ISSN: 2692-5370
Anaesthesia & Surgery Open Access Journal
DOI: 10.33552/ASOAJ.2024.05.000624
Iris Publishers

Research Article

Incidence of Complications Related to Central Venous Access Devices (CVADs) in Cancer Patients: A Retrospective Study

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Received Date: November 29, 2024

Published Date: December 04, 2024

Abstract

Aim: Implantable chambers (VVCs) are commonly used in the treatment of cancer patients, but they are associated with a risk of complications. This study aims to analyze the incidence and types of complications related to VVC implantation in cancer patients at the Mohamed V military training hospital.

Methods: Retrospective study conducted on 150 VVCs implanted in 145 cancer patients between January and June 2023. Complications were classified as infectious, mechanical and thrombotic.

Results: The incidence of complications was 10.7%, comprising infections (5.3%), mechanical complications (4.7%) and thrombosis (0.7%). Infections were mainly local or systemic, with three cases of sepsis. No significant associations were observed between complications and patient demographics.

Conclusion: Complications associated with VVC are frequent and impact the management of cancer patients. Rigorous preventive measures, including strict aseptic management and the use of guiding techniques, are needed to reduce the complication rate.

Keywords: Central Venous Access Devices; Complications; Cancer; Infections; Thrombosis

Introduction

The use of implanted ports, or central venous access devices (CVADs), has become common in the treatment of cancer patients. These devices are often essential for administering chemotherapy, long-term intravenous treatments, or for drawing blood samples. However, their use is not without risks. Despite growing expertise among medical teams, the placement and use of these devices can

lead to mechanical, infectious, or thrombotic complications in a significant proportion of cases. These complications, although somewhat inevitable (10-13% of cases), can have serious consequences, sometimes leading to the interruption of treatment, extended hospital stays, and a substantial economic burden on healthcare institutions. The objective of this study is to analyze the incidence of complications related to the implantation of CVADs in cancer patients over a six-month period at Mohamed V Military Teaching Hospital, in order to identify contributing factors and suggest improvements in clinical practices.

Materials and Methods

This is a retrospective observational, single-center study conducted in Mohamed V Military Teaching Hospital. The study included adult patients aged over 18 who were treated for cancer and received an implanted port between January 1, 2023, and June 30, 2023.

Inclusion Criteria:

- Adult patients (over 18 years) diagnosed and followed for cancer.
- Implantation of a central venous access device (CVAD) as part of oncological treatment.
- Exclusion Criteria:
- Patients with contraindications for CVAD implantation.
- Devices implanted for non-oncological purposes (e.g., dialysis, long-term treatment of diseases other than cancer).
- Data was extracted from patient medical records to identify:
- Demographic characteristics (age, sex, cancer type, etc.).
- Details on CVAD implantation (technique used, location, etc.).
- Complications occurring after implantation (mechanical, infectious, thrombotic complications).
- Factors associated with each type of complication.
- Complications were categorized as:
- Perioperative complications: Related to the implantation procedure itself (e.g., hemorrhage, perforation, failed placement).
- Infectious complications: Such as local or systemic infections related to the implanted port.
- Thrombotic complications: Thrombosis associated with the implanted port.

Results

During the study period, 150 CVADs were implanted in 145 patients of these patients, 56% were male, and the average age was 63 years. The most frequently encountered cancers were breast cancer (25%), lung cancer (22%), and gastrointestinal cancer (18%).

Patient Characteristics: During the study, 150 central venous access devices (CVADs) were implanted in 145 patients. The majority of the patients were male (56%), with an average age of 63 years. Breast cancer (25%), lung cancer (22%), and gastrointestinal cancer (18%) were the most frequently diagnosed malignancies, while other types of cancer accounted for 33% of the cases.

Table 1: Patient Characteristics.

Characteristics	Frequency (%)
Number of patients	145
Total number of central venous lines implanted	150
Gender	
-Male	81 (56%)
-Female	64 (44%)
Average age	63
Most common types of cancer	
Brest cancer	37 (25%)
Lung cancer	33 (22%)
Gastrointestinal cancer	27 (18%)
Other Cancers	48 (33%)

Complication Distribution: The overall complication rate was 10.7%, with a total of 16 cases observed. Infectious complications were the most common, representing 5.3% of all cases, including local Infections (3.3%) and sepsis (2.0%). Perioperative complications occurred in 4.7% of cases, predominantly hematomas (3.3%) and failed placements (1.3%). Thrombotic complications were relatively rare, accounting for only 0.7% of all cases. These results emphasize the importance of monitoring and addressing complications promptly.

Table 2: Distribution of Complications.

Complication type	Number of cases (n)	Percentage (%)
Total incidence of complications	16	10,7
Perioperative complications	7	4,7%
Hematomas	5	3,3%
Failed placements	2	1,3%
Infectious complications	8	5,3%
Local infections	5	3,3%
Sepsis	3	2,0%
Thrombotic complications	1	0,7%

Risk Factors Associated with Each Type of Complication: Various risk factors were associated with the observed complications. Perioperative complications were linked to advanced age (>70 years), poor vein assessment, and specific anatomical conditions. Infectious complications were more common in patients with lung and gastrointestinal cancers, non-compliance with hygiene protocols, and immunosuppression due to chemotherapy or radiotherapy. Thrombotic complications were associated with gastrointestinal cancer and extended implant duration. Understanding these factors is critical for improving patient outcomes and minimizing risks.

