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Hospital Records Analysis of Vascular Access for Imuno and Chemotherapy

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ABSTRACT

Introduction: Central venous access is essential for the administration of chemotherapy or immunotherapy in cancer treatment, with fully and semi-implantable devices associated with greater safety, comfort, and durability compared to other methods.

Objective: To analyze hospital records regarding the implantation of fully and semi-implantable central venous catheters, assessing trends in hospitalization, costs, prevalence, and mortality.

Methods: This was an observational, retrospective, and descriptive study using secondary data from the SUS Hospital Information System (SIH/SUS), extracted from DATASUS. The variables analyzed included the number of hospitalizations, average length of stay, total cost, prevalence rate and mortality rate.

Results: Between 2008 and 2024, implantations increased by more than 600% (from 2,892 to 20,736 procedures), with the highest annual growth between 2022 and 2023. The average hospital stay reduced from 4.0 to 1.5 days. The total cost increased from US$273,583.43 to US$2,287,534.09. The prevalence increased from 1.5 to 8.7 per 1,000 hospitalizations, and mortality decreased from 2.56% to 0.89%, despite intermediate fluctuations.

Conclusion: There was a significant increase in the implantation of central venous catheters for immunotherapy and chemotherapy in the SUS, with a reduction in hospital stay and mortality. Costs increased proportionally to the expansion of the procedure.

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Introduction

Cancer is a condition caused by the loss of control of cell division, leading to the disordered growth of cancer cells, which can form tumors that can be classified into two categories: benign and malignant. Benign tumors grow slowly and in a limited manner and, although they can compress adjacent structures, do not invade neighboring tissues. Malignant tumors, on the other hand, grow rapidly, invading nearby tissues and potentially spreading throughout the body in the form of metastases. In Brazil, malignant neoplasms are the second leading cause of death from diseases, thus representing a major public health challenge [1-4].

Successful cancer treatment depends on early diagnosis and primary staging of the disease to guide the therapeutic choice for each patient. Surgery, radiotherapy, immunotherapy, and chemotherapy are the main forms of treatment for neoplasms [5-7]. The first two are more effective when the disease is diagnosed in its early stages, with localized and non-metastatic tumors, but become inefficient when it is already disseminated. Therefore, in these cases, the therapy of choice is chemotherapy, which uses the administration of cytotoxic substances chemical compounds with cell-killing properties aimed at eradicating or reducing the tumor or targeting target cells [5, 8, 9].

Although chemotherapy can be administered orally in some cases, intravenous administration has proven to be the safest way to ensure tumor exposure to chemotherapy and immunotherapy [5, 9]. For safe administration, vascular access is essential, especially central access, as it minimizes the need for frequent punctures, reducing patient discomfort, and reducing the risk of complications associated with the infiltration of irritating medications into peripheral veins [10-13].

Since the first insertion of a central venous catheter (CVC) in humans in 1929, there has been significant evolution in devices, making them safer and more efficient. In the 1970s, Broviac et al. and Hickman et al. designed the first long-term CVCs that enabled the administration of intravenous therapies, such as chemotherapy. Later, in 1982, Niederhuber et al. introduced the first fully implantable device, the port-a-cath [14,15]. This device offers greater safety and comfort for cancer patients and is more durable, which significantly improved treatment adherence [11,12,14,16-18].

In recent years, particularly after 1990 in Brazil, the use of peripherally inserted central catheters (PICCs) has increased due to their simpler insertion. However, studies indicate that PICCs have a higher rate of complications associated with thrombotic events and infections compared to port-a-caths, which are more recommended [12,13,15,19].

Totally implantable devices and semi-implantable devices are inserted directly into the subclavian, jugular, or femoral veins (which are rarer), while PICCs are introduced through peripheral veins and guided to the superior vena cava [12, 15]. There are risks of complications inherent to both procedures, such as infection, incorrect positioning, and thrombosis; however, studies suggest higher rates of these adverse events with PICCs [12, 19]. Furthermore, when it comes to a better long-term cost-benefit ratio, implantable devices have been preferred.

This article's main objective is to analyze hospital records related to implantations and/or reimplantation of totally or semi-implantable vascular accesses for chemotherapy and immunotherapy, identifying financial aspects correlated with hospitalizations and mortality.

Methodology

This is an observational, retrospective, and descriptive study based on secondary data extracted from the Hospital Information System of the Unified Health System (SIH/SUS), available in the SUS database DataSUS referring to hospital procedures in Brazil between 2008 and 2024, by hospitalization location, related to the implantation of semi or fully implantable long-term catheters.

