Original Article

Determination of complication rate of PICC lines in Oncological Patients

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Abstract

Objective: To determine the complication rate of (PICCs) peripherally inserted central catheters in cancer patients with a 1 year prospective cohort study.

Methods: All PICCs inserted in adult cancer patients in Radiology Department of The Aga Khan University Hospital were followed prospectively till removed or patient expired and pattern of complications noted.

Results: One hundred and fourty six PICCs were inserted over a period of 1 year and followed for a total of 3329 catheter-days; median placement, 14 days: range 3-218 days. Of these 67 (32.8%) PICCs were complicated and removed earlier, for a rate of 14.4/1000 PICC-days. Patients with haematologic malignancies were more likely to have complications as compared to those with solid tissue malignancies.

Conclusions: Despite a significant complication rate, PICCs are a relatively safe and cost effective method of establishing central venous access (JPMA 59:663; 2009).

Introduction

Peripherally inserted central catheters (PICCs) represent a vascular access device (VAD) that can be considered to have an intermediate role in central venous access. Peripherally inserted central catheters can be made of either silicon rubber or polyurethane, the former being associated with a lower risk of thrombosis.[1]

Effective and reliable venous access is one of the cornerstones of modern medical therapy. With advancing age and increasing Co morbidities in our modern society, effective and reliable venous access can sometimes be very difficult to establish. PICCs provide reliable and safe intravenous access in a variety of indications.[2]

PICC lines are frequently used in oncology patients

to deliver chemotherapy as well as other intravenous medications, fluids and total parenteral nutrition.[3] Peripherally inserted central catheters offer certain advantages over other forms of long-term VAD.[4]

In particular, the use of PICC has provided a relatively simple,safe,easy,rapid and maintenance free means of accessing a central vein for the purposes of chemotherapy or other intravenous fluids.[5]

Despite the widespread use of PICCs, few prospective studies evaluating their safety have been performed, and even fewer have focused on patients with cancer. Overall, the complication rate in cancer patients appears to be higher than in other patients,

Therefore, we conducted this prospective study to determine the complication rate of PICCs in cancer patients attending our hospital.

Patients and Methods

The Aga Khan University Hospital (AKUH) is a 650 bed tertiary care center in Karachi, Pakistan. Medical Oncology Section is comprised of a 50 bedded inpatient unit with a four bedded BMT unit and a 30 bedded Day care chemotherapy unit. All the cancer inpatients who deemed to have difficult venous access or requiring a central venous access for multitude of indications, particularly chemotherapy after recommendation by primary care physician were referred to the department of Radiology for PICC insertion. We have a dedicated Interventional Radiology Team who inserts 4 Fr single lumen non-valved PICC under strict anti-septic conditions, and fluoroscopic guidance in Angiography suit. The PICC is inserted in any of the major vein of the upper extremities, more frequently in basilic vein and secured by stat-lock adhesive dressing. The polyurethane catheter is used because of its wide luminal diameter and easy blood products transfusion. It is recommended to be kept in place for 6-8 weeks duration by the manufacturer. It can be used for a longer period of time if no complication develops.

We prospectively identified and followed all patients who had a PICC successfully Inserted during a 1 year period, from March 1, 2007, to February 29, 2008, until they were removed or patient expired The project was approved by the AKUH Institutional Ethical Review Committee.

PICC maintenance:

PICCs are used for all types of infusions and phlebotomy. The primary care inpatient nurse is responsible for catheter care, changes both dressing and IV tubing three times weekly and as needed, and performs the weekly saline flush. The IV insertion team is responsible for repair of torn catheters and unblocking of catheters. For caring of PICC at home after discharge, either home health care team or patients attendants were given detailed instructions regarding care of catheter. Patients were called at home daily on phone regarding any evidence of complication and advised to come to the ward if any complication developed.

A single reason was determined for any PICC removed prematurely. Reasons included catheter-related bloodstream infection (CR-BSI), phlebitis, thrombosis, catheter occlusion, leakage or broken catheter, or accidental removal. The decision to remove a PICC line was made by the patient's primary physician. The data regarding PICC were entered into an already formed proforma and filled by the principal investigator.

Twenty-six patients had more than one PICC placed during the study period. For the analysis, each PICC placement was counted as a new event. Therefore, all presented calculations, including the demographic description of the patient group, used PICC placements rather than individual patients as the unit for counting. For data analysis SPSS version 15 was used.

