Original Research Article

Nurse-Led Central Venous Access Device (CVAD) Clinic: A Model of Safe and Efficient Vascular Access Care

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ABSTRACT

Introduction: Central Venous Access Devices (CVADs) play an important role in the management of oncology patients by providing reliable vascular access for the administration of chemotherapy, other intravenous therapies and blood sampling. A dedicated nurse-led CVAD clinic can provide comprehensive care throughout the life cycle of the device, including patient and family counseling, peripherally inserted central catheter (PICC) insertion, routine maintenance, assessment, and troubleshooting. Present study was conducted to describe the nurse-led CVAD clinic model at ACTREC, Tata Memorial Center, and its selected clinical and operational outcomes. **Materials and Methods:** The nurse-led CVAD clinic at ACTREC-TMC, a tertiary cancer center, was established in December 2016. Credentialed nurses provide counseling, PICC insertion, routine care and maintenance of Hickman catheters, implanted ports and PICCs, troubleshooting, and patient and caregiver education, following standardized insertion and maintenance bundles. Infectious and non-infectious PICC complications are audited monthly. **Results:** First-attempt PICC insertion success (2017–2025) and the proportion of PICCs remaining in situ until completion of treatment (2017–2024) are reported. Approximately 2,500 patients visit the clinic each month, and approximately 2,700 PICC insertions have been performed by certified nurses. The first-attempt insertion success rate increased from 76.64% in 2017 to 89.21% (554/621) in 2025. The proportion of PICCs remaining in situ until completion of treatment ranged from 65.95% to 70.05% during 2017–2021 and from 82.39% to 85.41% during 2022–2024. The maximum PICC dwell was 908 days without any complication. **Conclusion:** A nurse-led CVAD clinic can contribute to improved accessibility, continuity of care, patient education and efficient utilization of healthcare resources. Continued monitoring of clinical outcomes and quality indicators is recommended to demonstrate the impact of the service.

Keywords:
Central venous access device (CVAD), Peripherally inserted central catheter (PICC), Nurse-led clinic, Vascular access, Oncology nursing, Catheter maintenance, Patient education.

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Introduction

Central Venous Access Devices (CVADs) are an important component of vascular access for oncology patients, who require repeated or prolonged intravenous treatment. These devices prevent repeated venepuncture, infiltration and extravasation, and ensure patient safety. Common long-term vascular access devices used in oncology include Hickman catheters, subcutaneous implanted ports, and peripherally inserted central catheters (PICCs).[1,2]

Appropriate device selection, insertion, maintenance and monitoring of these devices are essential to reduce complications and provide safe and effective patient care. The World Health Organization emphasizes appropriate education and training of healthcare workers on hand hygiene, aseptic technique, standardized catheter care and care bundles as an important component of preventing catheter-associated infections. The 2026 WHO guideline specifically addresses prevention of bloodstream infections and other infections associated with central

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venous catheters during the stages of pre-insertion, insertion, maintenance, access, replacement and removal. [1,2]

Objectives

Primary objective

To describe the Nurse-Led CVAD clinic model at ACTREC, Tata Memorial Center, as an approach to safe and efficient vascular access care for oncology patients.

Secondary objectives

1. To describe the core functions, patient flow and service volume of the clinic.
2. To describe the staff training, competency assessment and credentialing process.
3. To report the first-attempt PICC insertion success rate from 2017 to 2025.
4. To report the proportion of PICCs remaining in situ until completion of treatment from 2017 to 2024.

Materials and Methods

Design

Setting

At ACTREC-TMC, a tertiary cancer center, the nurse-led CVAD clinic was established in December 2016. The clinic provides care and maintenance of Hickman catheters, subcutaneous implanted ports and PICCs. Specialized and credentialed nurses provide comprehensive CVAD services, including patient and family counseling, device assessment, PICC insertion, routine care and maintenance, education regarding home care, and early identification and management of complications.

Many centers use ultrasound guidance for PICC insertion. At the ACTREC nurse-led clinic, however, CVAD-certified nurses are empowered to perform PICC insertion by the traditional method (without ultrasound guidance). A separate PICC insertion room is allotted within the clinic. The nurse-led team monitors all PICC lines from insertion until removal. The dedicated CVAD service supports continuity of care and facilitates timely management of vascular access-related concerns.