The data obtained were processed using Microsoft Excel software, creating tables and graphs related to the collected data. These can be viewed on the TabNet portal at the following link: https://datasus.saude.gov.br/

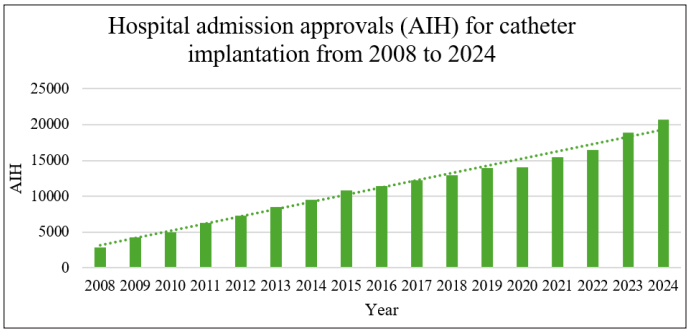
To obtain data on the procedure, the following terms were searched in DataSUS: implantation of a semi or fully implantable long-term catheter (main procedure), installation of a fully implantable long-term venous catheter, and implantation of a semi- or fully implantable long-term catheter (special procedure). The variables used were deaths, mortality rate, hospital admission authorizations (AIH), average catheter implantation length, total value, and prevalence rate. All values were converted to US dollars based on the exchange rate on February 27, 2025.

To calculate the hospital prevalence rate of admissions for catheter implantation relative to the total number of hospitalizations in Brazil, the ratio of the number of admissions for catheter implantation to the number of general admissions was calculated, according to the Brazilian region, in the same period.

Regarding ethical considerations, this study was exempted from submission to a Research Ethics Committee, as it exclusively used publicly accessible data, in accordance with current legislation. However, the researchers followed the ethical principles established by Resolution No. 466/2012 of the Brazilian National Health Council, ensuring confidentiality and responsible use of the analyzed information.

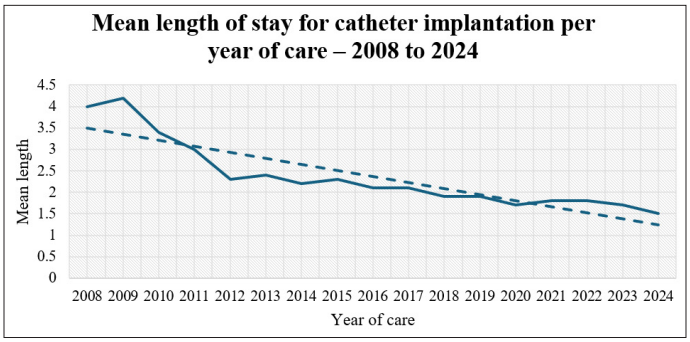
Results

Over the period evaluated, a progressive increase in the performance of this procedure was observed. In 2008, 2,892 hospitalizations were recorded, and in 2024, 20,736, according to Graph 1. The least pronounced growth occurred from 2019 to 2020 (during the coronavirus pandemic), while the most pronounced was from 2022 to 2023 (post-pandemic).



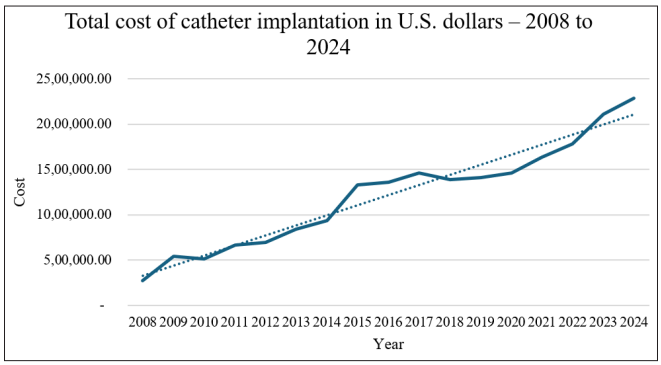
Graph 1: Hospital Admission Approvals (AIH) for Catheter Implantation from 2008 to 2024

According to graph 2, regarding the average permanence (in days) of catheters per year of care, a reduction can be seen from 2008 (4) to 2024 (1.5), with a fluctuation in the years between this period. In 2009 (4.2) there was an increase of 0.2 when compared to 2008. 2024 presented the lowest average (1.5), with a decrease of 0.2 when compared to the two previous years, suggesting a trend towards dehospitalization for this procedure.



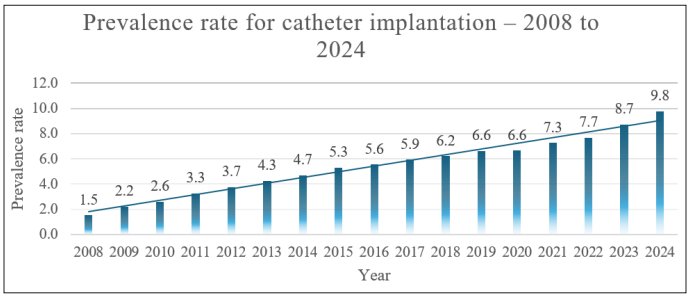
Graph 2: Mean Length of Stay for Catheter Implantation Per Year of Care – 2008 to 2024.

