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Three-year experience of chemoport insertion in 177 cancer patients at a tertiary care centre: outcomes and complications

Abstract

Background: Totally implantable venous access devices (chemoports) are essential for long-term chemotherapy administration but are not popular as they are associated with infectious and mechanical complications.

Methods: This retrospective observational study was conducted at a tertiary care center over a 3-year period. Medical records of 177 consecutive patients who underwent chemoport insertion for chemotherapy were reviewed. All devices were inserted using ultrasound-guided internal jugular vein access under strict aseptic precautions, with use of chemoport reservoir size according to patient built. All patients were followed for a minimum of 6 months to evaluate infectious, wound-related, thrombotic, and mechanical complications.

Results: Successful placement was achieved in all patients. The overall complication rate was 4.52% (8/177). Port-related infection occurred in 3 patients (1.69%), wound gape in 3 patients (1.69%), catheter-related thrombosis in 1 patient (0.56%), and port kink in 1 patient (0.56%). No major intraoperative complications were observed. A total of 95.5% of patients had no complications.

Conclusion: Ultrasound-guided internal jugular vein access combined with meticulous sterile technique and use of chemoport reservoir size according to patient built is a safe and effective method for chemoport placement, demonstrating a low infection and complication rate.

Keywords: chemoport, totally implantable venous access device, internal jugular vein, infection rate, chemotherapy, complications.

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Introduction

Totally implantable venous access devices (TIVADs), commonly referred to as chemoports, are integral to the management of patients requiring long-term intravenous therapy, particularly systemic chemotherapy.[1,2] Effective, efficient, reliable, easily accessible venous access is must for medical therapy in oncology. First described for oncologic use by Niederhuber et al. in 1982, these devices were developed to overcome the limitations of external central venous catheters and repeated peripheral venipuncture.[1] Chemoports provide reliable central venous access, improved patient comfort, better cosmetic acceptability, and reduced interference with daily activities, making them especially suitable for prolonged cancer treatment protocols.[2,3]

A chemoport is a completely implantable system composed of three principal components:

- a reservoir or port chamber with a self-sealing silicone septum,
- a catheter, and
- a connector mechanism attaching the catheter to the port chamber.

The port chamber is usually made of titanium or polymer and is implanted in a subcutaneous pocket, most commonly over the anterior chest wall. The silicone septum permits repeated percutaneous punctures using a non-coring (Huber) needle without compromising its integrity. The catheter, typically made of silicone or polyurethane, is inserted into a central vein—most commonly the internal jugular or subclavian vein—with its tip positioned at the cavoatrial junction to ensure optimal hemodilution of chemotherapeutic agents.[2,4] Proper placement and secure fixation of each component are critical to minimize mechanical and infectious complications.

Despite their advantages, chemoports are associated with early and late complications. Among these, infection remains the most clinically significant concern. Port-related infections may manifest as local site cellulitis, port pocket infection, tunnel infection, or catheter-related bloodstream infection (CRBSI). These infections can result in treatment delays, increased hospital stay, port removal, and, in severe cases, sepsis.[3,5] Reported infection rates vary from less than 1% to approximately 10%, depending on patient-related factors such as immunosuppression and neutropenia, as well as procedural factors including insertion technique, operating room sterility, and maintenance protocols.[5,6,7]

Potential Port Specific Complications are:

- Skin breakdown/ necrosis/ wound gap
- Port/Catheter separation
- Occlusion
- Release of sutures – “Twiddler’s Syndrome”
- Pinch-Off syndrome

Other recognized complications include venous thrombosis, catheter malposition, pneumothorax, hemothorax, arterial puncture, port rotation, and mechanical failure.[3,5] The adoption of ultrasound-guided venous access has been shown to reduce mechanical

complications and improve first-attempt success rates.[8,9] Furthermore, strict adherence to aseptic precautions and standardized central line insertion bundles significantly reduces catheter-related infection rates.[6,10]

Given the clinical importance of minimizing port-related complications, prospective evaluation of institutional outcomes is essential. Continuous monitoring of infection rates and complication profiles not only ensures patient safety but also allows benchmarking against established standards and refinement of procedural techniques.[11,12]

This clinical case analysis evaluates outcomes from 177 chemoport insertions performed using strict aseptic protocol, IJV access, and use of chemoport reservoir size according to patient built, with focus on safety and complication prevention.

Materials and methods

Study Design and Setting

This retrospective observational study was conducted in the Department of General Surgery at a tertiary care hospital. The study period extended over three years, from January 2022 to August 2025. All patients were followed for a minimum duration of six months after chemoport insertion to assess early and late complications.

