A study of the use of peripherally inserted central catheters in cancer patients: A single-center experience

Irappa Madabhavi, MBBS, MD, DM, ECMO, Apurva Patel, MBBS, MD, DM, Malay Sarkar, MBBS, MD, Pritam Kataria, MBBS, MD, DM, Nagaveni Kadakol, BE, and Asha Anand, MBBS, MD

Effective and reliable venous access is one of the cornerstones of modern medical therapy in oncology. The focus of this prospective observational research is to study the various indications of a peripherally inserted central catheter (PICC) in different solid and hematological malignancies and the various complications and outcomes in the pediatric and adult cancer patients. This study was conducted in a prospective observational study design and collected data of patients with a diagnosis of any cancer, at a tertiary care oncology hospital in Ahmadabad, Gujarat, India, during a 2-year period. The PICC was inserted in 352 patients and most commonly used in hematological conditions (n = 295, 83.8%), followed by solid malignancies 57 (16.2%). In the hematological malignancy group, acute myeloid leukemia (48.01%) was the most common indication, and in the solid malignancies group, osteosarcoma (n = 9, 2.55%) was the most common indication for PICC insertion. PICCs were inserted most commonly in the left side of the venous system in 70.7% cases. The complications in the PICC study group included infections (12.5%), thrombosis (4.82%), catheter blockage (4.82%), arrhythmias (4%), premature catheter removal (3%), bleeding (2.55%), and pneumothorax (2.55%). The median days of the PICC use in situ were 152 days. To conclude from our study, PICCs are most commonly indicated in malignancies that are requiring long-term chemotherapy, such as hematological malignancy, especially acute myeloid leukemia, and solid malignancies, usually osteosarcoma, and these catheters are associated with complications such as infection, thrombosis, catheter blockage, arrhythmia, bleeding, and pneumothorax. The most disturbing aspect of the treatment of a cancer patient is multiple painful venipunctures made for administration of cytotoxic agents, antibiotics, blood products, and nutritional supplements. From this study, we can infer that PICC lines can be used for various malignancies that require long-term chemotherapy. (J Vasc Nurs 2018;■:1-8)

From the Department of Medical and Pediatric Oncology, Gujarat Cancer Research Institute, Ahmedabad, Gujarat, India; Department of Pulmonary Medicine, Indira Gandhi Medical College, Shimla, Himachal Pradesh, India; Department of Medical and Pediatric Oncology, TMH, Mumbai, India; Department of Computer Science, GPT College, Bilagi, Bagalkot, Karnataka, India.

Corresponding author: Irappa Madabhavi, MBBS, MD, DM, ECMO, Department of Medical and Pediatric Oncology, Gujarat Cancer Research Institute, Ahmedabad, Gujarat, India (E-mail: irappamadabhavi@gmail.com).

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Effective and reliable venous access is one of the cornerstones of modern medical therapy in oncology. The management of the patient with cancer demands stable venous access that is used for a wide range of indications including chemotherapy, blood product and antibiotic administration, fluid resuscitation, and access to the bloodstream for clinical monitoring and microbial culturing. The use of central venous catheters (CVCs) can also decrease patient anxiety associated with repeated venipunctures. The number and variety of CVCs used in oncology practices are as follows:

- PICC (peripherally inserted central catheter),
- Hickman (cuffed) catheter, and
- Subcutaneous implanted port-a-cath (PORT) catheters.[1]

PICC, Hickman, and PORT catheter devices provide reliable and safe intravenous access in a variety of indications in oncology.[2] PICC, Hickman, and PORT catheter devices are frequently used in oncology patients to deliver chemotherapy as well as other intravenous medications, fluids, and total parenteral nutrition.[3]

PICCs are nontunneled, central catheters inserted through a peripheral vein of the arm; they are 50- to 60-cm long and are usually made of silicone or second- or third-generation polyurethane.

The use of PICCs is approved by the Food and Drug Administration for up to 3–12 months; although most PICCs may stay in

place and in use for several months, there is growing evidence that their actual duration depends on many factors: 1) type of material, 2) technique of insertion, 3) stabilization of the venous access device, 4) patient compliance, and, most importantly, 5) nurse competence in the maintenance of the device.