Regarding the total amount spent on implanting these catheters, there was a progressive increase over time, reflecting the country's economic instability, increased inputs and costs (Graph 3).



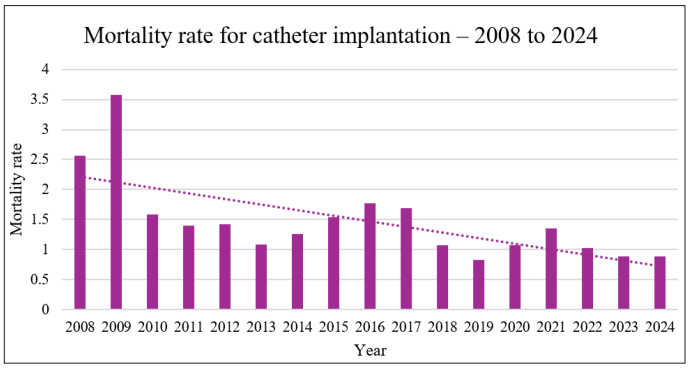
Graph 3: Total Cost of Catheter Implantation in U.S. Dollars, 2008 to 2024

Regarding the prevalence rate, according to graph 4, there was a continuous increase from 2008 (1.5) to 2024 (8.7), with a constant rate between 2019 and 2020 (6.6). In 2009 the rate was 2.2 and in 2023 it was 8.7.



Graph 4: Prevalence Rate for Catheter Implantation – 2008 to 2024

Regarding the mortality rate, according to graph 5, there was a progressive decrease reflecting the expansion of hemodynamic units across the extensive Brazilian continent, as well as an increase in the number of professionals specialized in this procedure reflecting an increase in the supply of services and experience of the teams.



Graph 5: Mortality Rate for Catheter Implantation – 2008 to 2024

Discussion

The data found are consistent with the literature: CVC use has grown worldwide, as can also be seen in the 10-year retrospective study by Shenzhen People's Hospital, where the number of implantations also increased annually. 11 This can be explained by the fact that the methods for performing this procedure are becoming simpler and safer, although the rates of thrombosis and infections that still occur cannot be ruled out. 11 The lower growth in 2020, compared to the previous year, can be explained by the incidence of the Covid-19 pandemic, in which people stopped going to health services due to fear of contamination by the virus. Another explanation could be the increased cancer diagnoses and the aging of the population, leading to an increase in the number of these procedures.

There was a decrease from 4 (in 2008) to 1.5 days (in 2024), although fluctuating. This result may indicate that measures such as proper insertion and maintenance techniques, as well as staff training, are being implemented. This is because, as seen in the literature, they reduce the rate of complications, which consequently reduces patient stay in the hospital environment.17, 20 Furthermore, the fluctuation described between years can be understood by the fact that the prognosis of catheter implantation is multifactorial, including factors such as patient age, stage of the neoplasm, therapeutic regimen, and the presence of comorbidities, which makes this variable more complex to study. 17 These findings are consistent with the trend toward dehospitalization for many procedures in Brazil, as well as the regionalization of many health services, bringing specialized professionals to remote areas.

Even with new techniques and technologies making the procedure less expensive, the expansion of coverage and annual inflation adjustments still justify the increase in total costs. 17 However, the lack of data by catheter type, average usage time, and complications limits cost-effectiveness assessment.

Regarding the prevalence rate, continuous growth has been observed since 2008, and this, combined with the linear population growth trend, reinforces the increase in the absolute value of implantations of this type of venous catheter in the SUS. There was a decrease in the mortality rate, indicating a progressive improvement in the safety of the implantation technique, in line with advances in the field. 11 However, this number fluctuated significantly from year to year, highlighting the need for greater hospital surveillance to ensure compliance with catheter insertion and maintenance protocols to minimize procedure-related complications [20].

The article has epidemiological limitations regarding discrimination by sex, age, race, associated comorbidities, and type of neoplasm. It also fails to measure clinical outcomes such as complication rates and readmissions, as these data are not available through the SUS.

Conclusion

There was an increase in the insertion of fully and semi-implantable catheters, accompanied by a significant reduction in the average hospital stay and mortality rate.

Despite this being a descriptive study, information gaps in the Brazilian healthcare data system make it difficult to conduct a more accurate descriptive assessment of some study variables, which represents its main limitation.

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