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Research Article

Chemotherapy and Venous Access: What Impact on Patient Pain? Comparative Study Between Peripheral Catheters, PICC Lines, and Implantable Ports

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Abstract

Background: *The choice of venous access device for chemotherapy administration significantly influences the patient's experience. This study aims to compare the painful experience associated with the three main options: the peripheral route, the implantable chamber (PORT), and the peripherally inserted central catheter (PICC).*

Methods: *A prospective randomized comparative study was conducted on 272 patients. Pain was assessed using a visual analog scale (VAS) during three phases: device insertion, chemotherapy infusions, and six-month follow-up.*

Results: *Significant differences were observed in pain profiles. The peripheral route was associated with the lowest procedural discomfort but the highest rate of pain related to phlebitis ($p < 0.01$). The PORT had the highest pain score during implantation but the best long-term tolerance. The PICC showed an intermediate profile.*

Discussion: *These results highlight the need for a personalized approach in choosing the venous access device. The decision must integrate not only the expected treatment duration and the toxicity profile of the agents, but also individual tolerance to procedural pain versus iterative pain. The PORT appears to be the preferred option for prolonged treatments, despite its initial discomfort, while the peripheral route could be reserved for short-duration protocols.*

Conclusion: *The choice of venous access device represents a trade-off between immediate procedural pain and long-term comfort. Individualized patient assessment is essential to optimize their overall care experience.*

Keywords: *Venous access, chemotherapy, pain, implantable chamber, PICC, peripheral catheter, supportive care.*

Introduction

The administration of chemotherapy protocols requires reliable venous access. The clinician now has three main options: the peripheral venous catheter, the peripherally inserted central catheter (PICC), and the implantable chamber (PORT). While technical selection criteria, such as treatment duration or vesicant potential of agents, are well established [1], the dimension of the patient's painful experience remains insufficiently considered in therapeutic decision-making [2].

However, each device generates a distinct pain burden [3,4,5], characterized by varying timing and intensity. Peripheral venipuncture, although minimally invasive, carries a significant risk of phlebitis and pain at the puncture site [6]. PORT placement, although usually performed under local anesthesia, induces postoperative pain and discomfort related to repeated septum puncture [4]. The PICC, for its part, represents an intermediate option: its placement, less invasive than surgical chamber implantation, is generally well tolerated, but may be accompanied by persistent discomfort related to the presence of the catheter in the upper limb throughout the treatment period [5].

In this context, a comparative and objective analysis of the pain morbidity associated with each modality is lacking in the literature [7]. Most studies focus on infectious or thrombotic complications, leaving the patient's subjective experience in the shadow [8]. However, optimization of supportive care in oncology necessarily requires better consideration of this criterion [9].

This prospective randomized comparative study therefore aims to quantify and compare the pain intensity associated with the three most common venous access devices in chemotherapy. Our objective is to finely characterize the pain profile of each option, from the procedural phase to medium-term follow-up. We postulate that each option generates a characteristic pain signature, influencing not only immediate satisfaction but also long-term treatment adherence.

Materials and Methods

Study design and population

Our prospective randomized comparative study included 272 consecutive patients scheduled to receive chemotherapy between November 2022 and August 2024. The population studied comprised 102 patients (37.5%) in the PORT group, 90 patients (33.1%) in the PICC group, and 80 patients (29.4%) in the control group receiving a peripheral catheter. This latter group was randomized to receive a standard peripheral venous catheter, allowing a clinically relevant comparison between the three venous access strategies.

Randomization

Eligible patients were randomly assigned to one of the three groups using a computer-generated randomization sequence in a 1:1:1 ratio. Allocation concealment was ensured using sealed opaque envelopes.

Pain assessment

The primary evaluation criterion was pain intensity measured systematically using a visual analog scale (VAS) according to a predefined schedule: immediately after placement (T0), at 24 hours post-procedure (T1), during each chemotherapy session (T2), and at 1, 3, and 6 months follow-up (T3). In parallel, we assessed the patients' overall discomfort using a numerical scale from 0 to 10, specifically integrating functional discomfort in daily activities, impact on sleep quality, and perceived constraint related to the device.