Study Population

The study included all patients who underwent chemoport placement for administration of systemic chemotherapy during the defined study period. Patients of all age groups and both sexes who required long-term venous access for chemotherapy were eligible. A total of 177 patients were included in the analysis, out of it 3 were children, 12 males, 162 were ffemales.As primary doctor is a breast specialist, we had more female partient. Patients with incomplete records or those lost to follow-up before six months were excluded from the study.

Device Characteristics

All patients received totally implantable venous access devices consisting of a polymer port chamber with a self-sealing silicone septum connected to a silicone catheter. In this study, use of chemoport reservoir size according to patient built were routinely used to minimize pocket tension and reduce wound-related complications. The port chamber was implanted in a subcutaneous pocket over the anterior chest wall.

Insertion Technique

All procedures were performed in a dedicated operating room under strict aseptic precautions. Prophylactic intravenous antibiotic Inj Cefuroxime 1.5g was administered within 60 min of procedure.

The right internal jugular vein (IJV) was the site of venous access. Out of 177 patients, only 5 patient had left IJV access. 56% of chemoports were inserted under local anaesthesia with sedation, and rest were part of main oncosurgery, so carried out under general anaesthesia. Ultrasound guidance was utilized for venous puncture to improve accuracy and minimize mechanical complications. After successful cannulation of the IJV, a guidewire was introduced using the Seldinger technique. A peel-away sheath was then advanced, and the catheter was inserted with its tip positioned at the cavoatrial junction.

A subcutaneous pocket was created over the anterior chest wall, deltopectoral region, 3 finger below clavicle, carefully sized to accommodate the chemoport chamber without undue tension. The catheter was tunneled subcutaneously and connected securely to the port reservoir. Proper positioning was confirmed intraoperatively. Backflow was assessed. The port was flushed with heparinized saline to ensure patency before wound closure in layers. Sterile dressing was applied at the end of the procedure. In children less than 10 years, low profile ports were used (Figure 1).

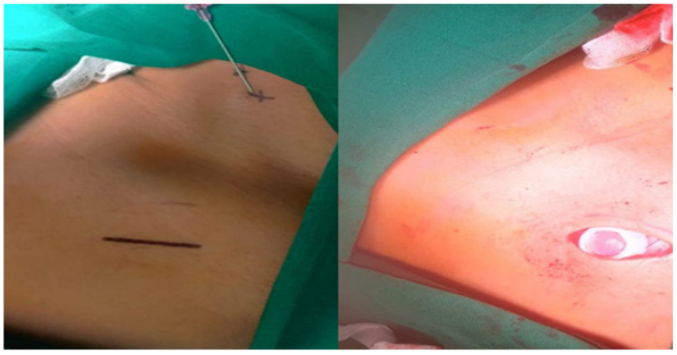


Figure 1 Port insertion technique.

Postoperative Care and Follow-up

Patients were monitored for immediate postoperative complications such as pneumothorax, bleeding, hematoma, arrhythmia, and catheter malposition. A chest X-ray was obtained postoperatively to confirm catheter position and rule out pneumothorax.

Ports were accessed only by trained oncology staff using aseptic technique. Regular flushing protocols were followed to maintain patency. Patients were followed up in surgical and medical oncology outpatient departments for a minimum of six months. Data regarding complications such as port-site infection, wound dehiscence, catheter thrombosis, port malfunction, port flip, and need for port removal were recorded.

Outcome Measures

The primary outcome was the rate of port-related infection. Infection was defined as:

Local port site infection (erythema, warmth, tenderness, or purulent discharge),

Port pocket infection, or

Catheter-related bloodstream infection confirmed clinically and/or microbiologically.

Secondary outcomes included:

Wound-related complications (wound gape),

Venous thrombosis confirmed clinically and radiologically,

Port kink, and

Any other mechanical complications.

Statistical Analysis

Data were entered into a structured database and analyzed using descriptive statistics. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequency and percentage.

Results

Patient Profile

A total of 177 patients underwent chemoport insertion during the study period. All ports were placed via the internal jugular vein

using ultrasound guidance and strict aseptic precautions. We used Right Internal jugular vein in almost all cases, left Internal jugular vein was only used in 3 patient. Small-sized port chambers were used in majority of the cases. In 3 children less than 10 years, low profile port were used. For 2 thin patient, BMI<18, low profile port were used. Successful placement was achieved in 100% of patients. There were no immediate major intraoperative complications such as pneumothorax, hemothorax, or arterial injury.

Overall Complication Rate

Out of 177 chemoport insertions, 8 complications were recorded during the follow-up period, yielding an overall complication rate of 4.52%.

Infectious Complications

Port-related infection was observed in 3 patients, corresponding to an infection rate of 1.69%.

Among these:

- Cases presented with local signs of infection at the port site.
- No cases of overwhelming sepsis or procedure-related mortality were observed.
- Infected ports were managed according to institutional protocol, including antibiotics and port removal as there infections failed to respond to antibiotics.

