Original Article

Use of Peripherally Inserted Central Catheter is integral to supportive care in Hematopoietic Stem Cells Transplantation – A single centre study

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ABSTRACT

Background: Peripherally inserted central catheters (PICCs) are commonly being used in haematological diseases for treatment and now are being used even in haemopoietic stem cells transplantation. The present study was planned with an objective to study the complications, safety and efficacy of PICCs in haemopoietic stem cell transplantation for haematological diseases. **Methods:** A prospective cohort study was conducted in stem cell transplantation department of our tertiary care cancer hospital for a period of two and half years as per the proforma. All patients with hematological cancer who were undergoing stem cell transplantation were enrolled and were followed up until catheter removal or patient death. The basic information was recorded at the time of PICC insertion, weekly care, and removal after the transplantation. The data were analyzed to study the aims and objectives of the study. **Results:** Seventy two PICCs were inserted over a period of two and half years for a total of 8048 catheter-days (mean of 111.77 +/_ 66.55 days i.e 3.7 months, range: 9 to 269 days). Out of these 72 PICCs, 11 (15.27%) PICCs had complications and all of them were removed at the rate of 1.35/1000 PICC-days. Catheter related blood stream infection (CRBSI) was higher in allogenic transplant group (16%) than in autologous group (2.5%) while thrombosis was present in allogenic group only. Mortality due to non-PICC complications was higher in allogenic transplant (40%) than in the autologous group (7.5%). **Conclusion:** PICCs plays an integral part to supportive care in hematopoietic stem cell transplantation for hematological cancers.

Key words: *Peripherally inserted central catheter (PICC), hematological, stem cell transplantation.*

High-dose chemotherapy followed by hematopoietic stem cell transplantation (HSCT) is one of the standard of care for many hematological malignancies [1,2,3]. HSCT is of two types, autologous stem cell transplantation especially for cancers like multiple myeloma, lymphoma and allogenic stem cell transplantation for leukemias. The management of patients undergoing to stem cell transplantation requires a central line for administration of high-dose chemotherapy as well as stem cell infusion. Hence, the use of peripherally inserted central catheters (PICCs) for this intermediate-term access has been increased significantly from the last few years [4]. PICCs were first described in 1975 [5] as a substitute for central venous catheters such as subclavian catheters that have higher rates of infection. PICCs provide guarded intravenous access to a variety of indications [6] which include any infusate, regardless of pH, osmolarity or other chemical properties of the medication. Intravenous medications especially high doses chemotherapies are toxic to the peripheral venous endothelium and hence requires central venous admission to avoid this damage [7]. The materials used to make PICCs are either silicon rubber or polyurethane material, silicon being associated with less thrombosis [8]. The recent advances in

hematological malignancies have enabled us to cure many cases while the rest get varying degrees of relief. But, relief from symptoms including both physical and emotional is to be provided to all. Hence, "Supportive Oncology" is developed as a well-recognized discipline [9]. The supportive care of the patient with any type of malignancy not only improves the quality of life but also the survival when combined with protocol based specific treatment.

PICC is very crucial to supportive care of hematological cancer patients undergoing stem cell transplantation. During the transplant process, prolonged and severe myelosuppression occurs post high dose chemotherapy due to which patient requires a lot of supportive measures. Blood and blood products are transfused regularly through the PICC line to combat anemia and thrombocytopenia. In case of neutropenic sepsis, higher antibiotics as well as anti-fungals are administered easily with the help of PICC. Daily blood counts are done until the engraftment of neutrophils which might take about ten to fifteen days in average. Total parenteral nutrition along with electrolytes support is given if patient develops severe mucositis as toxicity due to chemotherapy. Despite of these utmost significances, PICCs may develop various complications of which catheter related blood stream infection (CRBSI) and thrombosis are of paramount importance [10]. The aim of this study was to evaluate the efficacy and safety of the use of PICCs in hematological cancer patients undergoing hematopoietic stem cell transplantation.

MATERIAL AND METHODS

We conducted a prospective cohort study from June 2015 to December 2017 in stem cell transplantation unit in our tertiary comprehensive cancer hospital. The study was approved by our institutional department review board. All of the patients enrolled in the study provided written informed consent. All the hematological cancer patients that were admitted in transplant unit for transplantation were inserted PICC.