Results

A total of 166 PICCs were inserted into 128 patients during the 9 months study period. One Patient had six PICCs inserted, five patients had four PICCs, six patients had three PICCs and 12 patients had two PICCs inserted. One patient had two PICCs, one on each arm at the same time. Twenty patients with their 20 PICCs were lost to follow up and were excluded from the Analysis. For the remaining 122 patients and their 146 PICCs, the data was available for analysis. The demographic profile of 146 patients and the primary indications for PICC placement are listed in Table-1.

Overall, the patient population included 93 (63.3%) men and 53 (36.7) women, with a mean age 43.1±16.7 years (range, -> 16-82 years). Seventy four patients (50.68%) had a solid tumour, and 72 (49.32%) had haematological malignancy. Among the solid tumours, the most common were gastrointestinal malignancies, (50%).Acute myeloid leukaemia was the most common (66.3) among the haematological malignancies. The basilic vein was used most frequently, 119 (81.6%) for PICC placement. All the PICCs were secured by the stat-lok device.

Sixty seven patients (46%) were discharged from Hospital with a PICC still in place. Follow-up for these patients was arranged with home health care team, on phone and frequent follow ups in clinic. The remaining 79

Table-1: Characteristics of the patients Receiving a PICC (n=146).

Characteristics	No. of patient	%
Age by quartile (years)		
16-40	63	43.2
41-50	30	20.5
51-60	32	22.1
61-70	16	11.1
>70	05	3.1
Mean age years	43.1 ± 16.7	
Sex		
Male	93	63.3
Female	53	36.7
Underlying cancer		
Solid tumors (n-74)	74	50.8
Gastric carcinoma	14	9.5
Lymphomas	14	9.5
Colorectal carcinoma	13	8.9
Sarcomas	07	4.8
Pancreatico-biliary	07	4.8
Esophageal ca	05	3.4
Lung cancer	03	2.0
Others	11	7.5
Hematologic Malignancies (n-72)	72	49.3
AML	48	66.3
ALL	15	20.8
Myeloma	6	8.3
CLL	3	4.1
Primary indication for PICC		
Chemotherapy	88	60.6
TPN	29	24.0
IV access	23	12.0
K-Replacement	13	8.0
Site of PICC		
Right Basilic vein	103	70.5
Left Basilic vein	16	11.0
Right cephalic vein	9	6.1
Left cephalic vein	3	2.1
Right brachial vein	12	8.2
Left brachial	3	2.1

patients (54%) remained hospitalized for the entire duration of PICC use.

The 146 PICCs were in place for a total of 3329 catheter-days (median time, 14 days; range, 2 to 218 days; mean, 23.8 ± 29.8 days). The most common indication for PICC were chemotherapy (60.3%). The most frequently used chemotherapy regimen was induction chemotherapy for Acute Myeloid Leukaemia followed by FOLFOX for coloxectal carcinoma. Majority of patients (54%) preferred PICC in sections, remaining were not clear about, which line to be preferred and decision were left on primary physicians care discretion.

Demographic and disease characteristics of the 146 patients receiving a PICC are given in Table-1 and reasons of PICC removal are listed in Table-2. PICCs in sixty seven patients removed due to complications.

Table-2: Reasons of PICC removal and outcome of all PICCs (n-146).

Condition	No. of patients	%	Rate per 1000 catheter-days
No complication	98	67.1	-
Complications	48	32.8	14.4
Infections	37	25.3	11.1
Systemic	27	18.4	8.1
Phlebitis	10	6.8	3.0
Blockage	6	4.1	1.8
Accidental removal	3	2.0	0.9
Leakage	1	0.7	0.3
Thrombosis	1	0.7	0.3

Ninety-eight (67.1%) PICCs were removed at completion of therapy without any evidence of complication.

Forty-eight (32.8%) of 146 PICCs were removed because of complication, rate of 14.4 per 1,000 catheter-days.PICCs of patients with Haematologic malignancies were more likely to be complicated (p=<0.05).

Infections were the most common complication reported, but culture proven to be positive in 11 patients (29.7%), of them 7 (4.9%) were blood culture positive, 4 (2.8%) catheter tip positive and in 4 (2.1%) cases both blood and catheter tip cultures were positive.

