

Venous Thrombosis Associated with Peripherally Inserted Central Catheters in Oncology Patients: A Single Institutional Experience

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Abstract

Purpose: The use of peripherally inserted central catheters (PICCs) had gradually increased in recent years, especially in cancer patients, as it facilitates blood sampling and treatment administration. Unfortunately, they were associated with a high incidence of complications that limited their widespread use. The purpose of this study is to evaluate the characteristics of oncology patients presenting for complications of their PICC lines and to establish possible associated factors such as age, sex, type of cancer, site of insertion of PICC in our institution.

Materials and methods: This retrospective study includes all cancer patients who underwent placement of PICC, from January 2012 till December 2013, under radiology guidance at Hotel-Dieu de France university hospital. All patients were evaluated at enrollment for age, sex, site of PICC insertion, type of neoplasia (solid vs. hematologic malignancy), and followed up for complications for a minimum of two months.

Results: During the recruitment period, forty-four patients were enrolled in our study with 54.4% women and 45.6% men. Mean and median age at PICC insertions were 57 and 59 years respectively (standard deviation 16). Nineteen patients (43.2%) had hematologic malignancies and twenty-five had solid tumors (56.8%). Complications including dislodgement, infection, and thrombosis were encountered in eight patients. Thrombosis was the most frequent complication and was reported in six out of eight patients. Time of thrombosis occurrence varied from 1 to 132 days with an average of 37 days. No statistically significant association was found between thrombosis of the PICC and any of the evaluated factors listed above but we found a trend toward a higher rate of thrombosis in hematological cancer patients compared to solid tumor patients (26% v/s 4%).

Conclusions: Venous thrombosis complicating PICCs was reported in 13.7% of our oncology patients which represents a similar rate compared to the literature. However, the small number of recruited patients limits any conclusion and warrants more patients to be enrolled with a longer follow-up period.

Keywords: PICC; Thrombosis; Cancer

Introduction

The peripheral venous capital of oncology patients impoverishes rapidly over time because of different intravenously administered agents including chemotherapy, parenteral alimentation, and antibiotics. Subsequently, establishing the perfect venous access becomes a necessity and essential for the optimal supportive care of these patients. Peripherally inserted central catheters (PICC) are becoming widely used for long term treatments not exceeding few months [1]. The PICC line presents several advantages over other central and peripheral catheters as it is associated with a reduced incidence of pneumothorax, hemothorax, hemorrhage and sepsis [2,3]. Its use is relatively safe but presents an increased risk of thrombotic complications 0.3-28%. Reports evaluating this complication in our Mediterranean region are sparse [4-7]. Accordingly, we elaborated this study to evaluate the characteristics of oncology patients presenting for complications of their PICC lines and to establish possible associated factors such as age, sex, type of cancer, site of insertion of PICC in our institution.

Methods

This is a single institutional retrospective study conducted in the Hematology-Oncology Department of Hotel-Dieu de France Hospital. This is a tertiary university hospital center located in Beirut, Lebanon. All cancer patients hospitalized at our institution for placement of a PICC, from January 2012 till December 2013 were included in this study. We excluded patients that presented back for new PICC insertion after a previously complicated PICC. Each patient was evaluated at enrollment for age, sex, type of cancer, and site of catheter insertion.

Used catheters were of simple lumen type. The site of placement was decided according to ultrasound guidance. After application of local anesthesia (4 cc of lidocaine 1%), we punctured the humeral or cephalic vein above the elbow bend under ultrasound guidance with a 21 Gauze needle. The downstream venous network was catheterized with a guide reaching the superior vena cava. After cutaneous incision, an introduction system was inserted under fluoroscopic detection to install the PICC of which the distal extremity was positioned at the junction between the superior vena cava and the right atrium. The PICC was fixed to the skin by cutaneous sutures Mersilk type. Finally,

the PICC was rinsed with heparin 5 cc. The rinse was repeated before and after each usage with normal saline solution.

Patients were followed for 33 months and the duration between insertion of the PICC and the occurrence of thrombosis was evaluated. The diagnosis of deep venous thrombosis was established by color Doppler ultrasonography conducted by two independent radiologists.

Results

This study enrolled forty-four patients of which Twenty-four women (54.4%) and 20 men (45.5%) were included. The mean and median age at the placement of a PICC was 57 and 59 years respectively (standard deviation 16 years) with a maximum of 85 years and a minimum of 16 years.

A hematological cancer was present in 19 patients (43.2%): acute myeloblastic leukemia constituted the largest group with nine patients, followed by four non-Hodgkin lymphoma, three multiple myelomas, two acute lymphoblastic leukemia and one myelodysplasia. Solid tumors constituted 25 cases (56.8%) of our patients: breast cancer was the most prevalent, followed by four colorectal cancers, four lung cancers, two gastric cancers, two bladder cancers and one prostatic, pancreatic, ovarian, osteosarcoma, head and neck, testicular, thyroid and hepatocarcinoma cancers.