Under ultrasonogram guidance, 4 Fr single lumen triple-valved Groshong PICC (Bard Access, USA) was inserted with strict aseptic care by trained PICC team either in Minor Operation theatre or in ward. The PICC was inserted into any of the major vein of the upper extremities, more frequently in basilic vein and secured by stat-lock sutureless device. Chest radiograph was performed in all patients to verify the correct location of the tip (close to cavoatrial junction). PICC trained nurses of our unit were responsible for catheter care daily as well as weekly as per the protocols to reduce the complications. Flushing of devices was done with 10 ml of saline before and after each infusion (20 ml in case of infusion of blood products or blood sampling). The dressing over the exit site was changed every 48 h or more frequently if it was soiled. The site of insertion was examined daily for signs of inflammation like edema, erythema, tenderness etc. and recorded in a register.

Proforma was made with all the parameters related to PICC line, patients and transplant such as name, age, sex, date from insertion and removal of PICC, diagnosis, patient status, type of vein accessed, complication (if any), PICC dwell days etc. Data were collected in pre-designed proforma, entered in MS-Excel chart and converted to SPSS software for final analysis. Categorical variables were described by frequency distribution and percentages. Continuous variables were expressed by means and standard deviations. The rates of complications were expressed by percentage and per 1,000 catheter days. For the analysis, each PICC placement was counted as a new event. In case of Lost to follow up patients, last visit was taken as the date of removal of PICC line. After the initial overall study of PICC in transplant cohort, the study of PICC was done as per the types of transplantation – autologous and allogenic. Finally our study result was compared with the other similar studies that have used PICC in hematological cancer patients for transplantation.

RESULTS

A total of 72 PICCs were inserted successfully during the study period in 65 patients of which one patient had three PICCs inserted, five patients had two PICCS inserted and two PICCs were lost to follow up. The demographic profile of patients and PICCs details were listed in Table 1. Overall, the patient population included 32(49%) men and 33(51%) women, with a mean age of 41.66 +/_ 14.67 years (range- 7 to 67years). Age group 45-64 was the most common age group. Lymphoma (35%) was the most common of the haematological malignancies. The basilic vein (84.7%) was used most frequently for PICC placement. Weekly follow-up for these patients was arranged with PICC team in transplant unit or minor operation theatre for dressing.

Table 1: Characteristics of the patients receiving a PICC.

	Characteristics	No. of patients (n=65) (%)
Age (years)	07 - 24	6 (9.3%)
	25 -44	24 (36.9%)
	45 - 64	34 (52.3%)
	65 - 84	1 (1.5%)
Mean Age		41.6 +/_ 14.6
Sex	Male	32 (49%)
	Female	33 (51%)
Underlying Cancers	AML	15 (23.07%)
	Lymphoma	23 (35.38%)
	ALL	5 (7.7%)
	Multiple myeloma	17 (26.15%)
	Others	5 (7.7%)
Site Of PICC Line	Right basilic vein	14 (19.44%)
	Left basilic vein	47 (65.28%)
	Right cephalic vein	0 (0%)
	Left cephalic vein	6 (8.34%)
	Right brachial vein	3 (4.16%)
	Left brachial vein	2 (2.78%)
		Number of PICCs (n=72) (%)
Complications	CRBSI	5 (6.9%)
	Phlebitis	2 (2.77%)
	Blockage	0 (0%)
	Accidental Removal	2 (2.77%)
	Leakage	0 (0%)
	Thrombosis	2 (2.77%)
	Abnormal position	0 (0%)
	Hematoma	0 (0%)
Total PICCs removed	Removal due to death	13 (18%)
	Removal due to complications	11 (15.3%)
	Removal after completion of treatment without complications	46 (63.9%)
	lost to follow up	2 (2.8%)