Blood culture yielded E.coli in 4 cases and one of each of Staphylococcus Aureus, Staphylococcus epidermidis and Enterococcus.Catheter tip grew Staphylococcus Epidermidis in two cases and Staphylococcus Aureus and Enterococcus each in one case.

Discussion

PICCs are now becoming more popular than other Central Venous Catheters (CVCs), because of ease of insertion and removal, cost-effectiveness and low procedure related complications. PICCs have made administration of chemotherapy much safe and reliable. However its complications in cancer patients have not been much studied, therefore we studied prospectively its complication rate in cancer patients.

We found a complication rate of 32.8% and 14.4/1000 PICC-days, which is similar to that found by Walshe et al, 32.8%, 10.9/1000 PICC-days, the largest prospective study in 351 cancer patients.[9] However the pattern of complication was different in the two studies. The complication rate was more in the retrospective study of K. Cheong et al;[7] in comparison to our study, in which the overall complication rate was 40.7%, but infective complications were less, which is 25.9% at a rate of 8/1000 PICC-days.

The comparison of our result with other studies is given in Table-3.

The most common complication in our study was

Table-3: Comparison of Efficacy and Complications with other Study Results.

Efficacy and complications	current study	Walshe et al[9]	Cheong et al[7]	S.Yap[3]
Study design	**Prospective**	**Prospective**	**Retrospective**	**Retrospective**
Patient's	**cancer**	**cancer**	**cancer**	**cancer**
No. of patients	146	351	27	88
Total PICC (days)	3329	10,562	806	6872
Mean Dwell time (days)	23.81 ± 29.8	30	29	45
Complication rate				
/1000 catheter-days				
Infective	11.1	4.6	8.6	0.7
Thrombosis	0.3	1.14	1.2	0 .7
Accidental removal	0.9	1.80	0	0.4
Blockage	1.8	1.33	1.2	0
Leakage	0.3	1.99	2.4	0
Overall complication	14.4	10.9	13.6	2.0
/1000 PICC days				

infection which resulted in PICC removal in 37 (25.3%), at a rate of 11.1/1000 PICC-days. This is in contrast to the result of Walshe et al;[9] in which infection rate was 7.4% (2.5/1000 PICC-days). In the study by Safdar et al.[6] A prospective study of 251 ICU patients found a complication rate similar to other Subcutaneously implanted CVCs as PICC related infection rate was 2.4% a rate of 2.1/1000 catheter-days. The complication rate also seems to depend on the infusate being given through the PICC. PICCs when being used for only IV antibiotics, the complication rate have been found to be low as compared those where multiple infusates are being given through the PICC for example chemotherapy, blood products and electrolyte infusion and antibiotics.

The above findings can be further confirmed by the study conducted by Chu et al;[2] (Australasian Radiology) in which 44 PICCs were placed in 44 patients for only IV antibiotics and a complication rate of 5.5/1000 PICC days was found with infective complication rate of 0.8/1000 PICC days.

Our recent PICC complication rate compares favourably with published series in the oncology setting Walshe et al;[9] Cheong et al,[7] but comparison of complication rates across various institutions can also be difficult due to the varying definition of PICC complications. Theoretically patients who have PICCs in situ for only short periods of time, may be at lower risk of developing complications, resulting in apparently lower complication rate, but expressing PICC complication rate as complication per 1000 PICC-days may compensate for this.

Our infective complication rates were more, but thrombotic complications were less as compared to Walshe et al,[9] Cheong et al[7] and Chu et al.[2] This could be due to the fact that large number of our patients with haematological malignancies were neutropenic at the time of PICC insertion and at least for sometime thereafter, also we used our PICCs for all kinds of infusate, chemotherapy, blood products transfusion, electrolytes infusion and antibiotics, which could be the reason for more complications. This is the first study of its kind in Pakistan as only two to three Hospitals in our country have facility and expertise of PICC line placement.

Conclusion

PICCs provide safe and cost effective central venous access for all kinds of indications. Peripherally inserted central catheter complication rates can be minimized if used and maintained appropriately. This includes PICC insertion under strict sterile conditions, patient family and staff education with formal aftercare guidelines, strict infection control and regular PICC maintenance and surveillance, making them a safe and acceptable venous access alternative for cancer patients. However a prospective study is needed to compare safety, efficacy and quality of life of patients with PICC and implanted ports.

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