Overall, 35 patients had one PICC, 8 patients had two PICCs and 1 patient had three PICCs (Table 1). Thirty-six patients (81.8%) had PICC placement in the left arm: 27 in the basilic vein, 5 in the humeral vein and 4 in the cephalic vein. Eight patients (18.2%) had right arm PICC insertions: four in the basilica vein, three in the cephalic vein and one in the humeral vein.

	Number of patients	%	Number of patients	%	p value
Sex					0.81 ^o
Male	17	85%	3		
Female	21	87.5%	3		
Type of neoplasia					0.07 [‡]
Hematological	14	73.7%	5		
Solid	24	96%	1		
Site of insertion					0.918 ^o
Left	31	86.1%	5		
Right	7	87.5%	1		

Table 1: Summary of the association between thrombosis and possible risk factors; ‡Fisher exact test; ^oChi square test.

Patients that did not develop venous thrombosis had a mean age of 59 years (standard deviation 15 years) higher than the mean age of 45 years (standard deviation 18 years) of the thrombosis group (p value=0.042; independent sample t test with bilateral alpha =0.05). The mean and median duration between placement of the PICC and incidence of thrombosis is 37 and 9 days respectively (standard deviation 50 days) with a maximum of 132 days and a minimum of 1 day. We analyzed the association between incidence of thrombosis and the possible associated factors listed above and there were no

statistically significant associations but we found a trend toward a higher rate in hematological cancers compared to solid tumors (26% vs. 4%).

Discussion

A stable and sustainable venous access is essential for every cancer patient throughout his treatment course. One possible solution is the insertion of PICC that can be maintained for many months and used for home medical care [1]. Deep vein thrombosis of the upper extremity is a well-recognized complication of the PICC but the incidence of this serious problem varies widely between the different studies ranging between 0.3-28% [8]. The largest study measuring the incidence of deep venous thrombosis (DVT) in PICC detected 2.47% of thrombosis [9]. Moreover, a recent meta-analysis of 29503 patients that included 64 studies confirmed a higher incidence of thrombosis in critically ill (13.91%) and cancer patients (6.67%) [10]. Our study demonstrated a 13.6% incidence of thrombosis in PICC which is comparable to the literature. We attribute the wide variety of results between studies to the lack of a consensus on the optimal care of the PICC.

Some studies report that the prophylactic use of anticoagulation in solid cancer patients had positively reduced the incidence of thrombosis of central catheters but conflicting results of other studies did not permit its wide use [11,12]. In another perspective, only one study showed that the continuous low-dose infusion of heparin (100 U/kg per day) reduces the incidence of PICC-associated thrombosis to 1.5%. This finding is attributed to the higher incidence of chemotherapy-induced thrombocytopenia [13]. Many risk factors for PICC-related thrombosis were analyzed in several studies such as obesity, gender, history of DVTs and use of anticoagulation but none were conclusive and only revealed conflicting results [14-17]. In our study, only younger age at insertion of PICC was associated with higher risk of thrombosis. This finding may be attributed to the intensive and longer chemotherapy regimens used in younger patients.

The optimal time for ablation of PICC has been usually estimated to be between few weeks to months. In our study, the mean duration between the insertion of the PICC and venous thrombosis was 37 days with one patient presenting a thrombosis 132 days after PICC insertion. According to the previously mentioned meta-analysis, four studies estimated mean duration to thrombosis at 8.7 days which is by far shorter than the mean duration to thrombosis in our institution. This can be explained by the absence of guidelines for the optimal time of retrieval of the PICC. The risk of having a DVT with longer dwelling time seems to be elevated notably after an average of 16 days [18-20].

Interestingly, we found a higher rate of thrombosis in patients with hematological cancers compared to solid tumors (26% vs. 4%). In general, 20% of DVT are attributed to cancers but differences in study designs make it difficult to compare hematological to solid tumors in terms of risk for thrombosis [21]. Very few studies compared the incidence of central venous catheter-related thrombosis among different type of malignancies. One study by Wiegeling et al. attributed DVT occurrence to multifactorial etiologies related to the catheter characteristics and to the patient features [22]. On the other hand, intensive chemotherapy, whether in hematological or solid tumors, was associated with earlier DVT occurrence compared to low intensity regimens [20].

Conclusion

Keeping in mind the limitations of our single institution experience caused by its small sample size and retrospective design, further prospective and large studies are needed to establish major risk factors for PICC related thrombosis, elucidate the role of prophylactic anticoagulation, and elaborate the optimal management of PICC in the inpatient as well as the outpatient settings.

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