The 72 PICCs were in place for a total of 8048 catheter days (mean of 111.77 +/_ 66.55 days i.e. 3.7months and range, 9 to 269 days). The mean numbers of attempts on skin puncture during PICCS insertion were 1 attempt with mean duration of 26 minutes for PICCs insertion .The mean depth of PICCs inserted into the arms were about 1cm and the length of PICCs was about 38cm .Of these 72 ,11 (15%) PICCs had complications and all of them were removed at the rate of 1.35/1000 PICC-days. Total 7 patients out of 72 patients (9.7%) had infections with the incidence rate of 0.86 per thousand catheter days. Infective complications included 5 CRBSI and 2 phlebitis. During the study 5(6.9%) patients had blood culture positivity out of which 1 (1.38%) cases had PICC tips positivity and 1 patient had combined positivity. Blood culture showed growth of staphylococcus species which was sensitive to common antibiotics like penicillin and cephalosporin groups. Total 2 out of 72 patients (2.77%) developed thrombosis in the PICC line which is at the rate of 0.24 per thousand catheter days. Patients were started with low molecular weight heparin till thrombosis resolved out .The reasons for the catheter removal were the following: completion of therapy (46 patients, 63 %), catheter-related thrombosis (2 patients, 2.77 %), Infections (7 patients, 9.7%) accidental catheter removal (2 patients, 2.77 %), and death (13 patients, 18 %) due to other reasons.

Table 2: Characteristics of Stem Cell Transplant.

Characteristics	Autologous Transplant	Allogenic Transplant
Number of patients	40	25
Male	21	11
Female	19	14
Mean Dwell Time(days)	110	145
Most common malignancy	Lymphoma	AML
CRBSI	1(2.5%)	4(16%)
Thrombosis	0	2(8%)
Mortality due to PICCs complications	0	0
Mortality due to other complications	3(7.5%)	10(40%)
Treatment Completed	37	15

Out of the total 65 hematopoietic stem cell transplantation, 40(61.5%) transplant were autologous transplant and 25(38.5%) were allogenic transplant as depicted in Table 2.The most common malignancy was lymphoma in autologous transplant group and AML in allogenic transplant group. CRBSI was higher in allogenic transplant group (16%) than in autologous group (2.5%) while all the thrombosis was present in allogenic group only. This discrepancy could be due to prolonged use of chemotherapy multiple blood and blood products transfusion and prolonged myelosuppression. Mortality due to PICC complications was zero in both the groups however mortality due to other causes was higher in allogenic transplant (40%) than in the autologous group (7.5%). The most common cause of mortality in our study was infections other than CRBSI.

DISCUSSION

PICCs are now being increasingly used in hematopoietic stem cell transplantation due to ease of insertion, low procedure related complications and less financial expense which also helps in cutting down of transplant cost [11]. In a study by Harter et al [12] they described the use of PICC in a cohort of 66 hematological patients undergoing autologous stem cell transplantation with an overall success rate for insertion of 94 %, a low incidence of complications (phlebitis 7.6 %, CRBSI 3%). Hence, they concluded that PICC might be successfully used for high dose chemotherapy and autologous stem cell transplantation. However, time for PICC removal was very short for this series, with a median duration of catheterization of 8.9 days.

In an another study by Silvia Bellesi et al [4] regarding use of PICCs in 57 patients undergoing autologous stem cell transplantation, the incidence of CRBSI was low (3.3 %), despite severe neutropenia developed in all patients following the conditioning regimen. The incidence of catheter- related thrombosis was also low (5 %). They concluded that PICCs are a safe and effective alternative to conventional central venous catheters even in patients particularly prone to infective and hemorrhagic complications such as patients receiving autologous stem cell transplantation.

In a study by Alessandra Malato et al [13] regarding use of PICCs in 72 patients undergoing both autologous and allogenic stem cell transplantation they had an incidence rate of 2.63% in both CRBSI and thrombotic complications with a mean dwell time of 112 days .They concluded that lymphoma and leukemia patients have respectively an increased risk of developing a CRBSI and a thrombotic PICCs-complication when submitted to haematopoietic stem cell transplantation (HSCT).

In our study, we had a success rate of 100% PICC insertion by trained specialist with ultrasonogram guidance of strict aseptic procedure. It was relatively safe procedure as we didn't have any case of local hematoma after the procedure and we have very less incidence with phlebitis (2.77%).The incidence of CRBSI was higher (6.9 %), most likely due to severe and prolonged myelosuppression especially in allogenic transplant following the conditioning regimen .The incidence of catheter related thrombosis was very low (2.77 %), probably due to regular dressing and monitoring of the PICCs .The thrombosis rate of our study was lesser than Harter et al [12] and Silvia et al [4] studies however the CRBSI rate was almost double in our study than the other three studies. The use of antibiotic lock of tunneled central vein catheters is an effective strategy for catheter salvage in HSCT patients with catheter colonization and CRBSI [14]. However, we didn't have data to analyze regarding use of antibiotic lock for CRBSI prevention in our study.