Service organization and patient flow

Weekly flushing and dressing of the catheter ensure catheter safety. The clinic provides weekly appointments for flushing and dressing of all catheters except ports; port care and maintenance appointments are given monthly. Appointments for the next visit are made when the patient attends for routine care and maintenance. On the day of the allotted visit, the patient collects a token from the reception counter according to the given appointment slot. In case of any catheter complication, an appointment is given as required on a case basis.

The clinic provides CVAD care to pediatric patients aged 3 months to 17 years. Parents are counseled about securing the catheter during the child's activities and sleep. Distraction therapy is used for pediatric patients who do not cooperate during PICC insertion, dressing and flushing of the catheter.

The clinic also acts as a consultation service for the wards and day care for CVAD-related complications such as blockage, fracture, dislodgement of the catheter, phlebitis and rashes. A 24-hour on-call CVAD emergency service is provided by CVAD nurses for prompt and effective care.

Sample and Sampling

Service volume

Approximately 2,500 patients visit the ACTREC nurse-led CVAD clinic each month (Table 1).

Table 1: Approximate monthly patient visits to the CVAD clinic (n=2500)

Service	Patients per month
Counseling	130 – 150
PICC insertion – pediatric	20 – 25
PICC insertion – adult	40 – 45
Care and maintenance – adult	1,000 – 1,200
Care and maintenance – pediatric	600 – 800
Management of CVAD-related complications	100 – 120
Total (approximate)	**2,500**

Core Functions of the CVAD clinic

Pre-Insertion Counseling

Patients and their family members receive counseling regarding the selected vascular access device, its purpose, expected duration of use, care requirements, and potential complications.

- Education focuses on prevention and early recognition of complications such as infection, phlebitis, thrombosis, catheter occlusion and dislodgement.
- Patients and caregivers are also instructed regarding precautions to be taken during daily activities and when medical attention should be sought.
- Consent for PICC insertion is taken from the patient and family after effective counseling.

PICC insertion

- PICC insertion is performed according to the established insertion bundle protocol and within the scope of practice.
- A chest X-ray is taken post-insertion to confirm the position of the catheter tip.

Routine CVAD maintenance

Routine maintenance includes assessment of the catheter and insertion site, dressing changes, flushing the catheter, assessment of catheter function and monitoring for complications according to the maintenance-bundle protocol. Standardized maintenance practices and regular assessment are important components of safe CVAD

management. Current WHO guidance supports standardized approaches to catheter maintenance, access, and infection prevention. [1,2]

Troubleshooting and management of complications

The CVAD team assesses and manages complications associated with vascular access devices, including:

- Catheter occlusion
- Infection, and administration of antibiotic lock as per institutional policy
- Phlebitis
- Thrombosis
- Dislodgement
- Catheter fracture or damage
- Leakage
- Problems related to catheter function
- Malposition and migration

When a complication occurs, the event is assessed promptly and appropriate corrective action is initiated.

Patient and family education

Patient and caregiver education is an essential component of the nurse-led CVAD clinic. Patients and caregivers receive education regarding:

- CVAD care at home
- Dressing care
- Flushing as prescribed
- Prevention of infection
- Prevention of catheter dislodgement
- Recognition of complications
- Actions to be taken when the catheter becomes dislodged, fractured, or leaks
- When to contact or attend the CVAD clinic

Some patients living far away are allowed to go home during the maintenance period. Such patients have difficulty attending the clinic for routine care and maintenance; hence, their caregivers are taught PICC dressing and flushing according to institutional policy, to facilitate PICC care at home and reduce frequent clinic visits.

Patients are instructed to seek urgent assessment in the CVAD clinic for symptoms such as dislodgement, leakage, bleeding from the catheter, pain, redness, swelling, itching or rash at the catheter site.

Staff training and competency

Staff members receive education regarding CVAD management during induction. Staff are permitted to handle CVADs after completing the required competency assessment. A refresher course is conducted every 6 months for all staff to update knowledge and skills.

