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Implementation of tunneled versus not tunneled peripherally inserted central catheters

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Tunneled peripherally inserted central catheters (PICCs) offer several advantages such as an exit site at the green zone no matter where the puncture point is and a long subcutaneous route, which is considered a shield against infections and provides comfort to the patient. Clinicians could choose the proper exact exit site so as to avoid blood leakage from the exit point. The aim of the study was to assess the value of the tunneled PICCs versus normal PICCs with no long subcutaneous route. Sixty patients were randomly divided into two groups and underwent a PICC placement procedure between August 2014 and November 2014 and were then observed until February 2015. Thirty of them (group A) underwent a PICC placement procedure, after proper ultrasound scan and under local anesthesia, of the veins of the upper limb, internal jugular and axillary veins. The mean (±standard deviation) age of patients was 54.8 ± 9.2 years (range, 18–80 years). The primary success rate was 100% for all patients in both the groups. The procedure was not painful for the patients. In group A, after 3 months of surveillance, 7 devices were removed because the patients' therapy came to an end, and only in one incident, the catheter was removed due to soft tissue infection. Tunneled PICCs seem to be a safe option and an easy alternative to perform in contrast to placement without a tunnel. It is an easy, cheap procedure that allows us to catheterize the vein with a larger caliber and create an exit point at any preselected point on the upper limb. (J Vasc Nurs 2018;37:132-134)

Peripherally inserted central catheter (PICC) lines are used in patients who require long-term central venous access, for administrating antibiotics, chemotherapy, total parenteral nutrition, intravenous fluids, and blood sample. But, the most important part in the use of PICC lines is their proper care, especially in long-term use and the avoidance of complications that could be caused, including infections, thrombosis, fracture, and embolization. Bodenham et al,[1] 2016, mentioned that thrombosis related to central venous catheter has an incidence of 3%–32%. Evidence suggests that patients with PICCs usually develop peripheral thrombosis.

In addition, an oncology patient may suffer from malnutrition because of a malignancy, which is considered to reduce the quality of life. For an oncology patient, it is probable that he/she will cope with reduction of life expectancy due to improper administration of nutrition.[2] Nutrition support, through parental nutrition, and administration of medications should always be considered in these patients so as to enhance their quality of life.[3]

Recent protocols for administrating home parenteral nutrition or medications consider that tunneled central catheters are preferred over other central catheters, but evidence for this case is rare.[2] Moreover, outpatients who have been administrated medications or parenteral nutrition through a tunneled catheter appeared to have catheter-associated blood infection.[2]

A central line is a central catheter that is placed in a vein for a long-term use. It could be placed in the neck (internal jugular) but may also be placed in the groin (femoral), liver (transhepatic), chest (subclavian), or back (translumbar). The catheter is tunneled subcutaneously and has a cuff that is attached to it and allows tissue and skin to grow around it while the line becomes more stable.[4]

The aim of the study was to assess the value of the tunneled PICCs versus non-tunneled PICCs; specifically, we investigated the advantages and disadvantages of tunneled PICCs. Tunneled PICCs offer several advantages, such as less infections and complications, and they also provide comfort to the patient.

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METHODS

The research was approved by the scientific committee of major oncological hospital where it was carried out. A full respect of the confidentiality of information was guaranteed throughout the collection and processing of data. It complied with the principles laid down in the Declaration of Helsinki (recommendations guiding physicians in biomedical research involving human subjects. "Adopted by the 18th World Medical Assembly, Helsinki, Finland, June 1964; amended by the 29th World Medical Assembly, Tokyo, Japan, October 1975; the 35th World Medical Assembly, Venice, Italy, October 1983; and the 41st World Medical Assembly, Hong Kong, September 1989)".

Sixty patients were randomly divided into two groups and underwent a PICC placement procedure between August 2014 and November 2014 and were observed until February 2015. Thirty of them (group A) underwent a PICC placement procedure, after proper catheterization of the selected vein (basilica or brachial), and octyl cyanoacrylate skin adhesive was applied for skin closure. In group B (30 patients), after advancing the wire into the vein, a small incision was performed using a no. 11 scalpel, and subsequently, one or two tunnels were created using a 14-g peripheral intravenous line (Vygon) with a length of 5 or 10 cm. The PICC lines were also stabilized with octyl cyanoacrylate skin adhesive and a nylon suture to secure the puncture point, which were then removed 4 days later. In both groups, ultrasound scan was implemented in the upper limb, internal jugular and axillary veins.

The PICC Zone Insertion Method (ZIM), which aims to reduce patient risk and to optimize results, is used for PICC insertion and management. This classification identifies the ideal zone for upper arm needle insertion with ultrasound guidance. The ZIM classification reveals the zones that offer various risks and benefits for PICC insertion and management. ZIM uses musculoskeletal, skin, and vessel characteristics that are separated into red, green, and yellow zones. It is a system that simulates the traffic light system; each color indicates whether or not a zone should be catheterized. It was used in both groups.