Table 3: Risk Factors Associated with Each Type of Complication.

Type of complication	Associated risk factor	Frequency
Perioperative complications	- Age > 70 yo	2 Cases
	- poor assessment of vein pathways	4 Cases
	- Specific anatomical conditions	1 Case
Infectious complications	- Lung cancer and gastrointestinal cancer	5 Cases
	- non-compliance with hygiene rules	3 Cases
	- immunodepression (due to chemotherapy, radiotherapy)	5 Case
Thrombotic complications	- Gastrointestinal cancer	1 case
	- extended duration of the implantable chamber	1 case

Discussion

The results of our study showed an overall incidence of complications with central venous access devices (CVADs) of 10.7%. This rate aligns with figures reported in the literature, where the incidence of CVAD complications typically ranges between 10% and 13% in cancer patients [1]. Although these complications are relatively common, they present significant clinical and medico-economic challenges. It is, therefore, essential to understand their mechanisms and implement preventive strategies to reduce them.

Infectious Complications: Infectious complications, accounting for 5.3% of cases in our study, were the most frequent, which corresponds with findings from other studies on CVADs. Infections remain one of the most common complications of central access devices and are directly associated with increased mortality rates, prolonged hospitalizations, and interruption of cancer treatment [1]. According to a systematic review by Kearon et al. (2019), the incidence of infections related to central venous access devices ranges from 3% to 8%, depending on management techniques and patient characteristics. Infections can be local (at the implantation site) or systemic, such as sepsis, which is particularly concerning in immuno-compromised cancer patients [2].

Systemic infections are often caused by bacteria such as Staphylococcus aureus and coagulase-negative Staphylococci, pathogens known for their ability to form biofilms on the surfaces of intravascular devices. In our series, three cases of sepsis were reported, underscoring the need for constant monitoring and strict infection management protocols. Preventing infections relies on

rigorous aseptic measures during insertion, as well as appropriate post-implantation management. A study by Tsimberidou et al. (2019) recommends the use of antibiotic prophylaxis for high-risk patients and regular monitoring for clinical signs of infection.

Mechanical Complications: Mechanical complications, representing 4.7% of cases in our study, include hematomas, technical errors during placement, and failed placements requiring surgical revision. This type of complication is well-documented and typically occurs when the procedure is not performed according to best practices [2]. The rate of mechanical complications in the literature ranges between 4% and 6% and is often related to improper assessment of the venous pathway or specific anatomical conditions [3].

In our study, the incidence of mechanical complications could be reduced with better procedural planning, such as using ultrasound to guide CVAD placement, as recommended by several experts [4]. The management of hematomas, in particular, could be improved with proper pressure application post-placement and regular monitoring of the implantation site. Placement failures, observed in two cases in our study, may be due to inadequate vein assessment before the procedure. This complication could be minimized with ongoing practitioner training and better site selection.

Thrombotic Complications: Although rare in our study (0.7%), thrombotic complications are a major concern in CVAD management, as they can lead to serious complications such as pulmonary embolism or loss of CVAD function. Previous studies show that the incidence of thrombosis related to central venous devices ranges from 1% to 3% [5]. Risk factors include the duration of device use, the use of silicone or plastic catheters, and comorbidities like coagulation disorders. In our series, the observed thrombosis required anticoagulant treatment, highlighting the importance of proactive management of this complication.

Prevention of thrombosis relies on several measures, including the use of smooth-walled catheters and rigorous management of the device throughout its implantation period. Additionally, studies have shown that the use of prophylactic anticoagulant medications in certain cancer patients could reduce the risk of thrombosis. However, individualized management based on the patient's thrombotic risk remains essential [6].

Factors Associated with Complications: Our analysis did not identify specific clinical factors associated with complications in this patient population. However, it is well-known that factors such as age, sex, cancer type, and the presence of comorbidities can influence the risk of complications [1]. For instance, patients treated for gastrointestinal or hematological cancers, often subjected to prolonged chemotherapy or immunosuppression, are at higher risk for infections and thrombosis [3]. Managing these risks requires a thorough assessment of the patient's profile and personalized preventive strategies.

Medico-Economic Implications: CVAD complications have significant medico-economic implications. According to a study by Patel et al. (2018), each major complication related to a central venous device can lead to substantial additional costs, often exceeding $10,000 per episode, due to prolonged hospitalization and additional treatments. Indirect costs, such as the loss of quality of life for patients, are also considerable. These data underscore the importance of investing in prevention to not only improve clinical outcomes but also control costs in healthcare institutions.

Study Limitations: Our study has several limitations. First, it is a retrospective study conducted in a single center, which limits the generalizability of the results. Additionally, some variables that could influence complications, such as patients' immune status, nutritional status, or the presence of comorbidities (e.g., coagulation disorders), were not systematically collected. Larger, multi-center prospective studies are needed to confirm our results and further understand the risk factors associated with CVAD complications.

Conclusion

Complications related to implanted ports are frequent and can have a significant impact on the management of cancer patients. Although the frequency of complications is similar to that observed in the literature, the clinical and medico-economic consequences justify the implementation of enhanced preventive measures. Training for practitioners, regular monitoring of patients, and optimizing implantation and management techniques are key strategies to minimize complications. A more individualized approach, taking into account the patient's risk factors, would also improve outcomes. Finally, further studies are needed to better understand risk factors and refine management recommendations.

Acknowledgement

None.

Conflict of Interest

No conflict of interest

Reference

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