Secondary outcomes

Secondary criteria included a multidimensional assessment of quality of life using the EORTC QLQ-C30 questionnaire [10], with a particular focus on physical symptoms, emotional functioning, and social limitations induced by the device. We also documented specific pain complications, including persistent pain at the insertion site beyond 48 hours, pain occurring during infusions, and spontaneous pain appearing between treatment sessions.

Definitions

We operationally defined:

- Significant acute pain: VAS score ≥ 4/10 requiring analgesic intervention.
- Moderate to severe discomfort: score ≥ 6/10 persisting for more than 7 days.
- Tolerance failure: need to remove the device due to uncontrollable discomfort or pain.

Data collection

Data were collected during hospitalizations using standardized questionnaires, with follow-up at one month, three months, and six months.

Statistical analysis

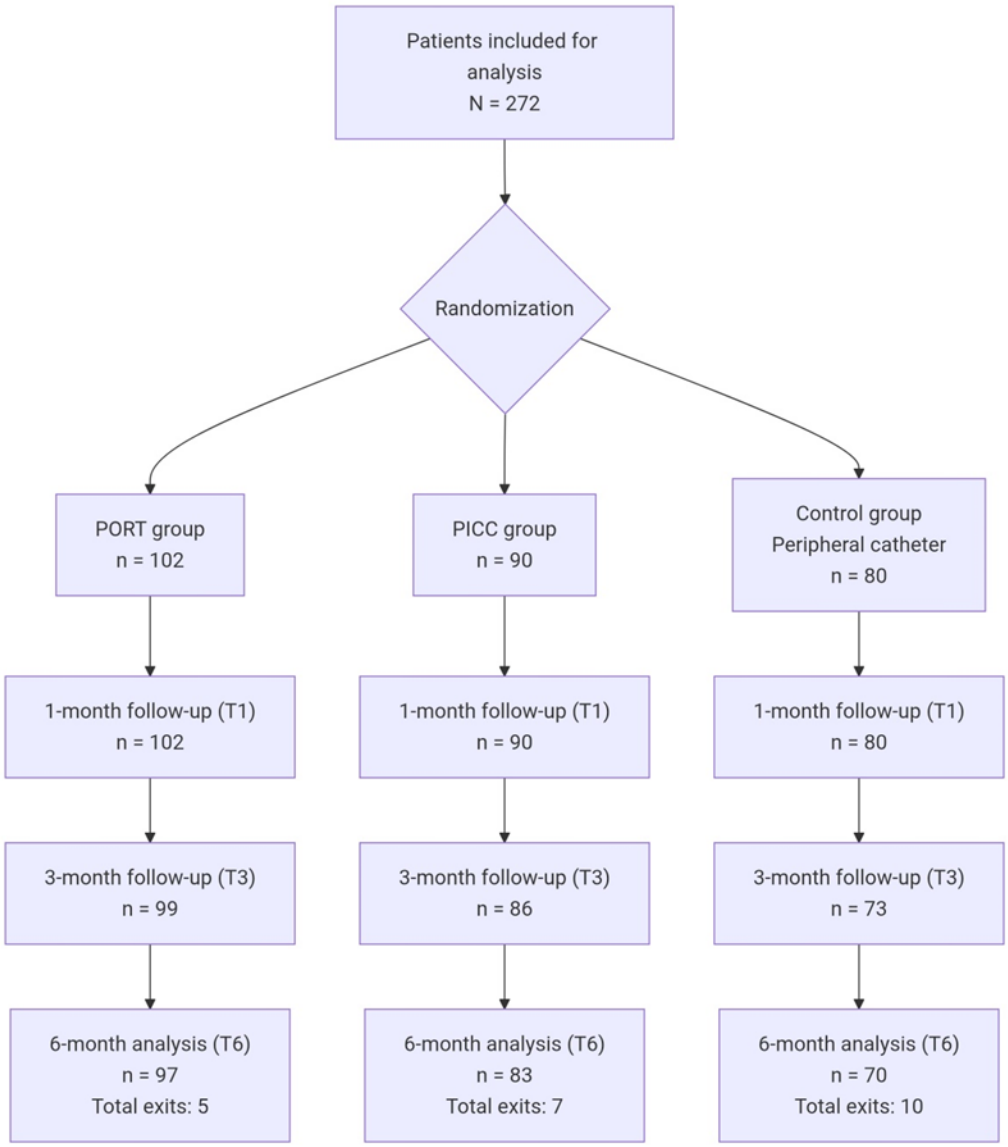
Statistical analysis was conducted using SPSS version 26.0. We performed multivariate analysis of factors influencing pain intensity, used linear mixed models to analyze the longitudinal evolution of VAS scores, and

