right atrium and twist. There was no statistical difference in complication types between

two groups. More information were showed in table 3

DISCUSSION

This study recruited 1027 participants from various inpatient departments in ZhongNan Hospital of Wuhan University to evaluate a modified patient posture for PICC catheter placement. In the control group, 519 patients receiving traditional posture for catheter placement were recruited from December 2006 to December 2008. In the experiment group, 508 patients receiving modified posture for catheter placement were recruited from January 2009 to June 2010. The participants in the two groups were generally comparable, and they showed similar incidence of complications and catheter heterotopias. Admittedly, a better design would be data on the two groups at the same time frame.

Effect of body posture on incidence of catheter heterotopia and complications

During the insertion operation, when catheters are placed in shoulder, patients in control group are required to turn his/her head to the procedure side and move his/her chin to touch clavicle to avoid catheter heterotopia through jugular vein. However, patients with dementia, Parkinson

disease, cerebral infarction and other mental disorders usually couldn't keep the special posture to cooperate with the operators to finish this procedure. Some patients even felt anxiety after they posed that way. And anxiety could stimulate sympathetic nerve to increase secretion of adrenaline and angiotensin, which could induce vascular spasm, narrow of vascular lumen to increase insertion friction and obstruction, and led to insertion difficulty even failure(16). Previous study has shown the potential of modified patient posture in PICC catheter placement for aged patients(17).

In this study, we evaluated modified PICC catheter placement body posture for patients by comparing incidence of catheter heterotopia and complications with the traditional posture and the results suggest that there is no statistical difference in both incidences of catheter heterotopia and complications in control and experiment group which further confirms the feasibility of the modified posture for catheter placement.

Effects of blocking jugular vein on catheter tip reaching expected position

PICC catheter placement, which can be easily operated and causes fewer complications, is widely used in China. However, catheter heterotopia can still happen for many reasons. If catheter tip is not located in lower 1/3 of superior vena cava, it can easily cause complications,

such as catheter obstruction, phlebitis, infection and other problems (18). In this study, there were 25 patients with catheter heterotopia in control group. For the patients whose catheters dislocate to right atrium, we can directly adjust the catheter to proper position. However, for patients with catheters dislocating to Jugular vein, axillary vein or twist, we need to reinsert catheter. Confirmed by X-ray radiograph observation, 21 of the 25 patients were reinserted successfully. The other 4 patients whose catheter couldn't be reinserted to proper position after many attempts were revealed to have vascular abnormality. There were 17 patients with catheter heterotopia in the experiment group and they were all successfully reinserted with the assistance of B-ultrasound observation.

Precautions for catheter heterotopia

Many reasons accounted for catheter heterotopia, such as oversize straight vein, forced insertion and choice of insertion vein (19,20). This study suggested comfort and relaxation of patients was important for successful insertion. And there was no relationship between insertion posture of patients and insertion success. According to anatomical feature, when catheter gets to subclavian vein, there is a branch with up to jugular vein and down to innominate vein and finally superior vena cava. Lili et al suggested that inserting PICC through cephalic vein can easily cause

catheter to reflex because of sharp angle between cephalic vein and innominate vein (20). Among the above 42 cases of catheter heterotopia, 28 chose cephalic vein, 5 chose basilica vein and 9 chose median cubital vein. The more catheter heterotopia incidence through cephalic vein coincides with previous study. Also among the above 42 patients who had catheter heterotopia, 19 have bad vascular elasticity, 4 have vascular abnormality, 6 suffered from lung cancer and had mediastinal oppression. Two of the 6 lung cancer patients also had clavicle deformation.

These observations highly suggested that in order to prevent catheter heterotopia, we need to choose proper vein based on individual anatomical features before inserting PICC. For patients with lung disease, we need to check chest radiograph first and then choose proper inserting site. In addition, operator must have good skills and follow the operation guidelines. During the operation, the patients can choose comfortable and relaxed posture for catheter insertion. The insertion should be slow to avoid catheter reflex. Meanwhile, observation through ultrasound imaging of blood vessel is a good way to reduce insertion troubles, and it can also lower complications (21, 22). American Center for Disease Control and Prevention also advocates that inserting PICC guided by venous ultrasound can improve insertion success and prevent (23).

CONCLUSION

Modified patients' posture during PICC catheter placement procedure can not only save operation time and simplify procedure, but also make patients feel more comfortable and relaxed to increase their obedience. Especially for patients with dementia, Parkinson disease, cerebral infarction and other mental disorders, modified position should be more widely used in clinical practice.

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Conflict of interest statement

No conflict of interest is declared by the authors.

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Table 1: Patients distribution of control and experiment group

	Disease						Retention time	
	Oncology	Cerebro-vascular disease	Cardio-vascular disease	Respiratory disease	Digestive disease	Mental disorder	Range	Mean
Control group (519)	231	108	71	48	61	45	7-366	305
Experiment group (508)	208	134	85	31	50	54	10-456	360

Table 2: General information of patients between control and experiment group

	Items	Sample size	Control group (n=519)	Experiment group (n =508)	χ^2	<i>p</i>
Age	Less than 50 years	434	223 (51.38%)	211 (48.62%)	0.216	0.642
	50 or more	593	296 (49.92%)	297 (50.08%)		
Gender	Male	622	301 (48.39%)	321 (51.61%)	2.898	0.089
	female	405	218 (53.82%)	187 (46.18%)		
Inserted arm	Left	622	301 (48.39%)	321 (51.61%)	2.892	0.089
	Right	405	218 (53.82%)	187 (46.18%)		
Inserted vein	basilic vein	787	398 (50.57%)	389 (49.43%)	0.084	0.084
	median cubital vein	212	101 (50%)	101 (50%)		
	cephalic vein	27	13 (48.15%)	14 (51.85%)		
	Jugular vein	11	7 (63.64%)	4 (36.36%)		
Treatment protocol	Chemo-treatment	398	200 (50.25%)	198 (49.75%)	1.134	0.488
	parenteral nutrition	376	198 (47.34%)	178 (52.66%)		

Table 3: Complications of patients between control group and experiment group

	Sam ple size	Phle bitis	Cathete r obstruc tion	Skin aller gy	Cathe ter emers ion	Infec tion	Inserti on tot proble al m	incide nce	χ^2	p	
Control group	519	7	11	3	2	2	15	40	7.71%		
Experim ent group	508	7	8	0	1	1	8	25	4.92%	2.86 4	0.80 0
Total	1027	14	19	3	3	3	23	65	6.33%		

Table 4: Incidences and positions of catheter heterotopia between two groups

	Sampl e size	Heterotopia			Positions of heterotopia			
		yes	no	incidence	Jugular vein	Axillary vein	Right atrium	Twist
Control group	519	25	494	4.8%	9	3	7	6
Experiment group	508	17	491	3.0%	4	4	5	4
χ^2		2.383						
p		0.123						