Wound-Related Complications

Wound gape occurred in 3 patients (1.69%). These cases were managed with appropriate wound care, and no long-term sequelae were observed. The use of smaller port chambers likely contributed to reduced pocket tension and favorable wound healing in the majority of cases. Out of 3 patient with wound gap, secondary suturing helped in 2 patient, while port was removed in 1 patient.

Mechanical Complications

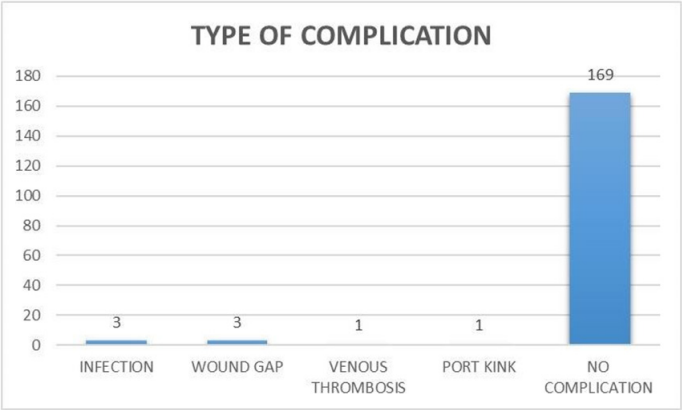
Catheter-related venous thrombosis: 1 case (0.56%) was diagnosed clinically and confirmed radiologically. The patient was managed with anticoagulation therapy.

Port kink: 1 case (0.56%) was noted, leading to difficulty in port access. Surgical revision was performed successfully under local anaesthesia.

We used pre-connected port, so catheter related complications such as catheter migration, catheter fracture, catheter dislodgement were not seen. There was no port flip in our study, as we did minimum 3 point fixation of port with non-absorbable suture- prolene 2-0 suture. Also our port pocket size was small, so minimal to no area for port to flip (Table 1, Graph 1 & Figure 2).

Table 1 Complication distribution table

Complication type	Number of cases	Percentage
Infection	3	1.69%
Wound gap	3	1.69%
Venous thrombosis	1	0.56%
Port kink	1	0.56%
Total complications	8	4.52%



Graph 1 Complications of chemoport.

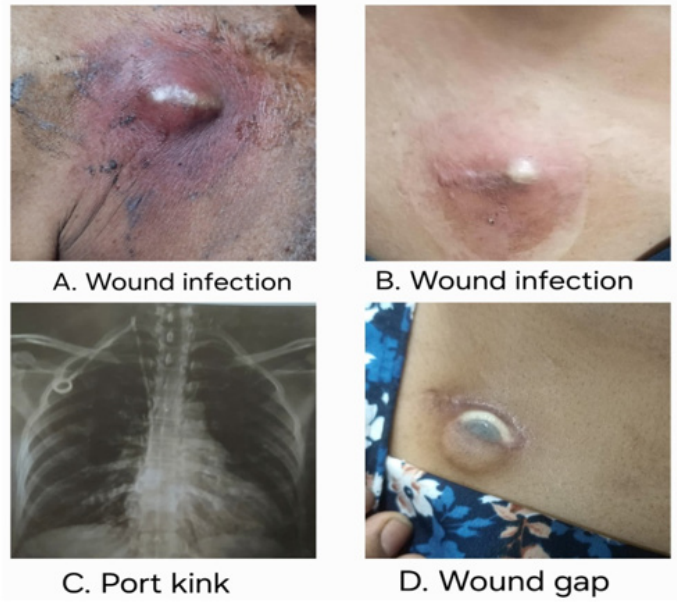


Figure 2 Complications of chemoport.

Interpretation

The observed infection rate of 1.69% is at the lower end of the range reported in published literature. The low incidence of infectious and mechanical complications in this study may be attributed to:

- Exclusive use of internal jugular vein access
- Routine ultrasound guidance
- Strict adherence to aseptic surgical technique
- Use of chemoport reservoir size according to patient built
- Standardized postoperative care and flushing protocols

The absence of major mechanical complications such as pneumothorax or hemothorax further supports the safety of the technique employed.

Discussion

Totally implantable venous access devices have become indispensable in modern oncological practice due to their reliability, durability, and improved patient comfort.[2,11] However, complications,

particularly infections, remain clinically significant because they may interrupt chemotherapy schedules, increase healthcare costs, and contribute to morbidity.[5,13] In the present prospective study of 177 chemoport insertions, the overall complication rate was 4.52%, with an infection rate of 1.69%, which compares favorably with published literature.