When a CVAD-related complication occurs, such as catheter fracture or occlusion, the incident is reported according to the institutional process. The CVAD team evaluates the event, identifies appropriate corrective measures, and repeat competency assessment of staff is undertaken.

Regular education and competency assessment are consistent with current recommendations emphasizing appropriate training and assessment of healthcare workers involved in central venous catheter management. [2,3]

Credentialing and training program

Credentialing is an important component of the nurse-led CVAD service. Nurses undergo a one-month certificate course in long-term CVAD care, consisting of theoretical and practical training followed by supervised clinical practice before independent practice. The training program supports development of knowledge and skills in:

- CVAD selection and assessment
- PICC insertion
- Aseptic technique
- Dressing and maintenance
- Flushing and catheter care
- Recognition and management of complications
- Patient and caregiver education
- Documentation and escalation of complications

Protocols and standardized practice

The CVAD clinic follows standardized protocols for insertion and maintenance of vascular access devices. Key principles include:

- Hand hygiene
- Aseptic technique
- Appropriate personal protective equipment
- Use of standardized insertion and maintenance bundles
- Regular assessment of the catheter and insertion site
- Appropriate dressing and flushing practices
- Early identification of complications
- Assessment of the catheter for removal when no longer in use
- Documentation and incident reporting
- Ongoing staff education and competency assessment

Standardized care and adherence to evidence-based recommendations are important for reducing variation in practice and supporting patient safety. [1,2]

Periodic audits and outcome measures

Periodic audits of infectious and non-infectious PICC complications are conducted by the clinic on a monthly basis. The outcomes reported in this article are the year-wise first-attempt PICC insertion success rate (insertions successful at the first prick ÷ total insertions × 100) and the proportion of patients whose (PICCs remaining in situ until completion of treatment ÷ total PICC insertions × 100).

Results

Service activity

Approximately 2,500 patients visit the clinic each month (Table 1). Approximately 2,700 PICC insertions have been performed by certified nurses from the ACTREC nurse-led CVAD clinic.

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First-attempt insertion success

The first-attempt success rate ranged from 76.64% to 81.91% between 2017 and 2023, and increased to 87.29% in 2024 and 89.21% in 2025 (Table 2; Figure 1). During January–December 2025, 621 PICC insertions were performed, with first-attempt success in 554.

Table 2: First-attempt PICC insertion success rate, 2017–2025 (n=2327)

Year	Total no. of patients	First-prick attempt	Percentage
2017	167	128	76.64
2018	169	137	81.06
2019	152	123	80.92
2020	94	77	81.91
2021	103	79	76.69
2022	144	116	80.55
2023	326	253	77.60
2024	551	481	87.29
2025	621	554	89.21

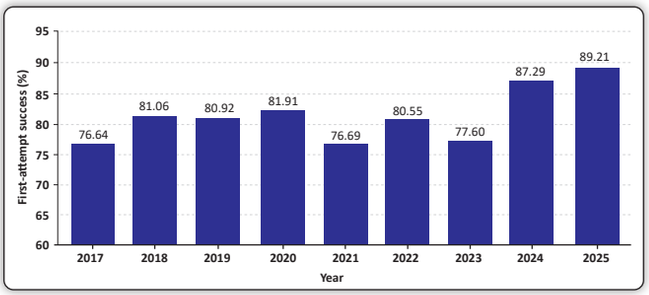


Fig. 1: First-attempt PICC insertion success rate (%), 2017–2025

PICC retention until completion of treatment

The proportion of patients whose PICC remained in situ until completion of treatment ranged from 65.95% to 70.05% during 2017–2021 and from 82.39% to 85.41% during 2022–2024 (Table 3; Figure 2). The maximum PICC dwell was 908 days without any complication.