The strength of this study lies in the fact that this is one of the considerable number of patients data onto PICCs used in a supportive care for hematopoietic stem cell transplantation in Indian hematological cancer patients. However, this analysis couldn't reveal about comparison of the other central venous access methods used in stem cell transplantation.

CONCLUSION

PICC provides relatively safe and persuasive alternative mode of central venous access for hematopoietic stem cell transplantation even in Indian cancer settings. PICC forms an integral part of supportive care in hematopoietic stem cell transplantation in hematological cancers. CRBSI is of little concern especially in allogenic stem cell transplantation which needs to be addressed properly .However more prospective study is needed with large population of cohorts for further validation.

REFERENCES

1. Philip T, Guglielmi C, Hagenbeek A, et al. Autologous bone marrow transplantation as compared with salvage chemotherapy in relapses of chemotherapy-sensitive non-hodgkin's lymphoma. N Engl J Med. 1995 Dec 7;333(23):1540–5.
2. Schouten HC, Qian W, Kvaloy S, et al. High-dose therapy improves progression-free survival and survival in relapsed follicular non-hodgkin's lymphoma: Results from the randomized european CUP trial. J Clin Oncol. 2003 Nov 1;21(21):3918–27.
3. Child JA, Morgan GJ, Davies FE, et al. High-dose chemotherapy with hematopoietic stem-cell rescue for multiple myeloma. N Engl J Med. 2003 May 08;348(19):1875–83. 2014/06.
4. Silvia Bellesi, Chiusolo P, De Pascale G et al. Peripherally inserted central catheters (PICCs) in the management of oncohematological patients submitted to autologous stem cell transplantation. Supportive Care in

Cancer. August 2012, DOI: 10.1007/s00520-012-1554-0 · Source: PubMed
5. Hoshal VL. Total intravenous nutrition with peripherally inserted silicone elastomer central venous catheter. Arch Surg 1975;110(5):644–6.
6. Chu FS, Cheng VC, Law MW, et al. Efficacy and complications in peripherally inserted central catheter insertion: a study using 4-Fr non-valved catheters and a single infusate. Australas Radiol. 2007;51:453-7.
7. Yap S, Karapetis C, Lerose S, et al. Reducing the risk of peripherally inserted central catheter line complications in oncology setting. Eur J Cancer Care (Engl) 2006;15:342-7.
8. Bishop L, Dougherty L, Bodenham A, et al. Guidelines on the insertion and management of central venous access devices in adults. Intl J Lab Hematol. 2007;29:261-78.
9. BB Rewari, Gupta S, AK Agarwal et al. Supportive Care in Oncology. Journal of Indian Academy of Clinical Medicine. 2004;5(1): 38-46.
10. Fracchiolla NS, Todisco E, Bilancia A et al. Peripherally Inserted Central Catheters (PICCs) Implantation in the Clinical Management of Oncohematologic Patients: Results of a Large Multicenter, Retrospective Study of the REL Group (Rete Ematologica Lombarda - Lombardy Hematologic Network, Italy). Blood. 2015;126:5611.
11. Derudas D, Baroncian D et al. Safety, Feasibility and Cost of Hematopoietic Stem Cell Transplantation Management by Peripheral Inserted Central Catheter (PICC): A Phase II Prospective Study. Blood. 2013;122:2971.
12. Harter C, Ostendorf T, Bach A, et al. Peripherally inserted central venous catheter for autologous blood progenitor cell transplantation in patients with haematological malignancies. Support Care Cancer. 2003;11:790–4.
13. Malato A, Luppino A, Pipitone R et al. Peripherally Inserted Central Catheters (PICCs) Can Be Successfully Utilized in Haematological Patients: Efficacy of an Educational Program. Blood. 2012;120:3161.
14. Zanwar S, Gokarn AG, Devdas S et al. Use of Antibiotic Lock for Salvage of Tunneled Central Venous Catheters with Catheter Colonisation and Catheter Related Blood Stream Infection in a Tertiary Care Hematopoietic Stem Cell Transplantation Unit- a Strategy Revisited, Blood. 2015;126:3116.

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