PICCs are usually inserted at the bedside by trained physicians, either resorting to the "blind" technique via the antecubital vein or the cephalic vein or to ultrasound guidance via a deep vein in the mid arm (basilic or brachial vein); they are available with one or more lumens. In the hematology-oncology setting, they are well suited for ambulatory or outpatient therapy because they can be safely used even in patients with extremely low platelet counts or at high risk of hemorrhage.[4]

Materials (silicone vs polyurethane) may influence the risk of complications because some types of polyurethane may be associated with a higher incidence of thrombosis. Sometimes polyurethane PICCs may be preferable because they have thinner lumen walls and larger internal diameters; these features significantly increase flow rates and reduce the risk of breakage and complete rupture of the catheter. This may be an advantage in hematology patients, who often require blood and platelet infusions.

On the other hand, pump-driven or low-flow intravenous infusions—as in chemotherapy treatments for solid tumors—can easily be delivered by either silicone or polyurethane PICCs; silicone is associated with better biocompatibility and durability than most types of polyurethane and thus seems more suitable for long-term use.[5] It is accepted that placement in the antecubital fossa or at mid arm carries the important advantage of moving the exit site of the catheter away from endotracheal, oral, and nasal secretions.

The aims and objectives of this study are as follows:

1 To study the various indications of PICCs in different solid and hematological malignancies in the pediatric and adult cancer patients attending to the Department of Medical and Pediatric Oncology.
2 To study the various complications and outcomes related to PICCs.

MATERIALS AND METHODS

This is a prospective observational study, and in this study, we have collected data pertaining to PICC insertion in patients with a diagnosis of any type of cancer, at a tertiary care oncology hospital in Ahmadabad, Gujarat, India, over a 2-year period (August 2013–2015). Patients of all age and sex, presenting to the Department of Medical and Pediatric Oncology and Hematology at the Gujarat Cancer Research Institute (GCRI) was included.

The data were collected from the department of anesthesia, surgical oncology, and institutional (GCRI) website, from patients admitted in the department of medical and pediatric oncology. Patients were interviewed using a detailed questionnaire regarding their age, sex, clinical symptoms, and treatment received from outside of GCRI. A particular note was made of a past history of any thromboembolic disease and bleeding disorders and whether the patient was ever treated for that.

The data were collected for indications of PICCs in various malignancies. The data were collected for the complications related to PICCs and outcomes of treatment. The study was approved by the Ethics Committee of GCRI, Ahmedabad, Gujarat, India. Written informed consent was obtained from the patients or the parent/guardian for publication of the clinical details in this report. In our center, PICC insertion was performed under anesthesia, in the operation theater.

Inclusion criteria

- All cancer patients presenting to medical and pediatric oncology and hematology.
- All histopathologically confirmed cancer patients.
- All the cancer patients of all the stages from I to IV and also based on Eastern Cooperative Oncology Group performance status.

Exclusion criteria

- Patients with abnormal coagulation profile.
- Platelet count < 15,000 per mm^3 of blood.
- Patients who did not give consent.

RESULTS AND OBSERVATIONS

In this present prospective observational study, patients of all age and sex who are presenting to Department of Medical and Pediatric Oncology, at GCRI, a tertiary care oncology hospital in Ahmadabad, Gujarat, India, with a diagnosis of any cancer during a 2-year period (August 2013–2015) were included. The data were collected for the indications, complications, and outcomes of PICCs, in various malignancies, from the patients admitted in the department of medical and pediatric oncology, bone marrow transplantation unit, surgical oncology, and department of anesthesia. Patients were interviewed using a detailed questionnaire regarding their age, sex, clinical symptoms, and treatment received outside of GCRI.

Distribution of the study population

A total of 652 patients were enrolled as the study population for the CVC study, and out of that, 352 (53.98%) required PICC insertion, 200 (30.67%) required Hickman catheter insertion, and 100 (15.33%) required PORT catheter insertion as part of their comprehensive management strategy in our cancer center.

Age and sex distribution of the study group

Out of the 352 patients in the PICC study group,

- 80 patients (22.85%) were in the less than 14-year age group (pediatric population),
- 270 patients were in the adult (14–65 years) age group (76.7%),
- 2 patients were in the geriatric age group (0.5%),
- 215 were males (61.00%), and
- 137 were females (39%).

Diagnosis and various indications of the PICCs

Most common indication for PICC in this study group was hematological conditions (n = 295, 83.8%), followed by solid