Table 3: PICCs remaining in situ until completion of treatment, 2017–2024

Year	Total no. of PICC insertions	No. of patients whose PICC remained in situ until completion of treatment	Percentage
2017	167	117	70.05
2018	169	114	67.45
2019	152	104	68.42
2020	94	62	65.95
2021	103	69	66.94
2022	144	123	85.41
2023	323	267	82.66
2024	551	454	82.39

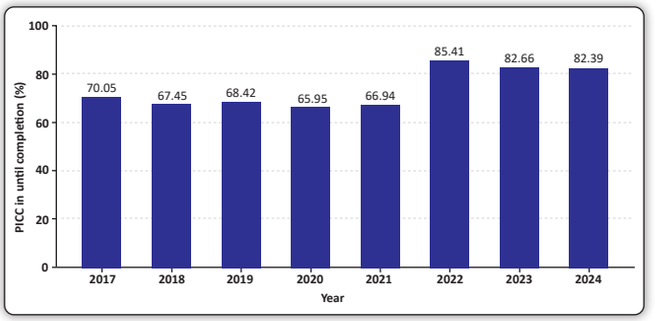


Fig. 2: Patients whose PICC remained in situ until completion of treatment (%), 2017–2024

Complications

The ACTREC nurse-led CVAD clinic reported a lower rate of CVAD-related complications than previously published studies.

Discussion

The establishment of a dedicated nurse-led CVAD clinic provides an organized approach to vascular access care for oncology patients. The model described at ACTREC-TMC integrates insertion, maintenance, troubleshooting, patient education, staff training and competency assessment within a specialized service.

A dedicated CVAD clinic provides patients with access to healthcare professionals who have specialized knowledge and experience in vascular access management. Patients can receive assessment, maintenance, troubleshooting, and education in a dedicated setting, supporting continuity of care.

Education provided by specialized nurses helps patients and caregivers recognize potential complications at an early stage and understand appropriate CVAD care at home.

A dedicated nurse-led service can support efficient utilization of healthcare professionals by allowing appropriately trained nurses to undertake activities within their defined scope of practice and competency.

Regular assessment, standardized maintenance practices, patient education, and early troubleshooting may support prevention and early recognition of catheter-related complications. The WHO 2026 guideline emphasizes education and training, hand hygiene, aseptic technique, standardized catheter care, and surveillance as important components of central venous catheter infection prevention. [2]

The role of nurses in vascular access management requires appropriate education, competency assessment, defined responsibilities, adherence to institutional policies, and standardized approaches to infection prevention and catheter care. [1,3]

Implications for Nursing Practice

- A dedicated nurse-led CVAD clinic can improve patient access to specialized vascular access care and support

continuity of care.

- Credentialing, supervised practice and periodic competency assessment enable nurses to undertake CVAD insertion and maintenance within a defined scope of practice.
- Structured patient and caregiver education supports early recognition of complications and safe CVAD care at home.
- Standardized insertion and maintenance bundles can reduce variation in practice and support patient safety.
- Regular audits of catheter outcomes help identify opportunities for quality improvement.

Limitations

- The findings describe a single tertiary cancer center and may not be generalizable to other settings.
- The report is descriptive and does not include a comparison group.
- Complication rates from the monthly audits are not presented numerically.
- Outcomes are reported as year-wise aggregate data.

Future Research

Further evaluation of the clinic could include additional quality indicators such as:

- Catheter-related bloodstream infection rates
- Catheter occlusion rates
- Dislodgement rates
- Dwell time
- Unplanned catheter removal
- Patient satisfaction
- Waiting time
- Cost-effectiveness

Conclusion

The nurse-led CVAD clinic at ACTREC-TMC provides a specialized and comprehensive model for vascular access care in oncology patients. The service integrates CVAD insertion, routine maintenance, troubleshooting, patient and family education, staff training, and competency assessment.

During January–December 2025, 621 PICC insertions were performed with an 89.21% (n=554) first-attempt success rate. The dedicated service supports timely access to specialized vascular access care and promotes standardized practice for safe CVAD management.

Continued monitoring of clinical and quality indicators will help evaluate the effectiveness of the nurse-led CVAD clinic and identify opportunities for further quality improvement.

Declarations

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Conflict of interest

The available study record did not report any competing interests.

AI-assisted writing disclosure

This manuscript was language-edited with AI assistance; the authors remain responsible for the scientific content, interpretation and final manuscript.

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