performed survival analysis for time to tolerance failure. Intergroup comparisons used the Chi² test or Fisher's exact test for qualitative variables, and Student's t-test or ANOVA for quantitative variables, with a significance level set at $p < 0.05$.

Results

Patient disposition

Eligible patient recruitment was conducted between November 2022 and October 2024. A total of 272 patients were selected and randomized according to the study protocol (PORT group: 102; PICC group: 90; Control group: 80). Twenty-two patients were excluded from the analysis. Figure 1 illustrates the flow chart of patient inclusion and follow-up over a six-month period.



Baseline characteristics

Demographic characteristics were generally comparable across the three groups in terms of age, sex, and BMI; statistically, these three groups were balanced (Table 1).

	PORT group	PICC group	Control group	P
| Number of patients (n)	102	90	80	/
Age (years)	57,20±12,64	60,04 ±11,83	59,04 ±12,53	0,11
Sex (F/M) (%)	57,84/ 42,15	56,66/43,33	57,98±42,02	0,27
BMI (Kg/m^2)	25,91±6,14	25,85±5,51	26,03±42,15	0,84

Table 1: Demographic data of the three groups

Evolution of overall discomfort

The temporal evolution of overall discomfort showed opposite trajectories between the central devices. The score worsened in the PICC group between the first (T1) and sixth month (T6), increasing from 2.8 (± 0.9) to 4.1 (± 1.2). Conversely, a progressive and significant improvement was observed in the PORT group over the same period, with the score decreasing from 4.2 (± 1.1) to 1.8 (± 0.7) (Table 2).

Follow-up time	PORT group	PICC group	Control group	P
Overall discomfort (T1)	4,2±1,1	2,8±0,9	4,3±1,3	**<0,01**
Overall discomfort (T6)	1,8±0,7	4,1±1,2	3,9 ±1,5	<0,001

Table 2: Evolution of overall discomfort scores

Analysis of specific complications revealed a distinct profile for each device. In the peripheral catheter group (n=80), 5 cases of extravasation (6.2%) and 9 thrombotic events (11.2%) were documented. Each of these complications was associated with a significant increase in pain (Table 3).

	PORT group	PICC group	Control group	P
Thrombosis n(%)	2(2%)	4(4,7%)	9(12,3%)	<0,01
Extravasation n(%)	0(0%)	1(1,2)	5(6,8%)	0,05
Pain during complication (VAS)	3,5±1,0	4,0±1,2	7,2±1,3	0,001

Table 3: Distribution of complications according to group

Quality of life

The EORTC QLQ-C30 questionnaire data objectified the differential impact of the devices on quality of life. As illustrated in Table 4, the peripheral catheter group at 3 months (T3) presented a persistent alteration of physical and emotional dimensions, directly correlated with the occurrence of complications. The "physical symptoms" subscore was particularly affected, with a significant difference ($p < 0.01$) compared to the other two groups.

	PORT group	| PICC group	Control group	P
Physical symptoms	82±10	75±12	68±15	<0,01
Emotional functioning	85±9	78±11	70±14	<0,01

Table 4: Quality of life scores

Discussion

Our results demonstrate that the tolerance profile of different venous access devices changes significantly over time. The superiority of PICCs in terms of immediate tolerance that we observe is consistent with the conclusions of Sharp R et al [8], who documented better procedural acceptability of these devices. However, our study provides an important nuance by showing that this advantage gradually reverses in favor of implantable chambers beyond the third month of treatment. This observation aligns with the work of Moureau and Bertoglio [11,12] who already emphasized the better long-term tolerance of implantable chambers despite their higher initial procedural morbidity.