Infection Rate and Comparison with Literature

Reported infection rates for totally implantable venous access devices range from approximately 1% to 10%, depending on patient population, duration of follow-up, insertion technique, and institutional infection-control measures.[13,14] Large retrospective and prospective series have documented infection rates between 2% and 8%. [13,15]

The infection rate of 1.69% observed in our study lies at the lower end of this spectrum. This Infection could be pre-procedural, intra-procedural or post-procedural. This favorable outcome may be attributed to several technical and procedural factors.

First, exclusive internal jugular vein (IJV) access was adopted in all cases. Several previous studies have reported that IJV cannulation, particularly when performed under ultrasound guidance, is associated with a lower rate of insertion-related complications compared to the traditional landmark-guided subclavian approach.[16,17] In our series, the use of IJV access resulted in a high technical success rate with minimal immediate and early procedural complications.

The internal jugular vein offers a relatively direct and straight pathway to the superior vena cava, which facilitates easier catheter advancement and optimal catheter positioning.[12] In the majority of cases in our study, the right internal jugular vein was used as the preferred access site. The left internal jugular vein was utilized only in three patients in whom right-sided access was technically difficult. Our findings also suggest that left-sided insertion was associated with a comparatively higher rate of complications.

This observation may be explained by the anatomical course and hemodynamic characteristics of the left-sided venous pathway. The catheter inserted from the left side follows a more angulated route before reaching the superior vena cava, which may increase the likelihood of endothelial irritation or injury.[3] Previous reports have similarly indicated that catheterization via the left internal jugular vein carries a slightly higher complication rate compared to the right side.[3] Furthermore, the use of a more direct venous pathway with minimal tissue manipulation may contribute to reduced procedural trauma and a lower risk of subsequent infection.

Second, routine ultrasound guidance was utilized for venous cannulation. Meta-analyses have shown that ultrasound guidance significantly improves first-pass success rates and reduces mechanical ccomplications.[8,9] By minimizing multiple puncture attempts and hematoma formation, the risk of infection may be further reduced.

Third, strict adherence to aseptic technique and infection-prevention bundles likely played a critical role. Implementation of standardized catheter insertion protocols has been shown to significantly reduce catheter-related bloodstream infections in various clinical settings.[6,10,18]

Role of chemoport reservoir size according to patient built

In this study, chemoport chambers were used according to patient built. For thin patient and pediatric age group, low profile ports were used. Device size influences pocket dimensions and tissue tension. A smaller subcutaneous pocket reduces dead space and minimizes wound stress, potentially lowering the risk of wound complications and secondary infection. Although literature primarily focuses on insertion technique and maintenance practices, device-related factors such as chamber size and pocket construction have also been recognized as important determinants of outcomes. [19]

Mechanical and Wound Complications

The wound gape rate in our study was 1.69%, which is low compared to rates reported in larger series.[13] Careful pocket creation, appropriate sizing for smaller ports, and layered wound closure likely contributed to favorable wound healing outcomes.[19]

Only one case (0.56%) of catheter-related thrombosis was observed. Published thrombosis rates vary between 1% and 5%.[15,20] Early recognition and prompt anticoagulation prevented further complications in our patient.

Port kink occurred in one case (0.56%). Port kink is an uncommon but recognized complication.[14,21] The low incidence in our study may reflect meticulous surgical technique and appropriate anchoring of the device.

Importantly, no cases of pneumothorax or hemothorax were encountered. This further supports the safety advantage of ultrasound-guided IJV access over blind or landmark-based subclavian cannulation.[9,17]

Recent literature has also emphasized the importance of proper catheter maintenance protocols and trained personnel in reducing long-term complications associated with central venous access devices.[22,23]

Furthermore, several studies evaluating vascular access devices have highlighted the association between catheter placement technique, infection prevention measures, and overall complication rates.[24,25]

Clinical Implications

The findings of this prospective study suggest that a standardized protocol emphasizing:

- Internal jugular vein access
- Routine ultrasound guidance
- Strict sterile precautions
- Use of chemoport chambers according to patient built
- Structured postoperative care can achieve complication rates that are lower than or comparable to those reported in large published series.

Maintaining low infection rates is particularly critical in oncology patients, as uninterrupted chemotherapy directly influences treatment outcomes and overall survival. Therefore, procedural standardization and institutional auditing of outcomes should be considered essential components of quality cancer care.

Conclusion

This prospective analysis of 177 chemoport insertions demonstrates that ultrasound-guided internal jugular vein access combined with meticulous sterile technique and the use of smaller chemoport systems is safe and effective. The infection rate of 1.69% and overall complication rate of 4.52% compare favorably with established literature.

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Continued adherence to standardized protocols is essential to maintain low complication rates and ensure optimal long-term central venous access for chemotherapy administration.

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None.

Conflict of interest

The authors declare no competing financial interests.

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