Statistical analysis was carried out using SPSS 22 (IMB SPSS Software, Chicago, IL) and compared the aforementioned parameters between the two groups of patients after conducting Kolmogorov-Smirnov test of Normality. Comparisons were made using the chi-square and Mann-Whitney tests, as well ANOVA test, so as to compare the means of the groups. The data are expressed as mean (SD), in a significance level of 0.05.

RESULTS

Patients' demographic data appeared in Table 1. The primary success rate was 100% for all patients in both the groups. PICC

TABLE 1

PATIENTS' DEMOGRAPHICS

Demographics	*Group A (N = 30) PICC*	*Group B (N = 30) Tunneled PICC*	**P** *value*
Gender, N (%)			$\chi^2 = .607$, $P = .606$
Male	14 (46.67)	17 (56.67)	
Female	16 (53.33)	13 (43.33)	
Age in y (mean ± SD)	55.17 ± 9.36	54.57 ± 9.18	U = 418, $P = .634$
Reason for PICC line, N (%)			F = .041, df = 1, $P = .84$
Chemotherapy	22 (73.33)	22 (73.33)	
Parental nutrition	6 (20)	5 (16.67)	
Perioperative administration of intravenous fluids	2 (6.67)	3 (10)	
PICC line disconnection (mo) (mean ± SD)	12.13 ± 4.78	13.47 ± 4.74	U = 354, $P = .154$
Catheters' culture and sensitivity, N (%)			$\chi^2 = 0$, $P = 1$
No	30 (100)	30 (100)	
Yes	0 (0)	0 (0)	
Painful procedure, N (%)			$\chi^2 = 0$, $P = 1$
No	30 (100)	30 (100)	
Yes	0 (0)	0 (0)	
Complications, N (%)			$\chi^2 = 1$, $P = .5$
No	29 (96.67)	30 (100)	
Yes	1 (3.33)	0 (0)	

PICC = peripherally inserted central catheter; SD = standard deviation.

lines were inserted in the first attempt, both tunneled or not. The procedure was not painful for the patients. In group A, after 3 months of surveillance, 7 devices were removed because the patients' therapy came to an end, and only in one incident was the catheter removed due to soft tissue infection (no catheter-related infection after catheter tip culture), which was then treated with the administration of antibiotics. Minor bleeding from the exit point was observed in 5 cases during the first 24 hours from the procedure. In group B, 3 devices were removed as the patients' therapy came to an end, and no incidents of thrombosis, hemorrhage, infection, or back flow issues were observed.

In our study, after follow-up, no incidents of thrombosis, hemorrhage, or back flow issues were observed in tunneled PICC lines, in comparison to typical insertion of PICC, where a soft tissue infection was noted.

DISCUSSION

This study observes and compares two different groups of patients' inserted PICC lines. It is a prospective randomized trial evaluating the benefits of tunneled PICC lines. It focused mainly on measuring complications. The expected benefit of tunneled PICC line insertion was to decrease the infections. The results of the present study showed that patients who had a tunneled PICC line had no complications.

The main finding of this study was the appearance of no complication in patients' inserted tunneled PICC lines. A finding that is opposite to the study of Aitken et al,[5] 2016, who noticed that tunneled central catheters developed significant complications, including culture-proven bacteremia and one death from line sepsis; also, patients spent an average of 11.9 days/year in hospital as a consequence of access-related complications.

In the present study, no catheter-related infection was observed after the catheter tip has sent for culture. In the study by Chopra et al,[6] 2013, it was observed that 5.7% of the catheters were removed due to suspicion of infection. But, after the catheter tips and the patient's peripheral blood were cultured, no catheter-related infection cases were mentioned.

In the present study, none of the groups had a development of thrombosis. Lefebvre et al,[7] 2001, observed in patients with breast cancer for adjuvant chemotherapy administration that PICCs were the only risk factor of catheter-related to major and minor complications. They noted that patients with a PICC port had 8.6% of chance of having at least one complication versus of 27.2% for patients who had PICCs lines, and thrombosis was one of the most frequent complications, which occurred at the beginning of the treatment. White et al,[8] 2018, noted in 5788 patients that the hazard ratio for venous thromboembolism was not significant compared with central venous catheter (1.21; 95% confidence interval, 0.94–1.55).

Furthermore, the study by Xing et al,[9] 2012, focused on thrombosis complications in 187 patients with breast cancer in a retrospective study with PICC lines for the administration of chemotherapy, showed that the rate of thrombosis was only 2.1%, including even patients who received chemotherapy even for a single day. These results showed that PICC lines are safe and effective.

LIMITATIONS

Despite the careful preparation for this trial, the researchers were aware of the study's limitations. It is difficult for the results to be generalized for the entire population of patients who had tunneled PICC lines inserted because patients of this study come from a single center, which is the main limitation of this study. A larger sample originating from different clinics and various hospitals would help significantly to generalize the results.

CONCLUSION

Tunneled PICC seems to be a safe option and an easy alternative to perform in contrast to normal placement. It is an easy, cheap procedure that allows us to catheterize the vein with a larger caliber and create an exit point at any preselected point on the upper limb.[10]

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