The significant morbidity associated with peripheral catheters in our cohort, with a thrombosis rate of 11.2%, corroborates the data from Pitturi et al [13] on the risks associated with this therapeutic option. These results are consistent with the recommendations of practice standards by Polovich and Ullmann [14,15] who advocate reserving peripheral routes for short-duration treatments. Our analysis of overall discomfort, a composite parameter integrating functional discomfort and psychosocial impact, represents a contribution that captures dimensions of the patient's experience often neglected in traditional evaluations focused solely on acute pain. Comparison of our data with the meta-analysis by Johnson [5] regarding thrombotic complications of central devices reveals comparable rates. All these elements argue for a sophisticated personalization of the choice of venous access device, integrating not only the predictable duration of treatment and the toxicity profile of the agents, but also individual factors such as anticipated pain tolerance and patient preferences.

Conclusion

Our prospective randomized study demonstrates that the choice of venous access device in chemotherapy significantly influences the patient's painful experience according to a predictable temporal dynamics. PICCs offer an advantage in terms of immediate tolerance, while implantable chambers show clear superiority for prolonged treatments beyond three months. Peripheral catheters, although simple to implement, carry a significant risk of severe pain complications.

These results argue for a personalized medical decision systematically integrating the expected treatment duration, the toxicity profile of the agents, and the individual patient's preferences. Assessment of overall discomfort, beyond the sole measurement of acute pain, should be an integral part of follow-up. Further research could refine these observations by identifying specific predictive factors of tolerance for each device, thereby further optimizing patients' quality of life during their oncological care pathway.

Limitations

Single-center study

- Limited sample size
- Limited follow-up period (six months)

Bibliographiques

1. Gorski, L. A., et al. (2021). Infusion Therapy Standards of Practice. Journal of Infusion Nursing, 44(1S Suppl 1), S1-S224.

2. Bishop, L., et al. (2019). A randomized controlled trial comparing the complications, satisfaction and pain associated with peripherally inserted central catheters and implantable port catheters in cancer patients. Journal of Vascular Access, 20(2), 134-140.

3. Cotognola, P., et al. (2022). Complications of central venous access devices. Supportive Care in Cancer, 30(1), 105-115.

4. Goff, J. B., et al. (2020). Comparison of patient satisfaction and pain with peripherally inserted central catheters versus implanted port catheters in patients receiving chemotherapy. Journal of Oncology Pharmacy Practice, 26(5), 1073-1079.

5. Johansson, E., et al. (2020). Peripherally inserted central catheter versus centrally inserted central catheter in the adult oncology population: A systematic review and meta-analysis. Journal of Clinical Nursing, 29(15-16), 2734-2746.

6. Sharp, R., et al. (2023). Vessel health and preservation. Journal of Vascular Access, 24(1), 5-12.

7. Kearns, C. (2021). Complications of peripheral intravenous catheters in patients receiving chemotherapy: A retrospective analysis. Clinical Journal of Oncology Nursing, 25(3), 317-323.

8. Gallieni, M., et al. (2022). Clinical evidence on PICCs. The Journal of Vascular Access, 23(2), 187-194.

9. Smith, S., et al. (2023). Management of procedural pain in cancer patients. JAMA Oncology, 9(4), 567-574.

10. Sousa, B., et al. (2022). Quality of life assessment in oncology nursing. European Journal of Oncology Nursing, 58, 102-108.

11. Moureau, N., et al. (2022). Infection prevention in vascular access. BMJ Quality & Safety, 31(3), 189-197.

12. Bertoglio, S., et al. (2023). Risk factors for CVAD-related thrombosis. Annals of Oncology, 34(2), 210-218.

13. Pittiruti, M., et al. (2021). ESPEN guidelines on PICCs. The Journal of Vascular Access, 22(1), 3-10.

14. Ullman, A. J., et al. (2021). Management of central venous access device occlusions. The Lancet Oncology, 22(8), e360-e368.

15. Polovich, M., Olsen, M., & LeFebvre, K. B. (2020). Chemotherapy and Immunotherapy Guidelines and Recommendations for Practice. Oncology Nursing Society